JAMES J. MIZNER

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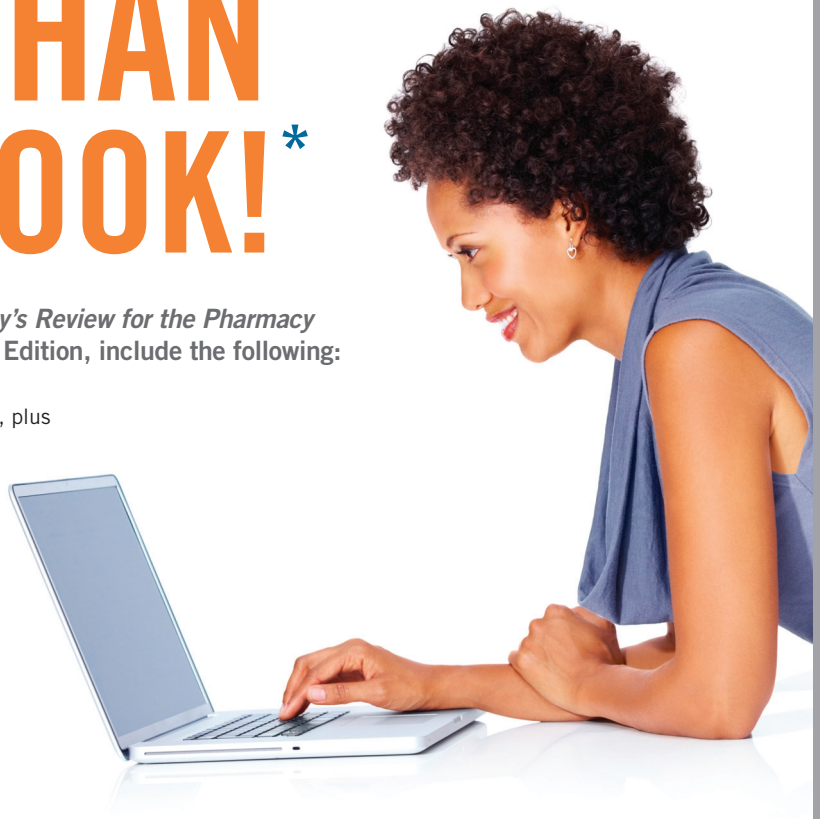

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Pharmacy Technician Certification Examination

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Pharmacy Technician Certification Examination

Third Edition

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Preface

Pharmacy technicians have become a major asset for both pharmacies and pharmacists in the world today. With an increasing population, longer life spans, patients taking multiple medications, and managed care playing a major role, pharmacies are seeing a major increase in processed prescriptions. A pharmacy cannot be successful in providing medications without knowledgeable pharmacy technicians assisting the pharmacists.

The Bureau of Labor Statistics predicts the growth of pharmacy technicians to be very strong, with a growth of 32% between now and 2020. State Boards of pharmacy realize the importance of pharmacy technicians in the drug delivery process and are committed to ensuring that pharmacy technicians possess the necessary skills to work in a pharmacy. By 2020, all new pharmacy technicians entering the workforce will be required to have obtained a pharmacy technician education from an approved ASHP program.

Presently there are two organizations that certify pharmacy technicians, the Pharmacy Technician Certification Board (PTCB) and the National Health-Career Association (NHA). Both organizations are accredited by the National Commission for Certifying Agencies (NCCA). The PTCB has certified over 480,000 pharmacy technicians, and its examination is approved by 45 state boards of pharmacy. The NHA is recognized by 32 state boards of pharmacy.

In 2012, the Pharmacy Technician Certification Board conducted a Job Analysis Study that involved over 25,000 pharmacy technicians. As a result of this study, it was announced that in second half of 2013 the arrangement of the material would change. However, the length of the test (90 questions to be completed in 1 hour and 50 minutes) and the multiple-choice format would not change.

The new blueprint organizes content into nine knowledge domains, called "knowledge areas" in the table below, each with a number of sub-domains. This organization gives the new blueprint a knowledge focus, and conveys more information about the type and relative amount of content in the exam.

The vast majority of knowledge *statements* in the current blueprint are covered by one or more of the knowledge *areas* in the new blueprint. By extension, this means that the new PTCE content will be very similar to what is covered in the current exam.

As a result of these changes, *Mosby's Review for the Pharmacy Technician Certification Examination, third edition,* is arranged to review the content based upon the nine domains. Each chapter is focused on one of the domains covered on the examination followed by questions. The pretest and the seven practice tests attempt to mirror the actual certification examination by adhering to the percentage of questions for each domain. The questions have been scrambled to make the test realistic. Many of the questions may cover material from multiple domains. As in the previous two editions, rationales are provided with the answers. Domains are also included with the rationales.

Mosby's Review for the Pharmacy Technician Certification Examination has been written to assist a pharmacy technician preparing for the PTCB or the NHA

NEW PTCE BLUEPRINT DOMAINS

KNOWLEDGE DOMAINS	DOMAIN DESCRIPTION	% OF PTCE CONTENT	KNOWLEDGE AREAS
1	Pharmacology for Technicians	13.75	6
2	Pharmacy Law and Regulations	12.50	15
3	Sterile and Non-sterile Compounding	8.75	7
4	Medication Safety	12.50	6
5	Pharmacy Quality Assurance	7.50	5
6	Medication Order Entry and Fill Process	17.50	7
7	Pharmacy Inventory Management	8.75	5
8	Pharmacy Billing and Reimbursement	8.75	5
9	Pharmacy Information Systems Usage and Application	10.00	2

examination. *Mosby's Review for the Pharmacy Technician Certification Examination* is to be used to augment either a formalized pharmacy technician training program or on-the-job training, not replace it. This review text has been designed to review the competencies covered on the PTCB exam and material on the NHA exam.

Enhancements to the third edition of *Mosby's Review for the Pharmacy Technician Certification Examination* include:

- The inclusion of new drug entities that have been approved by the FDA since the second edition
- An update on laws affecting the practice of pharmacy
- An in-depth discussion on USP <797>
- Seven multiple-choice paper-based practice tests
- Ten multiple-choice computer-based tests
- Flashcards that focus on the content of the domains
- Instructor aids, such as lesson plans, test banks, and PowerPoint slides, to assist in the pharmacy technician's review for the examination

The pharmacy technician should use *Mosby's Review for the Pharmacy Technician Certification Examination* as a guide to determine which topics he or she may need additional assistance in studying for either the PTCB or ExCPT examination. Good luck on the test and in your new career.

James J. Mizner, Jr., MBA, BS, RPh

Mosby's Review for the Pharmacy Technician Certification Examination is dedicated to my wife, Mary, and son, Andrew. They have been very supportive of me through my life and are my source of inspiration.

A special thanks to Jennifer Janson and Jennifer Bertucci, who provided both advice and direction to me during this revision. Finally, thanks to Drs. Margaret Bush, Anthony Guerra, Joshua Neumiller, and Carrie Wamer, who were instrumental during the review phase of the book.

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Pretest

1. If a physician writes a prescription for Coumadin that indicates "brand name medically necessary" on the prescription, what DAW code should be used in submitting a prescription claim?
   a. DAW 0
   b. DAW 1
   c. DAW 2
   d. DAW 3

2. If a physician prescribes 250 mg qid for 10 days, how many milliliters of amoxicillin oral suspension containing 250 mg/5 mL should be dispensed?
   a. 75 mL
   b. 100 mL
   c. 150 mL
   d. 200 mL

3. How many 250-mg capsules are needed to fill the following prescription?
   amoxicillin 500 mg tid for 10 days
   a. 20
   b. 40
   c. 60
   d. 80

4. Which of the following organizations is not involved with patient safety?
   a. CMS
   b. FDA
   c. ISMP
   d. TJC

5. Which organization establishes standards for purity and quality of medications?
   a. DEA
   b. CMS
   c. TJC
   d. USP

6. Which of the following is not a benefit of health information technology?
   a. Alert fatigue
   b. Improved efficiency
   c. Improved patient care
   d. Improved productivity

7. What is the maximum number of refills allowed on a prescription of lorazepam if authorized by a physician?
   a. None
   b. Five
   c. 12
   d. Unlimited

8. Which of the following reference books discusses the therapeutic equivalence of products?
   a. *Drug Topics Blue Book*
   b. *Drug Topics Green Book*
   c. *Drug Topics Orange Book*
   d. *Drug Topics Red Book*

9. What is the brand name for paroxetine?
   a. Effexor
   b. Paxil
   c. Prozac
   d. Zoloft

10. What is a third-party payment?
    a. Cash payment at time of receiving a prescription
    b. Credit card payment at time of receiving a prescription
    c. Debit card payment at time of receiving a prescription
    d. Reimbursement to the pharmacy for prescription services

11. How many grams of hydrocortisone powder should be used to prepare 1 lb of a 0.25% hydrocortisone cream?
    a. 1.14 g
    b. 1.2 g
    c. 113.5 g
    d. 120 g

12. What is the meaning of the abbreviation of "*ut dict*"?
    a. As directed
    b. As needed
    c. If there is need
    d. Ointment

13. What is the meaning of the suffix *-dipsia*?
    a. Discharge
    b. Hardening
    c. Pain
    d. Thirst

14. Which organization is responsible for accrediting pharmacy education programs?
    a. ACCP
    b. ACPE
    c. APhA
    d. ASHP

15. Which of the following medications can be crushed?
    a. Ambien CR
    b. Augmentin XR
    c. Maxzide
    d. Tessalon Perles

16. What is the generic name for Augmentin?
    a. Amoxicillin–clavulanate
    b. Ampicillin–sulbactam
    c. Piperacillin–tazobactam
    d. Ticarcillin–clavulanate

17. Which of the following is not a required text in a pharmacy?
    a. A copy of the Controlled Substances Act
    b. NF
    c. PDR
    d. USP

18. Which of the following medications should be tapered off at discontinuation?
    a. Fexofenadine
    b. INH
    c. Prednisone
    d. SMZ-TMP

19. Which of the following products can be purchased as an exempt narcotic if all conditions outlined by the federal Controlled Substances Act are met?
    a. Phenobarbital
    b. Robitussin A-C
    c. Stadol NS
    d. Tussionex

20. What is the maximum weighable amount for a class A prescription balance?
    a. 0.6 g
    b. 6 g
    c. 60 g
    d. 120 g

21. In what schedule is acetaminophen with codeine placed?
    a. II
    b. III
    c. IV
    d. V

22. In which classification of medication does acyclovir belong?
    a. Analgesic
    b. Antibiotic
    c. Antifungal
    d. Antiviral

23. If a medication is to be taken "tid," how many times would it be taken each day?
    a. One time
    b. Two times
    c. Three times
    d. Four times

24. Which of the following products is not a combination product?
    a. Bactrim DS
    b. Dyazide
    c. Estrace
    d. Prempro

25. Which organization has developed standards for e-prescribing?
    a. CMS
    b. DEA
    c. NCPDP
    d. PSTAC

26. What type of filter is used to prevent glass from entering the final solution when drawing from an ampule?
    a. Depth filter
    b. Filter needle
    c. Filter straw
    d. Final filter

27. In which drug classification does Singulair belong?
    a. Bronchodilator
    b. Corticosteroid
    c. Leukotriene inhibitor
    d. Xanthine derivative

28. When should a pharmacy technician seek assistance from the pharmacist?
    a. A patient asks a question about drug interactions with a medication
    b. During DUE a contraindication message shows up on the computer screen
    c. If an elderly patient is receiving a prescription for an antiparkinson medication
    d. All of the above

29. Why is it necessary to rotate medications on a shelf?
    a. To allocate shelf space effectively
    b. To ensure the medication with the shortest dating is dispensed before drugs with longer dating to reduce the possibility that the medication will expire before being dispensed
    c. To prevent dust from accumulating on the shelf
    d. To prevent overstock from occurring

30. Which of the following pharmacy abbreviations tells that a medication order is needed immediately?
    a. ASAP
    b. dtd
    c. NOW
    d. STAT

31. Which pharmacy legislation requires that tamperproof pads be used for Medicaid patients?
    a. Anabolic Steroid Control Act of 2004
    b. Combat Methamphetamine Epidemic Act of 2006
    c. Isotretinoin Safety and Risk Management Act of 2004
    d. Medicaid Tamper-Resistant Prescriptions Act

32. What letter indicates a midlevel practitioner, such as a nurse practitioner or physician's assistant, who may prescribe controlled substances?
    a. A
    b. B
    c. F
    d. M

33. Which of the following medications is not a combination product?
    a. Estratest
    b. Hyzaar
    c. Lotrel
    d. Remeron

34. What is the sensitivity of a class A prescription balance?
    a. 0.6 mg
    b. 6.0 mg
    c. 60 mg
    d. 100 mg

35. Which of the following medications does not need to be dispensed in a "child-resistant" container?
    a. Amoxicillin
    b. Lanoxin
    c. Nitrostat
    d. Synthroid

36. Which of the following tasks may be performed by a pharmacy technician?
    a. Checking and verifying finished prescriptions
    b. Counseling a patient
    c. Receiving a verbal prescription over the phone from a designated person from a physician's office
    d. Receiving a written prescription from a patient

37. What must be found on all controlled substance prescriptions?
    a. Pharmacy DEA number
    b. Physician's business license number
    c. Physician's DEA number
    d. Physician's license number

38. In which schedule does meperidine belong?
    a. II
    b. III
    c. IV
    d. V

39. Which association represents the interests of chain drugstores?
    a. APHA
    b. NABP
    c. NACDS
    d. NCPA

40. Which of the following medications is considered a "high-alert" medication according to the ISMP?
    a. Amoxicillin
    b. Insulin
    c. Naproxen
    d. Tessalon Perles

41. An effervescent tablet has the following formula:

APAP	325 mg
$CaCO_3$	280 mg
Citric acid	900 mg
Potassium bicarbonate	300 mg
Sodium bicarbonate	465 mg

    How many grams would one tablet contain?
    a. 0.227 g
    b. 2.27 g
    c. 22.7 g
    d. 227 g

42. What is the generic name for Serevent?
    a. Albuterol
    b. Beclomethasone
    c. Salmeterol
    d. Triamcinolone

43. What does the pharmacy abbreviation "Rx" mean?
    a. Generic substitution
    b. Number of refills
    c. Take this drug
    d. Write on label

44. Nitroglycerin is to nitrate as nifedipine is to:
    a. ACE inhibitor
    b. Beta-blocker
    c. Calcium channel blocker
    d. Loop diuretic

45. What is the meaning of PHI?
    a. Personal Health Index
    b. Personal Health Information
    c. Personal Health Inquiry
    d. Protected Health Information

46. Which of the following organizations certifies health care organizations?
    a. DEA
    b. FDA
    c. ISMP
    d. TJC

47. Which of the following medications is not indicated as a smoking cessation drug?
    a. Chantix
    b. Cubicin
    c. Nicorette
    d. Zyban

48. Which of the following drugs may be used prophylactically for influenza and Parkinson disease?
    a. Amantadine
    b. Bromocriptine
    c. Levodopa–carbidopa
    d. Selegiline

49. Who approves a change in an institution's formulary?
    a. CEO
    b. Head pharmacist
    c. Head physician
    d. P&T committee

50. How much time does a physician have to provide a written prescription for an "emergency prescription" for a Schedule II drug?
    a. 24 hours
    b. 48 hours
    c. 72 hours
    d. 7 days

51. Which is not a drug file that would be found in an ambulatory pharmacy's database?
    a. Abbreviations
    b. Brand and generic drugs
    c. Investigational new drugs
    d. Pricing structure

52. What is the generic name for Celexa?
    a. Citalopram
    b. Phenelzine
    c. Selegiline
    d. Tranylcypromine

53. Which of the following is not a patient's right covered under HIPAA?
    a. The right to request an amendment to his or her health record
    b. The right to obtain an accounting of any disclosures of his or her protected health information
    c. The right to obtain a copy of his or her designated record set of protected health information
    d. The right to receive compensatory and punitive damage for violations of HIPAA

54. Which form is used to inform a drug manufacturer of errors caused by commercial packaging and labeling?
    a. FDA Form 79
    b. MedWatch
    c. MERF
    d. USP-ISMP

55. You have received a medication order to prepare 500 mL of a 1:500 solution. The pharmacy has in stock a concentrate of 80%. How much of the concentrate will you need to use?
    a. 1 mL
    b. 1.25 mL
    c. 498.75 mL
    d. 499 mL

56. A physician orders KCl 40 mEq to be added to D5W 1000 mL and administered over 4 hr. The injection solution on hand is KCl 2 mEq/mL. How many milliliters of KCl should be added?
    a. 40 mL
    b. 8 mL
    c. 16 mL
    d. 20 mL

57. You have been asked to prepare 1 L of a 2% (w/v) solution. You have a 100% solution in stock. How much diluent will be needed?
    a. 2.0 mL
    b. 20 mL
    c. 200 mL
    d. 980 mL

58. Which of the following patient monitoring function is found in a pharmacy information system?
    a. Drug-allergy interaction
    b. Drug duplication
    c. IV incompatabilities
    d. All of the above

59. How many grams of NaCl are in 100 mL of NS solution?
    a. 0.009 g
    b. 0.09 g
    c. 0.9 g
    d. 9 g

60. Which of the following medications is approved for the treatment of diabetes?
    a. Januvia
    b. Lunesta
    c. Remeron
    d. Telithromycin

61. Which part of Medicare pays for prescriptions for senior citizens if enrolled in the prescription component of Medicare?
    a. Part A
    b. Part B
    c. Part C
    d. Part D

62. In what drug classification is quinapril?
    a. ACE inhibitor
    b. Alpha-blocker
    c. Beta-blocker
    d. Calcium channel blocker

63. Which of the following OTC medications must be recorded in a book before it is sold to the customer?
    a. Acetaminophen
    b. Pseudoephedrine
    c. Ranitidine
    d. Simethicone

64. Which of the following is an example of a drug with an "sl" dosage form?
    a. Amoxicillin
    b. Depakote
    c. Nitrostat
    d. Synthroid

65. How long is a prescription valid if it has "prn" refills written on it by the physician?
    a. 1 month
    b. 6 months
    c. 1 year from the date the prescription was written
    d. As many as needed

66. What provides a computer with temporary work space?
    a. Modem
    b. RAM
    c. ROM
    d. Software

67. Which amendment to the Food, Drug and Cosmetic Act of 1938 distinguished prescription and over-the-counter medications?
    a. Durham-Humphrey Amendment
    b. FDA Modernization Act
    c. Kefauver-Harris Amendment
    d. Poison Control Act

68. Which organization provides pharmacy resources such as "Do Not Crush List," "Error Prone Abbreviations," and "Sound-Alike, Look-Alike Drug Lists"?
    a. FDA
    b. ISMP
    c. TJC
    d. USP

69. A Pyxis machine is an example of a(n):
    a. Automatic compounder
    b. Automatic dispensing machine
    c. Bar coding machine
    d. CPOE

70. A prescription has the following directions: "1 tab po bid × 14 d for URI." How should it appear on the prescription label?
    a. Take one tablet by mouth twice a day for 14 doses for URI.
    b. Take one tablet twice a day for 14 days for URI.
    c. Take one tablet by mouth twice a day for 14 days for upper respiratory infection.
    d. Take one tablet by immediately; then one tablet twice a day for 14 days for upper respiratory infection.

71. Which of the following is not overseen by the FDA?
    a. FAERS
    b. MedWatch
    c. MERP
    d. VAERS

72. Who oversees the FAERS program?
    a. CMS
    b. DEA
    c. FDA
    d. OSHA

73. Which of the following pieces of information is not required on a prescription label?
    a. Directions for use
    b. Name and address of the pharmacy
    c. Name and address of the prescriber
    d. Telephone number of the prescriber

74. Which of the following abbreviations is not a dosage form?
    a. amp
    b. BS
    c. cap
    d. tab

75. How many capsules each containing 250 mg of chloramphenicol are needed to provide 50 mg/kg/day for 10 days for an adult weighing 187 lb?
    a. 17
    b. 82
    c. 170
    d. 822

76. What does aseptic technique prevent?
    a. Introduction of an active ingredient
    b. Introduction of a diluent
    c. Introduction of a nutrient
    d. Introduction of a pathogen

77. Which organization establishes the standards for the practice of pharmacy in that state?
    a. BOP
    b. MedWatch
    c. MERP
    d. NABP

78. Which of the following will a pharmacy computer perform?
    a. Identify drug interactions
    b. Maintain patient profiles
    c. Indicate non-formulary usage
    d. All of the above

79. What should a pharmacy technician do if he or she observes a patient attempting to purchase Bayer aspirin while he or she is waiting for a prescription for warfarin to be filled by the pharmacy?
    a. Inform the patient of the interaction between aspirin and warfarin.
    b. Inform the pharmacist of the situation and allow the pharmacist to counsel the patient.
    c. Point out to the patient that the "house brand" of aspirin is just as effective as Bayer aspirin.
    d. Refuse to sell the aspirin to the patient.

80. What would a computer message of "NDC Not Covered" indicate to the pharmacy technician?
    a. The medication has been recalled by the FDA.
    b. The patient's insurance plan does not cover the drug.
    c. The medication is a controlled substance.
    d. The medication has been backordered by the wholesaler.

81. Which of the following expressions refer to the price a pharmacy pays for drug after receiving discounts or rebates?
    a. AAC
    b. AWP
    c. MAC
    d. U&C

82. What type of information should be collected from the patient or representative before a prescription is processed?
    a. Disease states of the patient
    b. Drug allergies
    c. Medications taken by the patient, whether prescription or OTC
    d. All the above

83. Where does one measure a liquid in a conical graduate?
    a. Bottom of the meniscus
    b. Center of the meniscus
    c. Top of the meniscus
    d. Any of the above

84. How many times may a prescription with "prn" refills be transferred from a pharmacy?
    a. 0 times
    b. 1 time
    c. 5 times
    d. It may be transferred as many times as necessary within 1 year of the date the prescription was filled.

85. Which of the following terms is associated with reimbursement of generic medications?
    a. AAC
    b. AWP
    c. MAC
    d. POS

86. To what does the term "inventory" refer?
    a. All drugs available for sale
    b. All drugs purchased
    c. All drugs sold
    d. The value of all drugs in stock

87. Which of the following individuals cannot originate an e-PHR?
    a. Nurse
    b. Patient
    c. Pharmacist
    d. Physician

88. Which of the following should not be taken with Sandimmune?
    a. Carbonated beverages
    b. Chocolate milk
    c. Milk
    d. Orange juice

89. A prescription is received, and the directions state "1 supp pr qd." How should it be taken by the patient?
    a. Applied to the skin
    b. By mouth
    c. By rectum
    d. By vagina

90. A prescription order has the following directions: "4 gtt in each ear tid." How many drops will a patient use each day?
    a. 8
    b. 12
    c. 16
    d. 24

91. Which of the following is an advantage of a parenteral drug?
    a. Difficult to reverse an overdose
    b. Rapid onset of action
    c. Possibility of injecting pathogens and pyrogens into the body
    d. Trauma to the body from the needle

92. Which of the following tasks may a pharmacy technician not perform?
    a. Compounding nonsterile products
    b. Making decisions during drug utilization evaluation
    c. Ordering medications
    d. Stocking pharmacy shelves

93. What is the minimum number of times a prescription should be read while it is being filled?
    a. 1 time
    b. 2 times
    c. 3 times
    d. 4 times

94. Which of the following expressions refers to a point in which inventory is reordered?
    a. AAC
    b. JIT
    c. PAR
    d. U&C

95. Which of the following is not an input device?
    a. Mouse
    b. Keyboard
    c. Printer
    d. Touch screen

96. How many hours of continuing education are required for a pharmacy technician to be recertified every 2 years?
    a. 5 hours
    b. 10 hours
    c. 15 hours
    d. 20 hours

97. Which of the following provides an income tax deduction for medical expenses?
    a. HSA
    b. HMO
    c. PPO
    d. POS

98. What is the net profit for a prescription that has an acquisition cost of $45.00 and a dispensing cost of $3.75 and retails at $55.00?
    a. $3.75
    b. $6.25
    c. $10.00
    d. $13.75

99. Which of the following abbreviations indicates the medication is to be taken orally?
    a. po
    b. pr
    c. sl
    d. top

100. Which organization oversees Medicare and Medicaid payments?
    a. CMS
    b. FDA
    c. PBM
    d. TJC

Pharmacy Technician Certification Examination Test-Taking Skills

PREPARE FOR THE TEST

- Know exactly what you will be tested on. Review test outlines if available.
- Study all key topics that will appear on the examination.
- Spread out your review over a period of weeks. Focused reviews over time are more effective than cramming.
- Outline your text and mark topics that need a more concentrated review.
- Try to predict questions that may be on the test, then test your skills in answering them.

ON THE DAY OF THE TEST

- Get enough sleep the night before the test. Make sure you have gotten adequate sleep the week before the test as well.
- Arrive early and choose a comfortable working area.
- Dress casually and comfortably. Take extra time to plan appropriate clothes.
- Come with your admissions ticket and government-approved identification (driver's license, walker's identification or passport).
- The following items are not permitted in the testing room:
  - Electronic devices including
  - Cell phones
  - PDAs
  - Personal calculators (Test Center provided calculators are permitted)
  - Translators
  - Any other electronic device
  - Outerwear, e.g. coats or jackets
  - Hats, barrettes and clips larger than 1/4 inch or hairbands wider than 1/2 inch
  - Wallets, watches or jewelry wider than 1/4 inch
  - Backpacks, briefcases, purses or other bags
  - Notes, books or translating devices
  - Pens or pencils
  - Food or drinks
  - Water bottles, inhalers, eye drops or lip balm
  - Weapons of any kind

AS YOU TAKE THE TEST

- Listen, read, and follow the directions carefully.
- Answer the questions in order but postpone questions that challenge you until later in the test. Answer the harder questions later.
- On your second pass through the test, ignore the answered questions and focus only on the questions you did not answer.
- Never leave a question unanswered; there is no penalty for guessing. (Time management is a key to success; it is to your advantage to answer all the items on the test.)
- Change your answers only when you are certain you made a mistake. Your first answer is usually the correct one.

TIPS FOR MULTIPLE-CHOICE QUESTIONS

- Remember that there is only one preferred answer even though more than one answer may appear to be correct.
- Use the process of elimination when you do not know the answer. Eliminate the most obviously wrong answer first, then eliminate the second, and then make your best decision between the last two choices.
- If you are still unsure about which is the correct answer, select the longer or more descriptive answer of the remaining answer set.
- Slow down when you see negative words in the question. Look for words such as *not, except,* and so on. In these cases, you need to identify the false statement instead of the true statement.
- Items that contain "absolutes," such as *always, never, must, all,* and *none,* severely limit the meaning of the item. Statements that contain absolutes are sometimes incorrect.

See Appendix A for specific information for the PTCE and the NHA exams.

Chapter 1

Pharmacology for Technicians

Chapter Objectives

Upon completion of Chapter 1, the pharmacy technician student will be able to

1. List and describe the various systems of the human body and their function.
2. Define the terms *pharmacology, pharmacokinetics,* and *therapeutic equivalence.*
3. Discuss the importance of recognizing drug interactions, problems, and pregnancy categories.
4. Recognize and recall how drug names are created and how their names can indicate usage.
5. Recognize the following for each drug classification and medication:
   - Mechanism of action
   - Medications within each classification
   - Difference between each classification
   - Brand and generic name
   - The daily dosage, dosage forms, and route of administration
   - Common side effects, allergic reactions, and therapeutic contraindications
6. Identify common vitamins, electrolytes, nutritional supplements, minerals, and over-the-counter medications.

PTCB Knowledge Domains

1.1 Generic and brand names of pharmaceuticals
1.2 Therapeutic equivalence
1.3 Drug interactions (e.g., drug–disease, drug–drug, drug–dietary supplement, drug–over-the-counter [OTC] drug, drug–laboratory, drug–nutrient)
1.4 Strengths and doses, dosage forms, physical appearance, routes of administration, and duration of drug therapy
1.5 Common and severe side or adverse effects, allergies, and therapeutic contraindications associated with medications
1.6 Dosage and indication of legend, OTC medications, herbal and dietary supplements

ExCPT Knowledge Domains

2.1 Drug classification
- ***2.1.1*** Major drug classes (e.g., analgesics, anesthetics, antibiotics)
- ***2.1.2*** Dosage forms (types, characteristics, and uses)
- ***2.1.3*** Over-the-counter products

2.2 Most frequently prescribed medications
- ***2.2.1*** Brand and generic names
- ***2.2.2*** Basic mechanism of action (pharmacology) and drug classification
- ***2.2.3*** Primary indications
- ***2.2.4*** Common adverse drug interactions and contraindications

ANATOMY AND PHYSIOLOGY

AUDITORY SYSTEM

- Responsible for hearing, balance, equilibrium, and communication skills

ANATOMY OF THE EAR	EAR COMPONENT	FUNCTION
External Ear		
	Auricle	Serves as entrance for sound into the ear
	Auditory canal	Links the external ear to the tympanic membrane
	Tympanic membrane	Protects middle ear from foreign objects and transmits sound waves to the middle ear
Middle Ear		
	Malleus (hammer)	Transmits sound waves
	Incus (anvil)	Transmits sound waves
	Stapes (stirrup)	Transmits sound waves
	Eustachian tube	Connects middle ear to the nasopharynx; relieves the change of pressure between the outside and inside of the ear during swallowing or yawning
Inner Ear		
	Labyrinth	Transmits audible sounds via nerve impulses
	Cochlea	Transmits impulses to the brain
	Vestibule	Responsible for equilibrium and balance
	Semicircular canal	Transfer of message via acoustic nerve

CARDIOVASCULAR SYSTEM

- The heart is a muscle that initiates systemic arterial pulse waves, causing blood to circulate throughout the body and supply it with nutrition and oxygen. Consists of the heart (pumps blood that supplies nutrients and oxygen throughout the body), arteries (carries oxygenated blood and nutrients to the tissues and organs), veins (returns deoxygenated blood to the heart), and capillaries.

ANATOMY OF THE CARDIOVASCULAR SYSTEM	FUNCTION
Aorta	The largest artery in the body, originating from the left ventricle of the heart and extending down to the abdomen; the aorta distributes oxygenated blood to all parts of the body through the systemic circulation
Endocardium	Inner layer of the heart wall that allows the heart wall to collapse when it contracts
Myocardium	Middle layer of the heart wall that contracts
Epicardium	Outer layer of the heart wall
Superior vena cava	Transports venous blood from the upper portion of the body to the heart
Inferior vena cava	Transports venous blood from the lower portion of the body to the heart
Right ventricle	Expels blood through the pulmonary arteries to the lungs
Left atrium	Receives oxygenated blood from the lungs
Left ventricle	Contracts and expels oxygenated blood into the aorta
Right atrium	Receives blood from the body

DIGESTIVE SYSTEM

- Responsible for the digestion, absorption, metabolism, and excretion (elimination) of food
- Organs of the digestive system include the mouth, salivary glands, pharynx, esophagus, stomach, small intestine, large intestine, and rectal area

ANATOMY OF THE DIGESTIVE SYSTEM	FUNCTION
Gallbladder	Small organ that aids mainly in fat digestion and concentrates bile produced by the liver
Mouth	Chews food
Salivary gland	Secretes the enzyme amylase used to break down carbohydrates
Pharynx	Connects the mouth to the esophagus
Esophagus	Transports food from the mouth to the stomach
Pancreas	Both an endocrine gland producing several important hormones, including insulin, glucagon, somatostatin, and pancreatic polypeptide, and a digestive organ, secreting pancreatic juice containing digestive enzymes that assist the absorption of nutrients and the digestion in the small intestine
Stomach	Releases acid to break down food
Small intestine	Absorbs nutrients from digested food
Large intestine	Reabsorbs water back into body; excretes or eliminates food from the body
Rectum	Excretes fecal matter from the body

ENDOCRINE SYSTEM

- Responsible for the production and secretion of hormones from the glands
- Hormones stimulate specific target cells, resulting in a response
- Includes the pituitary gland, hypothalamus, pineal gland, thyroid gland, parathyroid gland, thymus, adrenal gland, pancreas, ovaries, and testes

ANATOMY OF THE ENDOCRINE SYSTEM	FUNCTION
Pituitary gland	The anterior pituitary gland produces GH, TSH, ACTH, FSH, LH, and prolactin; the posterior pituitary gland produces oxytocin and vasopressin (ADH)
Hypothalamus	Serves as a bridge between the nervous system and the hormonal system
Pineal gland	Maintains circadian rhythms and sleep–awake patterns
Thyroid gland	Produces thyroxine (T_4), triiodothyronine (T_3), and calcitonin
Parathyroid gland	Secretes PTH, which maintains appropriate calcium levels in the body
Thymus gland	Secretes humoral factors necessary in maintaining the immune system
Adrenal gland	The medulla region secretes epinephrine and norepinephrine; the cortex region secretes glucorticoid and mineralocorticoid hormones
Pancreas	Produces and secretes hormones from the islets of Langerhans; alpha cells produce glucagon, and beta cells produce insulin
Ovaries (females)	Secrete estrogen and progesterone
Testes (males)	Secrete testosterone

ACTH, Adrenocorticotropic hormone; *ADH,* antidiuretic hormone; *FSH,* follicle-stimulating hormone; *GH,* growth hormone; *LH,* luteinizing hormone; *PTH,* parathyroid hormone; *TSH,* thyroid-stimulating hormone.

IMMUNE SYSTEM

- A defense system that identifies and destroys foreign substances that invade the body

ANATOMY OF THE IMMUNE SYSTEM	FUNCTION
Thymus	A small glandular organ that is situated behind the top of the breastbone, consisting mainly of lymphatic tissue and serving as the site of T-cell differentiation
Lymph node	Filters fluids, catching viruses, bacteria, and other unknown materials
T cells	WBCs known as lymphocytes and play a central role in cell-mediated immunity
B cells	Make antibodies against antigens, to perform the role of APCs, and to develop into memory B cells after activation by antigen interaction
Spleen	Acts as a blood filter

APC, Antigen-presenting cell; *WBC,* white blood cell.

INTEGUMENTARY SYSTEM

- Protects the body against heat, cold, light, dehydration, and infection

ANATOMY OF THE SKIN	FUNCTION
Epidermis	Produces new skin cells
Dermis	Contains collagen and supports blood vessels, glands, and nerves
SC (hypodermis)	Stores fat that insulates the body
Sebaceous glands	Secretes sebum that lubricates the skin and retains water to keep hair and skin soft
Sweat glands	Acts as cooling system when the body temperature rises

NERVOUS SYSTEM

- Controls both voluntary and involuntary functions of the body
- Responsible for the transmission of impulses from sensory neurons to the central nervous system (CNS); interpretation of impulses sent to the CNS and transmission of a response to muscles or glands; coordination of the activities of all divisions of the nervous system; and maintenance of homeostasis by responding to sensory changes in the body.
- Consists of two components, the CNS and peripheral nervous system (PNS)

CENTRAL NERVOUS SYSTEM

ANATOMY	FUNCTION
Cerebral Cortex	
Frontal lobe	Controls motor function, parts of speech, emotions, problem solving, reasoning, and planning
Parietal lobe	Responsible for orientation, recognition, sensation, and comprehending language
Occipital lobe	Controls perception and interpretation related to vision
Temporal lobe	Responsible for auditory stimuli, long-term memory, and behavior
Brainstem	
Midbrain	Responsible for vision, hearing, eye movement, and voluntary body movement
Pons	Accountable for motor control and sensory analysis
Medulla oblongata	In charge of breathing, cardiac rate, heart contractions, and blood vessel dilation
Diencephalon	
Thalamus	Responsible for transmitting messages between the brain spinal cord and for body temperature control
Hypothalamus	Controls emotions, thirst, hunger, heart rate, and autonomic nervous system hormone production
Cerebellum	
Cerebellum	Maintains body balance, posture, and coordinating movement
Cranial Nerves	
I	Olfactory
II	Optic
III	Specific eye and eyelid movement
IV	Another specific type of eye movement
V	Provides sensation to the face, scalp, mucous membranes in the nose, mouth, and eyes
VI	Eye movement
VII	Taste in the front of the tongue
VIII	Inner ear hearing and balance
IX	Reflex control of heart and swallowing
X	Swallowing, breathing, speaking, heartbeat, and digestion
XI	Swallowing and movement through the digestive tract; muscle movements of the upper shoulders, head, and neck
XII	Tongue muscles
Blood–Brain Barrier	
Blood–brain barrier	Prevents molecules from entering and damaging the brain by a chemical reaction

- The spinal cord is a pathway from the brain to the PNS.

PERIPHERAL NERVOUS SYSTEM

SYSTEM	ANATOMY	FUNCTION
Autonomic nervous system		Responsible for unconscious body functions such as the heartbeat and breathing
	Sympathetic system	Responds in stressful time and shuts down nonessential systems during a "fight-or-flight" situation
	Parasympathetic system	Counterbalances the sympathetic system
Somatic system		Sends motor impulses to the skeletal muscle

OPHTHALMIC SYSTEM

- Responsible for providing an individual with vision

ANATOMY OF THE EYE	FUNCTION
Orbit	Socket that contains the eye
Conjunctiva	A thin transparent mucous membrane that covers the anterior eye
Sclera	Protective white portion of eye that contains fibers and muscles
Iris	Responsible for the color of the eye and filters light
Cornea	Allows light into the eye for visual acuity
Pupil	Allows the proper amount of light to enter the eye
Lens	Focuses the image
Retina	Contains receptor cells that are responsible for vision
Lacrimal gland	Secretes tears that possess antimicrobial enzymes
Optic nerve	Sends images from the eye to the brain

REPRODUCTIVE SYSTEM

- Production of offspring for the survival of the species

MALE REPRODUCTIVE SYSTEM

MALE REPRODUCTIVE STRUCTURES	FUNCTION
Testicles	Production and immediate storage of sperm
Epididymis	Responsible for the storage of mature sperm cells
Prostate	Secretes fluid necessary for the transport of sperm cells
Urethra	Transport sperm cells and fluid for ejaculation during sexual intercourse

FEMALE REPRODUCTIVE SYSTEM

ANATOMY	FUNCTION
Ovary	Produces ova
Fallopian tube	Transports the ova monthly where it may become fertilized
Uterus	Houses the fertilized egg
Mammary glands	Used during milk production
Endometrium	Functions as a lining for the uterus, preventing adhesions between the opposed walls of the myometrium
Cervix	During menstruation, the cervix stretches open slightly to allow the endometrium to be shed
Vagina	Has two main functions, sexual intercourse and childbirth

RESPIRATORY SYSTEM

- Responsible for respiration and maintaining homeostasis
- Consists of two systems, the upper and lower respiratory system

RESPIRATORY SYSTEM	ANATOMY	FUNCTION
Upper Respiratory System		
	Nose	Detects smell and serves as a drainage system for tears from the eyes
	Nasal cavities	Warms and moistens inhaled air
	Cilia	Catch small air particles
	Pharynx	Tube that is shared with the digestive system
	Larynx	Contains the vocal cords that produce sound
Lower Respiratory System		
	Alveolus	Site of gas (oxygen and carbon dioxide exchange)
	Trachea	Traps particles and expels them; provides a pathway to the lungs
	Bronchial tree	Provides oxygen distribution and serves as a passageway to the alveoli
	Lungs	Promotes breathing, which includes inspiration and expiration

URINARY SYSTEM

- Responsible for the excretion of chemicals and substances from the body system
- Responsible for creating and maintaining homeostasis throughout the body
- Maintaining chemical composition of electrolytes, fluids, and tissues throughout the body
- Preserving normal blood pressure
- Production erythropoietin

ORGAN	ANATOMY	FUNCTION
Kidney		
	Ureter	Carries waste products removed from the blood to the bladder; carries waste from the kidneys to the bladder
	Bladder	Waste products are stored at this location until eliminated
	Urethra	Carries waste products from the body
	Nephrons	Responsible for the regulation of fluids, solutes, and waste
	Renal artery	Carries blood into the kidney
	Nephron	Chief function is to regulate the concentration of water and soluble substances such as sodium salts by filtering the blood, reabsorbing what is needed, and excreting the rest as urine
	Loop of Henle	Creates a concentration gradient in the medulla of the kidney

PHARMACOLOGY

Pharmacology is defined as the scientific study of the action of drugs on a living system. A medication interacts with receptors and produces a biological response.

PHARMACOKINETICS

Pharmacokinetics involves the absorption, distribution, metabolism, and elimination (excretion) of the drug in a living system.

THERAPEUTIC EQUIVALENCE

A drug is defined as being therapeutically equivalent if the drug:

- Contains the same chemical entity
- Contains the same quantity of active ingredient
- Is the same dosage form
- Has the same route of administration

INTERACTIONS

DRUG–DRUG INTERACTIONS

One drug alters the action of another drug; interactions include addition, antagonism, potentiation, and synergism.

- **Addition:** The combined effect of two drugs; it is equal to the sum of the effects of each drug taken alone.
- **Antagonism:** One drug works against the action of another drug.
- **Potentiation:** One drug increases or prolongs the effect of another drug; the total effect is greater than the sum of the effects of each drug alone (e.g., Vistaril and Demerol).
- **Synergism:** The joint action of drugs in which their combined effect is more intense or longer in duration than the sum of the effects of two drugs

DRUG–DISEASE INTERACTIONS

Various diseases may inhibit the absorption, metabolism, and elimination of different drugs. An example is taking decongestants if the patient is has hypertension or diabetes.

DRUG–DIETARY SUPPLEMENT INTERACTIONS

Many herbal and dietary supplements have developed drug interactions with prescription drugs. Vitamins, glucosamine–chondroitin, fish oil, and coenzyme Q have interacted with warfarin. A total of 62% of herbal supplements used have had interactions with warfarin.

DRUG–OVER-THE-COUNTER DRUG INTERACTIONS

Various over-the-counter (OTC) medications may either increase or decrease the effects of a prescription medication. For example, aspirin can increase the effect of warfarin, and antacids can decrease the effects of cimetidine.

DRUG–LABORATORY INTERACTIONS

Many drugs used today have demonstrated they may have an effect on serum potassium and creatine levels in the body. These interactions can result in additional testing to detect abnormalities.

DRUG–NUTRIENT INTERACTIONS

Poor nutrition may affect the metabolism of various drugs. An example of a drug–nutrient interaction occurs when warfarin and vitamin K are taken simultaneously.

EXAMPLES OF DRUG–FOOD INTERACTIONS

- Improved absorption occurs if the following drugs are taken with a fatty meal: ketoconazole, nitrofurantoin, and griseofulvin.
- Decreased absorption occurs if the following drugs are taken with food: tetracycline, ciprofloxacin, etidronate, phenytoin, norfloxacin, zidovudine, levothyroxine, and didanosine.
- Grapefruit juice affects the following drugs metabolized by cytochrome P450: calcium channel blockers, estrogens, cyclosporine, midazolam, and triazolam.
- Warfarin interacts with foods high in vitamin K, such as romaine lettuce and spinach. Warfarin users should consult a cardiologist or internist for a list of these foods.

DRUG-RELATED PROBLEMS

- An event or situation involving drug therapy that actually or potentially interferes with the optimum outcome. These drug-related problems include an untreated indication, improper drug selection, subtherapeutic dosage, failure to receive a drug, overdosage, and drug use without an indication.

PREGNANCY CATEGORIES

When pregnancy appears as a contraindication or precaution to the use of a drug, it is categorized as by the Food and Drug Administration in one of five different categories:

- **Category A:** Adequate studies in pregnant women have failed to show a risk to the fetus in the first trimester, and there is no risk in later trimesters.
- **Category B:** Animal studies have failed to show a risk to the fetus, but no adequate studies in pregnant women or animal studies have shown an adverse effect but human studies have not shown a risk to the fetus in the first trimester and there is no evidence of risk in later trimesters.
- **Category C:** Animal studies have shown an adverse effect on the fetus and there are no adequate studies in humans, but the benefits may outweigh the risks.
- **Category D:** Positive evidence of human fetal risk, but the benefits outweigh the risks.
- **Category X:** Animal or human studies have shown fetal abnormalities or toxicity, and the risk outweighs the benefits.

DRUG NOMENCLATURE

A drug may have three different names:

- **Chemical name:** Determined by chemical structure of the drug entity
- **Proprietary (brand or trade) name:** Assigned by the drug manufacturer and is protected through a patent
- **Nonproprietary (generic) name:** Assigned to a medication and contains a word stem that has been issued by the U.S. Adopted Names Council

Knowledge of prefixes, root words, and suffixes allows a pharmacy technician to identify the drug classification and subsequently its indication. Some of these drug prefixes and suffixes encountered daily include:

WORD STEM	CLASSIFICATION	WORD STEM	CLASSIFICATION
-astine	Antihistamine	-prazole	Antiulcer
-azepam	Antianxiety	-pril	ACE inhibitor
-caine	Local anesthetic	-sartan	Angiotensin II receptor antagonist
-cillin	Penicillin	-semide	Loop diuretic
-conazole	Systemic antifungal	-setron	Serotonin (5-HT3) antagonist
estr-	Estrogen	sulfa-	Sulfonamide
-glitazone	Antiabetic	-terol	Bronchodilator
-micin	Aminoglycoside	-tidine	H_2 receptor antagonist
-thromycin	Macrolide	-e-triptyline;-amine	Tricyclic antidepressant
-olol	Beta-blocker	-oxetine	Fluoxetine-type antidepressant
-olone	Steroid	-vastatin	HMG CoA reductase inhibitor
-profen	Antiinflamatory		

ACE, Angiotensin-converting enzyme.

A complete listing of the word stems issued by the U.S. Adopted Names Council can be found in Appendix B.

CONDITIONS AND TREATMENTS FOR THE IMMUNE SYSTEM

Bacterial infections: Occur when the body's immune system is unable to resist bacteria. Symptoms of a bacterial infection include a fever greater than 101° F and an increase in white blood cells.

Multidrug-resistant infections: An infection caused by bacteria that is resistant to one or more drug classifications. Some examples of multidrug-resistant infections include the following:

- Methicillin-resistant *Staphylococcus aureus* (MRSA)
- Vancomycin-resistant *S. aureus* (VRSA)
- Multidrug-resistant *Streptococcus pneumoniae* (MDRSP)
- Gram-negative resistant bacilli (GNRB)
- Vancomycin-resistant enterococcus (VRE)

Pneumonia: An infection that causes acute inflammation in the airways of the lung, blocking them with thick mucus

SULFONAMIDES

Mechanism of action (MOA): Interfere with para-aminobenzoic acid and folic acid formation and thus destroy bacteria

Common indications: Urinary tract infections (UTIs), otitis media, ulcerative colitis, lower respiratory infections

Adverse reactions: Photosensitivity resulting in sunburns, rashes, nausea and vomiting, jaundice, blood complications, and kidney damage

Contraindications/cautions: Hepatic or renal impairment

Special considerations

- Avoid direct sunlight or use sunscreens when exposed.
- Drink plenty of water to prevent crystallization in the urine.
- Sulfamethoxazole–trimethoprim infusion fluids need to be stored at room temperature.

EXAMPLES OF SULFONAMIDES

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
sulfamethoxazole–trimethoprim	Bactrim, Septra	Oral suspension, tablet, IV	1 tab PO bid
sulfadiazine	Silvadene	Cream	Apply 1–2 times a day
sulfasalazine	Azulfidine	Tablet, enteric-coated tablet, oral suspension	1 tab PO qid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

PENICILLINS

MOA: Prevent bacteria from forming a cell wall
Common indications: Abscesses, meningitis, otitis media, pneumonia, respiratory infections, prophylaxis
Adverse reactions: Diarrhea, hives, rash, wheezing, anaphylaxis
Contraindications/cautions: Hypersensitivity to β-lactams, seizure disorders, renal impairment
Special considerations: Take on an empty stomach with water; avoid taking with colas or juices.

PENICILLINS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
amoxicillin	Amoxil, Polymox	Capsule, oral suspension, chewable tablet	1 cap/tab PO tid
ampicillin	Omnipen	Capsule, oral suspension	1 cap PO qid
amoxicillin + clavulanate	Augmentin	Chewable tablet, tablet, suspension	1 tab PO bid
dicloxacillin	Dynapen	Oral suspension, oral tablet, chewable tablet	1 cap q6h
piperacillin	None	Powder for injection	3–4 g IM/IV q4–6 h
piperacillin + tazobactam	Zosyn	Powder for injection, solution for injection	3.375 g IV q6h for 7–10 days
penicillin	Veetids	Tablet, oral suspension	1 tab PO 4 times a day for 10 days
ticarcillin–clavulanate	Timentin	IV	3.1 g IV q4–6h

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

CEPHALOSPORINS

MOA: Prevent bacteria from forming a cell wall
Indications: Dental work, heart and pacemaker procedures, orthopedic surgery, pneumonia, upper respiratory infections (URIs), and sinus infections
Adverse reactions: Diarrhea, hives, rash, wheezing, anaphylaxis
Contraindications/cautions: Hypersensitivity to penicillin, history of gastrointestinal (GI) problems, renal impairment
Special considerations: Approximately 10% of the population may have a cross-sensitivity to penicillin.

CEPHALOSPORINS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
cefaclor	Ceclor	Capsule, oral suspension, extended-release tablet	1 cap PO q8h
cefdinir	Omnicef	Capsule, oral liquid	1 cap PO q12h for 10 days
cefixime	Suprax	Oral suspension, tablet	1 tab PO daily
cefepime	Maxipime	Injection (IV)	1–2 g IV q12h
cefpodoxime	Vantin	Oral suspension	100–400 mg PO bid
cefadroxil	Duricef	Capsule, oral suspension, tablet	1–2 g PO div q12–24h
ceftaroline–fosamil	Teflaro	IV	600 mg IV q12h × 5–7 days
ceftibuten	Cedax	Oral suspension, capsule	1 tab PO qd
ceftriaxone	Rocephin	IM, IV	1–2 g IM/IV q24h
cefuroxime	Ceftin, Zinacef	IM, IV, oral suspension, tablet	1 tab PO bid × 10 days
cephalexin	Keflex	Capsule, oral suspension, tablet	1 cap PO qid
cefprozil	Cefzil	Oral liquid, capsule	1 cap PO q12h × 10 days

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

CARBAPENEMS AND MONOBACTAMS

MOA: Inhibit bacterial cell wall synthesis
Indications: Gram-positive and gram-negative bacteria
Contraindications/cautions: Hypersensitivity to multiple allergens, seizure history, CNS disorders
Adverse reactions: Same as penicillin and cephalosporin, but there is an increased possibility of seizures.

CARBAPENEM AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
ertapenem	Invanz	Injection (IV)	1 g IM/IV qd × 5–14 days
imipenem–cilastatin	Primaxin	Injection (IV)	250–500 mg IV q6h

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

MONOBACTAM AGENT

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
aztreonam	Azactam	IV	1–2 g IM/IV q8–12h

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

TETRACYCLINES

MOA: Inhibit protein synthesis in bacteria by binding ribosomes
Indications: Acne, chronic bronchitis, Lyme disease, Rocky Mountain spotted fever, "walking" pneumonia, prophylaxis for traveler's diarrhea
Adverse reactions: GI, such as nausea and vomiting; photosensitivity to sunlight, resulting in rashes and sunburns
Contraindications/cautions: Pregnancy, renal or hepatic impairment

Special Considerations

- May bind to antacids and dairy products and therefore decrease the effectiveness of the antibiotic
- Tetracyclines should be taken several hours apart from antacids and dairy products because of the possibility of chelation.
- They should not be taken by pregnant women because of the possibility of dental birth defects.
- Children younger than 9 years should not be given tetracyclines.
- Taking expired tetracycline may result in toxicity and possibly death.
- Doxycycline should be protected from light.

TETRACYCLINES

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
doxycycline hyclate	Vibramycin	Capsule, IV, oral suspension, tablet	100 mg PO qd
doxycycline monohydrate	Monodox	Tablet	100 mg PO qd
minocycline	Minocin	Capsule, IV, oral suspension, tablet	100 mg PO q12h
tetracycline	Sumycin	Capsule, oral suspension, topical	1–2 g/day PO div bid–qid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

MACROLIDES

MOA: Inhibit protein synthesis by interacting with ribosomes
Indications: Pulmonary infections, chlamydia, *Haemophilus influenzae*
Adverse reaction: May cause GI distress
Contraindications/cautions: Hepatic or renal impairment, QT prolongation

Special Considerations

- The patient should take macrolides with food.
- Clarithromycin may leave a metallic taste in one's mouth.
- The first dose of azithromycin is a loading dose.

MACROLIDES

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
azithromycin	Zithromax	Capsule, oral suspension	500 mg PO × 1 on day 1; then 250 mg/day × 4 days
clarithromycin	Biaxin	Granules for oral suspension, film-coated tablet	250–500 mg PO q12h × 7–14 days
erythromycin base	Eryc, E-Mycin, Ery-Tab	Capsule, tablet, enteric-coated tablet, film-coated tablet	1000 mg/day PO div q6–12h
erythromycin ethylsuccinate	E.E.S.	Oral suspension, tablet, chewable tablet	1600 mg/day PO div q6–12h
erythromycin stearate	Erythrocin	Film-coated tablet, IM, IV	1000 mg/day PO div q6–12h
erythromycin–sulfisoxazole	Pediazole	Oral suspension	40–50 mg/kg/day PO div q6–8h
erythromycin lactobionate	Erythrocin	IV	15–50 mg/kg/day IV div q6h

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

KETOLIDES

MOA: Block protein synthesis by binding to ribosomal subunits; may inhibit the formation of newly forming ribosomes

Indications: Used to treat bacterial infections in the lungs and sinuses

Adverse reactions: Blurred vision; side effects similar to those of macrolides

Contraindications/cautions: Myasthenia gravis, hypersensitivity to macrolides, hepatic impairment, QT prolongation

KETOLIDE AGENT

GENERIC NAME	BRAND NAME	DOSAGE FORM	DAILY DOSAGE*
telithromycin	Ketek	Tablet	800 mg PO qd × 7–10 days

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

QUINOLONES

MOA: Antagonize an enzyme required for DNA synthesis, causing DNA breakage and finally death

Indications: Bone and joint infections, dental work, infectious diarrhea, URIs, and UTIs

Adverse reactions: Nausea and vomiting, joint swelling, dizziness

Contraindications/cautions: Myasthenia gravis, patients younger than 18 years of age, and patients older than 60 years of age

Special Considerations

- Antacids interfere with absorption.
- Potentiates the effect of theophylline products and may cause toxicity
- Cause phototoxicity
- Should not be given to pregnant women
- Ciprofloxacin injection should be protected from light.
- Ofloxacin injection needs to be protected from light.

QUINOLONE AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
ciprofloxacin	Cipro	Tablet, oral suspension, ophthalmic, IM, IV	250–750 mg PO q12h
levofloxacin	Levaquin	IV, tablet	500 mg PO/IV q24h × 7 days
moxifloxacin	Avelox, Vigamox	Tablet, IV (Vigamox—ophthalmic use only)	400 mg PO/IV q24h × 5–14 days
norfloxacin	Noroxin	Tablet	400 mg PO bid
ofloxacin	Floxin, Ocuflox	Tablet, ophthalmic	200–400 mg PO q12h

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

STREPTOGRAMINS

MOA: Inhibit bacterial protein synthesis

Indications: Gram-positive infections, *Enterococcus faecium,* and vancomycin- and methicillin-resistant infections

Adverse reactions: Nausea, vomiting, joint swelling, dizziness. There is a possibility of an adverse reaction occurring at the site of infusion.

Contraindication/caution: Hypersensitivity to drug, class, or component

Special Considerations

- Synercid should not come into contact with saline or other medications. It must be stored in the refrigerator.

STREPTOGRAMIN AGENT

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
Quinupristin–dalfopristin	Synercid	IV	7.5 mg/kg IV q8h

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

AMINOGLYCOSIDES

MOA: Inhibit bacterial protein synthesis
Indications: Life-threatening infections, sepsis, immunocompromised patients
Adverse reactions: Nephrotoxicity, ototoxicity, tinnitus, permanent deafness
Contraindications/cautions: Neuromuscular blockade, nephrotoxicity, neurotoxicity

Special Considerations

- Doses need to be adjusted for each patient after the first dose and closely monitored, especially in patients with renal impairment.
- Once-per-day dosage has the tendency to reduce toxicity; however, monitoring is still required.

AMINOGLYCOSIDE AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
gentamicin	Garamycin	Cream, IM, IV, ophthalmic	1–1.7 mg/kg IM/IV q8h
streptomycin	Streptomycin	IM	1–2 g/day IM q6–12h
tobramycin	Nebcin	IV, ophthalmic, inhaler	1–1.7 mg/kg IM/IV q8h

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

CYCLIC LIPOPEPTIDES

MOA: Bind to bacterial membranes and cause the cell membrane to depolarize, resulting in an inhibition of DNA and RNA synthesis
Indications: Used to treat complicated skin infections and aerobic gram-positive bacterial infections
Adverse reactions: Hypotension, headache, insomnia, allergic site reactions
Contraindication/caution: Elderly patients
Special consideration: Should not be taken with 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase inhibitors

CYCLIC LIPOPEPTIDE

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
daptomycin	Cubicin	IV	4 mg/kg IV q24h × 7–14 days

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

MISCELLANEOUS ANTIBIOTICS

Clindamycin (Cleocin)

MOA: Inhibits protein synthesis
Indications: Acne, dental prophylaxis for penicillin-allergic patients, infections caused by anaerobic organisms, bone infections, female genital infections
Adverse reaction: Bloody diarrhea
Contraindications/cautions: *Clostridium difficile*–associated diarrhea, ulcerative colitis, hepatic or renal impairment
Special consideration: Should be avoided during pregnancy

Metronidazole (Flagyl)

MOA: Destroys parts of the bacteria's DNA nucleus
Indications: *Trichomonas* infections of vaginal canal, cervix, and male urethra; amebic dysentery; intestinal infections
Adverse reactions: Metallic taste, diarrhea, rash, and "Antabuse-like reaction" when alcohol is consumed. An Antabuse-like reaction results in blurred vision, confusion, difficult breathing, hot and scarlet face, an intense throbbing in the head and neck, and chest pains.
Contraindications/cautions: Pregnancy, blood dyscrasias
Special consideration: Take with food, and avoid any form of alcohol 1 day before, during, and 2 days after therapy with metronidazole.

Pentamidine (NebuPent, Pentam)

MOA: Unknown
Indication: Indicated for the treatment of *Pneumocystis carinii* infection
Adverse reactions: Hypotension, wheezing, coughing
Contraindications/cautions: Hypertension, tachycardia
Special consideration: If the medication is inhaled, the dose must be diluted with sterile water and delivered at a rate of 6 mL/min by a nebulizer.

Linezolid (Zyvox)

MOA: Inhibits bacterial protein synthesis
Indications: Used to treat methicillin-resistant *S. aureus* and vancomycin-resistant *E. faecium* and other gram-positive infections
Contraindications/cautions: Thrombocytopenia, uncontrolled hypertension

Special Considerations

- The intravenous (IV) form must be protected from light and cannot be administered with other medications.
- Avoid foods that are high in tyramine.

Vancomycin (Vancocin)

MOA: Interferes with bacterial wall formation
Indications: Dialysis patients, endocarditis, staphylococcus infections
Adverse reactions: Red man syndrome, ototoxicity, nephrotoxicity, neutropenia
Contraindications/cautions: Renal impairment, inflammatory bowel disease
Special considerations: Blood urea nitrogen or creatine if renal impairment

- Potential for overuse prompted the Centers for Disease Control and Prevention to issue specific guidelines for use
- Patient needs to be kept hydrated.

ANTIFUNGALS

Fungal infections: Caused by single-cell organisms that do not have chlorophyll, possess a cell wall, and reproduce by spores. Fungus develops in individuals whose immune systems have been compromised by disease, drug therapy, or poor nutrition.
Tinea infections: A fungal infection of the skin or feet
MOA: Prevent synthesis of ergosterol and inhibit fungal cytochrome P450
Adverse reactions: Liver toxicities may develop; therefore, liver function tests are recommended. GI distress may occur. Photosensitivity, rashes, and nausea are other common side effects.

Special Considerations

- Antifungals may be used as either topical or systemic agents.
- Pulse dosing is recommended for nail fungal infections.
- Consuming a cola before taking itraconazole is recommended.
- Fatty meals should be taken with griseofulvin.
- Fluconazole suspension should be refrigerated and expires in 14 days.

ANTIFUNGAL AGENTS

GENERIC NAME	BRAND NAME(S)	DOSAGE FORMS	DAILY DOSAGE*	RX or OTC
amphotericin B	Amphotec, Fungizone, Amphocin	IV, topical	3–4 mg/kg/day IV	
butenafine	Mentax	Topical cream	Apply 1–2 times a day for 7–14 days	RX and OTC
ciclopirox	Loprox	Topical	Apply twice a day for 1–4 weeks	
clotrimazole	Lotrimin	Oral troche, topical, vaginal	10 mg PO 5 × day × 14 days	RX: troche OTC: cream
clotrimazole–betamethasone	Lotrisone	Cream	Apply bid	
fluconazole	Diflucan	IV, tablet, oral suspension	100 mg PO/IV qd	
griseofulvin	Grisactin, Fulvicin, Gris-PEG	Capsule, tablet, oral suspension	500 mg PO qd × 2–4 wk	
itraconazole	Sporanox	Capsule, oral suspension	200 mg PO bid × 7 days; off 21 days	
ketoconazole	Nizoral	Tablet, topical cream, shampoo	200–400 mg PO qd	
miconazole	Monistat	Topical, vaginal	Varies because of dosage and condition	OTC
nystatin	Nilstat	Tablet, oral suspension, topical, vaginal	4–6 mL PO qd; 1–2 tabs PO tid	
oxiconazole	Oxistat	Cream, lotion	Apply 1–2 times a day for 14 days	
sertaconazole	Ertaczo	Cream	Apply twice a day for 4 wk	
sulconazole	Exelderm	Cream	Apply 1–2 times a day	
terbinafine	Lamisil	Tablet, topical cream, solution	1 tab PO qd × 6–12 wk	
terconazole	Terazol	Vaginal cream, suppository	1 applicator (supp) vag hs × 3–7 days (depending on dosage)	
voriconazole	Vfend	IV, oral liquid, tablet	1 tab PO 1 h ac or pc; 3 mg/kg/h infused over 1–2 h (IV)	

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

ANTIVIRALS

Viral infections: Caused by agents smaller than bacteria, which are normally spread by direct contact, ingestion of contaminated food and water, or inhalation of airborne particles. Viral infections may be acute, chronic, or slow in nature, and the infection may be local or generalized. Their symptoms are more severe than in bacterial infections and include malaise, myalgia, headaches, chills, or fever.

Herpes: An outbreak of the skin that causes painful blister-like eruptions and is caused by a virus

Influenza: A respiratory tract infection caused by an influenza virus

MOA: Inhibit penetration of the host cell

Indications: Cytomegalovirus retinitis, genital herpes, herpes simplex, herpes simplex keratitis, herpes zoster (shingles), influenza prophylaxis, organ transplants, varicella, chickenpox

Adverse reactions: Headaches, nausea, vomiting, diarrhea, constipation, renal disorders

Contraindications/cautions: Renal or hepatic impairment, electrolyte impairments

Special Considerations

- Oral products should be taken with plenty of water.
- When acyclovir is reconstituted, the injection solution should be used within 12 hours.

ANTIVIRAL AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
acyclovir	Zovirax	Capsule, tablet, oral suspension, IV, ointment	200–800 mg q4h 5 times daily for 7–10 days
amantadine	Symmetrel	Capsule, syrup	200 mg PO qd
cidofovir	Vistide	IV	5 mg/kg IV over 1 h
famciclovir	Famvir	Tablet	200–1000 mg PO qd
foscarnet	Foscavir	IV	90 mg/kg (over 1–1½ h) q12h
ganciclovir	Cytovene	Capsule, IV	5 mg/kg over 1 h q12h for 14–21 days
oseltamivir	Tamiflu	Capsule, oral liquid	75 mg bid × 5 days
penciclovir	Denavir	Cream	Apply q2h during waking hours × 4 days
rimantadine	Flumadine	Tablet	100 mg bid × 7 days
ribavirin	Virazole	Aerosol inhalant	Continuous aerosol administration for 12–18 h for 3–7 days
valacyclovir	Valtrex	Caplet	Dosage varies by condition being treated
valganciclovir	Valcyte	Tablet, oral	900 mg bid × 21 days
zanamivir	Relenza	Inhalant	10 mg bid × 5 days

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

ANTIRETROVIRALS

Human immunodeficiency virus (HIV): A bloodborne sexually transmitted viral disease that causes the host to become too weak to fight any infection

Acquired immunodeficiency syndrome (AIDS): An end-stage disease that occurs as a result of HIV when the CD4 T-cell count is less than 200 per microliter of blood

Indication: Limits the progression of the retrovirus that causes HIV, which may progress to AIDS

Nucleoside Reverse Transcriptase Inhibitors (NRTIs)

Indication: Assist in the treatment of HIV disease

MOA: Inhibit the release of neuraminidase, a viral enzyme, to prevent the spread of the virus to healthy cells. NRTIs bind and inhibit the action of neuraminidase. This results in the formation of a defective proviral nucleus, which is unable to become part of the host cell's nuclei.

Contraindications/cautions: Pancreatitis, lactic acidosis

Adverse reactions: Nausea, vomiting, peripheral neuropathy

Special consideration: Should not be used during lactation

NUCLEOSIDE REVERSE TRANSCRIPTASE INHIBITORS (NRTIs)

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
abacavir (ABC)†	Ziagen	Solution, tablet	300 mg PO bid or 600 mg PO qd
didanosine (ddI) †	Videx, Videx EC	Capsule, tablet, powder	200 mg PO bid
emtricitabine (FTC) †	Emtriva	Tablet	200 mg PO qd
lamivudine (3TC) †	Epivir	Tablet, solution	150 mg PO qd or 300 mg PO qd
stavudine (d4T) †	Zerit	Capsule, powder	30–40 mg PO qd

NUCLEOSIDE REVERSE TRANSCRIPTASE INHIBITORS (NRTIs)—cont'd

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
tenofovir (TDF) †	Viread	Tablet	300 mg PO qd
zalcitabine (ddC) †	Hivid	Tablet	0.75 mg PO q8h
zidovudine (AZT) †	Retrovir	Capsule, syrup, IV	600 mg PO qd in div doses
abacavir-lamivudine	Epzicom	Tablet	1 tab PO qd
emtricitabine–tenofovir	Truvada	Tablet	1 tab PO qd
zidovudine–lamivudine (CBV) †	Combivir	Tablet	1 tab PO bid
zidovudine–lamivudine–abacavir (TRZ) †	Trizivir	Tablet	I tab PO bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†Both The Joint Commission and the Institute for Safe Medication Practices are against the using of abbreviations for medications; however, physicians may still use these abbreviations.

Nonnucleoside Reverse Transcriptase Inhibitors (NNRTIs)

Indications: Aid in the treatment of HIV disease
MOA: Inhibit the action of neuraminidase by preventing the formation of the proviral DNA
Adverse reactions: Dizziness, headache, rashes, nightmares, hallucinations, hepatotoxicity
Contraindication/caution: Hepatic impairment

Special Considerations

- Drug interactions are common.
- Can induce or inhibit the cytochrome P450 systems
- Resistance to one NNRTI results in resistance to the others.

NONNUCLEOSIDE REVERSE TRANSCRIPTASE INHIBITORS (NNRTIs)

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
delavirdine (DLV) †	Rescriptor	Capsule, tablet	1–2 tab PO tid
etravirine	Intelence	Tablet	200 mg PO bid
efavirenz (EFZ) †	Sustiva	Capsule	600 mg PO qd
nevirapine (NVP) †	Viramune	Capsule, tablet	1 tab PO qd × 14 days, then 1 tab PO bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†Both The Joint Commission and the Institute for Safe Medication Practices are against the using of abbreviations for medications; however, physicians may still use these abbreviations.

Protease Inhibitors

Indication: Assist in the treatment of HIV
MOA: Prevent the cleavage of certain HIV protein precursors, which are necessary for the replication of new viruses
Adverse reactions: Redistribution of body fat ("protease paunch," humped back), facial atrophy, breast enlargement, hyperglycemia, hyperlipidemia
Contraindications/cautions: Nephrolithiasis history, diabetes, hepatic impairment

PROTEASE INHIBITORS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
amprenavir	Agenerase‡	Capsule, oral liquid	1200 mg PO bid
atazanavir	Reyataz	Capsule	300–400 mg PO qd
fosamprenavir (FPV) †	Lexiva	Tablet	700–1400 mg PO qd–bid
indinavir (IDV)†	Crixivan	Capsule	2 caps PO q8h
lopinavir–ritonavir (LPV/r) †	Kaletra	Solution, capsule	3–6 caps PO qd–bid
nelfinavir (NFV) †	Viracept	Powder, tablet	750 mg PO tid or 1250 mg PO bid
ritonavir (RTV) †	Norvir	Solution, capsule	600 mg PO bid
saquinavir (SQV-SGC) †	Invirase	Capsule	1000 mg PO bid
tipranavir	Aptivus	Capsule	500 mg PO bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†Both The Joint Commission and the Institute for Safe Medication Practices are against the using of abbreviations for medications; however, physicians may still use these abbreviations.
‡Brand is no longer available in the United States.

Fusion Inhibitor

Indication: Aids in the treatment of HIV
MOA: Prevents AIDS virus from entering immune cells
Adverse reactions: Skin reactions, which may cause bruising, cysts, itching, bumps, pain, and redness
Contraindication/caution: Pulmonary disease

Special Considerations

- The product has a pregnancy category B rating.
- It is diluted with sterile water.

FUSION INHIBITORS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
enfuvirtide	Fuzeon	SC injection	90 mg SC bid
maraviroc	Selzentry	Tablet	300 mg PO bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

ANTIPROTOZOAL AGENTS

Indications: Malaria, extraintestinal amebiasis
MOA: Unknown
Adverse reactions: Nausea or vomiting, anorexia, diarrhea, abdominal pain
Contraindications/cautions: Retinal field changes, long-term usage

ANTIPROTOZOAL AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
chloroquine	Aralen	Tablet	500 mg po q wk
iodoquinol	Yodoxin	Tablet	650 mg po tid × 20 days
mefloquine	†	Tablet	250 mg po q wk
metronidazole	Flagyl	Tablet	750 mg po tid × 5–10 days
praziquantel	Biltricide	Tablet	54–25 mg/kg po × 1 dose
primaquine	Primaquine	Tablet	30 mg po qd × 14 days
pyrimethamine	Daraprim	Tablet	25 mg po q wk × 10 wk

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

ANTIHISTAMINES, ANTITUSSIVES, DECONGESTANTS, AND EXPECTORANTS

Allergies: A response of our immune system due to an unrecognized substance
Rhinitis: An irritation and inflammation of the mucous membranes lining the nasal passages

Antihistamines

Indications: Treatment of allergies, insomnia, rashes, hay fever, dizziness; prophylaxis for drug reactions and allergies
MOA: Block the release of histamine (H_1) in the respiratory system
Adverse reactions: Drowsiness, anticholinergic reactions such as drying up of body fluids, possible hyperactivity in children
Contraindication/caution: Renal impairment

Special Considerations

- Antihistamines have a synergistic effect with alcohol.

ANTIHISTAMINES

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	RX OR OTC
azelastine	Astelin	Spray	1–2 sprays per nostril bid	
budesonide	Rhinocort Aqua	Nasal spray	1–4 sprays/nostril qd	
cetirizine	Zyrtec	Tablet	5–10 mg PO qd	OTC
chlorpheniramine	Chlor-Trimeton	Tablet, capsule	1 tab PO q4–6h prn	OTC
ciclesonide	Omnaris	Nasal spray	2 sprays per nostril qd	
clemastine	Tavist	Tablet	1 tab PO q12h prn	OTC
cyproheptadine	†	Tablet, syrup	1 tab PO tid	
dexamethasone	Decadron	Tablet, elixir	Dosing varies by condition	
diphenhydramine	Benadryl	Capsule, tablet, topical, elixir, strips	1–2 tabs/caps/strips PO q4–6h	RX and OTC

ANTIHISTAMINES—cont'd

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	RX OR OTC
fexofenadine	Allegra	Tablet	1 tab PO bid	OTC
fluticasone	Flonase	Nasal spray	2 spray per nostril per day	
hydroxyzine HCl	†	Tablet, capsule, syrup, IM, IV	1 tab PO tid–qid	
hydroxyzine pamoate	Vistaril	Capsule, syrup	1 cap PO tid–qid	
loratadine	Claritin	Tablet, syrup	1 tab PO qd	OTC
meclizine	Antivert, Bonine	Tablet, capsule, chewable tablet	1 tab PO tid–qid	OTC
mometasone	Nasonex	Nasal spray	2 sprays per nostril qd	
olopatadine	Patanol	Ophthalmic solution	1 gtt in eye bid	
promethazine	†	Tablet, syrup, suppository, IM, IV	25 mg bid	
triamcinolone	Nasacort AQ	Nasal spray	1–2 sprays q nostril qd	

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Antitussives

Indication: Treatment of cough
MOA: Depression of the cough center or suppression of nerve receptors in respiratory system
Adverse reactions: CNS depression, nausea, lightheadedness
Contraindication/caution: CNS depression

Special Considerations

- Dextromethorphan interacts with monoamine oxidase inhibitors (MAOIs).
- Benzonatate should be swallowed but not chewed.

ANTITUSSIVES

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	RX OR OTC
benzonatate	Tessalon Perles	Capsule	1 cap PO tid prn cough	
codeine	Codeine	Tablet, elixir	15–60 mg PO q4h	
dextromethorphan	Benylin, Delsym, Hold, Robitussin DM	Syrup, lozenges	10 mL PO q12h prn	OTC
hydrocodone–homatropine	†	Syrup, tablet	1 tab or 1 tsp PO q4–6h	
promethazine–codeine	†	Oral liquid	1 tsp PO q4–6h	
promethazine–dextromethorphan	†	Oral liquid	1 tsp PO q4–6h	

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Decongestants

Indications: Temporary relief of nasal congestion from the common cold, sinusitis, and upper respiratory allergies
MOA: Stimulation of the α-adrenergic receptors, resulting in constriction of the dilated arteries within the nasal mucosa
Adverse reactions: CNS stimulation, increased blood pressure, increased heart rate, insomnia, anxiety, tremor, rhinitis medicamentosa, and headache
Contraindications/cautions: Urinary retention, coronary artery disease, uncontrolled hypertension

Special Considerations

- Decongestants should be avoided if the patient has diabetes, heart disease, hypertension, hyperthyroidism, prostatic hypertrophy, or Tourette syndrome.

DECONGESTANTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	RX OR OTC
oxymetazoline	Afrin	Nasal drops, spray/mist	2–3 sprays q nostril q10–12h prn	OTC
phenylephrine	Neo-Synephrine, Neo-Synephrine II	Nasal drops and spray	2–3 sprays q nostril prn	OTC
pseudoephedrine	Sudafed	Capsule, tablet, oral solution	1 tab PO q6h	OTC sold behind the counter

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

COMBINATION DECONGESTANTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*	RX OR OTC
cetirizine–pseudoephedrine	Zyrtec-D	Tablet	1 tab PO q12h	OTC (behind the counter)
fexofenadine–pseudoephedrine	Allegra-D	Tablet	1 tab PO q12h	OTC (behind the counter)
loratadine–pseudoephedrine	Claritin-D	Tablet	1 tab PO q12h	OTC (behind the counter)

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Expectorants

Indications: To remove mucus from both lungs and airway passages during coughing
MOA: Decrease thickness of mucus by decreasing the viscosity of the liquid
Adverse reactions: Nausea and vomiting, drowsiness, GI distress
Contraindications/cautions: Nephrolithiasis, patients younger than 6 years of age
Special consideration: Patient should consume plenty of water while taking medication.

EXPECTORANT

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	RX OR OTC
guaifenesin	Mucinex	Capsule, caplet, liquid, tablet	1 tsp PO q4–6h	OTC

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

COMBINATION EXPECTORANTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*	RX OR OTC
chlorpheniramine/hydrocodone	Tussionex PennKinetic	Suspension	5 mL q12h	
guaifenesin–codeine	Robitussin A-C	Liquid	1 tsp PO q4–6h prn cough	Exempt narcotic
guaifenesin–pseudoephedrine	Mucinex D	Tablet	2 tab PO q12h	OTC
promethazine–codeine	Phenergan/codeine	Syrup	5 mL PO q4–6h	

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

CONDITIONS AND TREATMENTS FOR THE NERVOUS SYSTEM

Anxiety: A state of uneasiness characterized by apprehension and worry about possible events resulting from either exogenous or endogenous stress

Panic disorders: Intense anxiety characterized by a sense of fear, apprehension, or a premonition of serious illness or a life-threatening attack

MOA for Antianxiety Agents

Adverse reactions: May cause either physical or psychological dependence, drug accumulation, birth defects if taken during early pregnancy, muscle relaxation, sedation, and depression

Contraindications/cautions: Pulmonary impairment, sleep apnea, CNS depression, seizure history

Special Considerations

- Many agents used to treat anxiety are controlled substances; therefore, federal and state controlled substance laws must be obeyed.
- Should be tapered on discontinuation

ANTIANXIETY AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	CONTROLLED SUBSTANCE
alprazolam	Xanax	Tablet	0.25–0.5 mg PO tid	Yes
amoxapine	†	Tablet	100 mg PO bid–tid	No
buspirone	BuSpar	Tablet	20–30 mg PO qd	No
chlordiazepoxide	Librium	Capsule, injection	5–10 mg PO tid–qid	Yes
clorazepate	Tranxene	Capsule, tablet	15–60 mg PO qd in divided doses	Yes
diazepam	Valium	Tablet, injection	2-10 mg PO bid–qid	Yes
lorazepam	Ativan	Tablet, IM, IV	2–3 mg PO qd in divided doses	Yes
meprobamate	†	Tablet	1200–1500 mg PO in divided doses	Yes
oxazepam	Serax	Capsule, tablet	10–15 mg PO tid–qid	Yes

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Depression: Psychiatric disorder that may be caused by changes in neurotransmitters (e.g., dopamine, norepinephrine, or serotonin) in the brain; symptoms include a loss of interest in normal activities, low self-esteem, pessimism, self-pity, weight loss or gain, insomnia, loss of energy, feelings of worthlessness, feelings of guilt, or recurrent thoughts of death or suicide

SELECTIVE SEROTONIN REUPTAKE INHIBITORS (SSRIs)

Indications: Major depression, obsessive-compulsive behavior, anxiety

MOA: Block the reuptake of serotonin

Adverse reactions: Nervousness, insomnia, nausea, diarrhea, loss of weight, decreased libido, ejaculatory disturbances

Contraindications/cautions: Pregnancy, elderly patients, hepatic impairment

Special Considerations

- Delay of onset for SSRIs is 10 to 21 days.
- Alcohol should be avoided.
- These drugs interact with phenytoin.

SELECTIVE SEROTONIN REUPTAKE INHIBITORS (SSRIs)

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
citalopram	Celexa	Tablet, liquid	20–40 mg PO q AM
escitalopram	Lexapro	Tablet	10 mg PO q am
fluoxetine	Prozac	Capsule, liquid	20–80 mg PO q AM
fluvoxamine	Luvox	Tablet	50 mg PO q hs
paroxetine	Paxil	Tablet	20–50 mg PO q AM
sertraline	Zoloft	Tablet	50 mg PO q AM

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

SELECTIVE SEROTONIN AND NOREPINEPHRINE REUPTAKE INHIBITORS (SSNRIs)

MOA: Inhibit norepinephrine and serotonin reuptake
Indications: Major depressive disorder, diabetic neuropathic pain, generalized anxiety disorder
Adverse effects: Suicidality, hypomania, withdrawal syndrome
Contraindications/cautions: Hepatic impairment or disease

SELECTIVE SEROTONIN AND NOREPINEPHRINE INHIBITORS (SSNRIs)

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
desvenlafaxine	Pristiq	Tablet	50 mg PO qd
duloxetine	Cymbalta	Capsule	40–60 mg PO q AM
venlafaxine	Effexor	Timed-release capsule	75–150 mg PO with food

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

TRICYCLIC ANTIDEPRESSANTS (TCAs)

Indications: Depression, nocturia (bedwetting) in children
MOA: Block reuptake of norepinephrine or serotonin
Adverse reactions: Cardiotoxic in high doses, postural hypotension in elderly adults, drowsiness, anticholinergic effects
Contraindications/cautions: Myocardial infarction, elderly patients
Special consideration: Noticeable results may not occur for several weeks.

TRICYCLIC ANTIDEPRESSANTS (TCAs)

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
amitriptyline	†	Tablet, injection	75–150 mg PO qd in divided doses
clomipramine	Anafranil	Capsule	25–100 mg PO q hs
desipramine	Norpramin	Tablet	100–200 mg PO qd
doxepin	Sinequan, Zonalon	Capsule, oral liquid, cream	75–150 mg PO qd
imipramine	Tofranil	Capsule, tablet, injection	75–150 mg PO qd
nortriptyline	Pamelor, Aventyl	Capsule, oral solution	25 mg PO tid–qid
protriptyline	Vivactil	Tablet	15–40 mg PO qd in divided doses

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

MONOAMINE OXIDASE INHIBITORS (MAOIs)

Indication: Atypical depression
MOA: Inhibit enzymes that break down catecholamines
Adverse reaction: Possible hypertension
Contraindications/cautions: General anesthesia within 10 days, elective surgery within 10 days, congestive heart failure

Special Considerations

- If physician changes therapy, MAOIs should be discontinued for 2 weeks before new therapy begins.
- Patients should avoid certain foods containing tyramine (aged cheeses, certain wines, and certain yeast products).
- MAOIs should not be taken if the patient is taking ephedrine, amphetamine, methylphenidate, levodopa, or meperidine.

MONOAMINE OXIDASE INHIBITORS (MAOIs)

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
phenelzine	Nardil	Tablet, patch	15 mg PO tid
selegiline	Eldepryl	Tablet, patch	5 mg PO with breakfast and lunch
tranylcypromine	Parnate	Tablet, patch	30 mg PO qd in divided doses

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

BIPOLAR AGENTS

Bipolar disease: Depressive psychosis, alternating between excessive phases of mania and depression. Mania may be characterized by exhibiting three of the following symptoms: increased need for sleep, distractibility, elevated or irritable mood, excessive involvement in pleasurable activities with a potential for painful consequences, grandiose ideas, increase in activity, pressure to keep talking, and racing thoughts.

MOA: Unknown

Adverse reactions: Bloating and abdominal distress, bloody stools, acne, leucocytosis, hand tremor, increased body weight, polyuria, polydipsia, nocturia, abnormal development of fetus during pregnancy

Contraindications/cautions: MAOI use within 10 days, bone marrow depression

Special Considerations

- Blood levels must be established for patients taking lithium and should be in the range of 0.6 to 0.8 mg/mL.
- Salt content must be monitored and alcohol avoided.
- Carbamazepine interacts with benzodiazepines, cimetidine, corticosteroids, cyclosporine, diltiazem, doxycycline, erythromycin, ethosuximide, isoniazid, MAOIs, oral contraceptives, phenytoin, propoxyphene, theophylline, thyroid medications, TCAs, valproic acid, verapamil, and warfarin.

EXAMPLES OF BIPOLAR AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
carbamazepine	Tegretol	Tablet, chewable tablet, suspension	200 mg PO tid–qid
divalproex	Depakote, Depakote ER	Tablet	2540–500 mg PO tid
lamotrigine	Lamictal, Lamictal ER	Tablet	200 mg PO qd
lithium	Lithobid	Capsule, tablet	900–1200 mg/day PO div bid/tid
olanzapine–fluoxetine	Symbyax	Capsule	1 cap PO q AM
valproic acid	Depakene	Capsule, syrup, IV	250–500 mg PO tid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

ANTIPSYCHOTIC AGENTS

Neurosis: A mental disorder arising from stress or anxiety in the patient's environment without loss of contact with reality

Phobias: A continuous irrational fear of a thing, place, or situation that causes significant distress

Psychosis: A chronic psychotic disorder manifested by a retreat from reality, delusions, hallucinations, ambivalence, withdrawal, and bizarre or regressive behavior

Schizophrenia: Chronic psychotic disorder characterized by a retreat from reality, delusions, hallucinations, ambivalence, withdrawal, or regressive behavior

MOA: Block Dopamine (D2) receptors in the dopamine pathways of the brain

Adverse reactions: Sedation, anticholinergic responses, postural hypotension, excessive tanning, hyperglycemia, lack of menses, nonreversible bone marrow depression, dystonia, akathisia, and pseudoparkinsonism. The following drugs may minimize the side effects: dimenhydrinate, benztropine, diphenhydramine, and trihexyphenidyl.

Contraindication/caution: Cardiovascular disease

Special Considerations

- Gains in reducing symptoms may take anywhere from 6 to 12 weeks.
- Discontinuing medication may lead to relapse of symptoms.
- Thioridazine has a ceiling dose of 800 mg/day.
- Promazine dosage should not exceed 1000 mg/day.

ANTIPSYCHOTIC AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
aripiprazole	Abilify	Tablet	10–15 mg PO qd
clozapine	Clozaril	Tablet	150–300 mg PO bid
fluphenazine	†	Tablet, liquid, IM, IV	2.5–10 mg/day PO div q6–8h
haloperidol	†	Tablet, liquid, IM	0.5–5 mg bid–tid
iloperidone	Fanapt	Tablet	6–12 mg PO bid
loxapine	Loxitane	Capsule, liquid, IM	30–50 mg PO bid
lurasidone	Latuda	Tablet	40–80 mg PO qd

Continued

ANTIPSYCHOTIC AGENTS—cont'd

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
olanzapine	Zyprexa	Tablet	10 mg PO qd
prochlorperazine	†	Tablet, capsule, liquid, suppository, IM, IV	5 mg PO q6–8h
quetiapine	Seroquel, Seroquel ER	Tablet	150–750 mg/day PO div bid–tid
paliperidone	Invega	Extended-release tablet	6 mg PO q AM
risperidone	Risperdal	Tablet, liquid	1–4 mg/day PO div qd–bid
thioridazine	†	Tablet, liquid	200–800 mg/day PO div bid–qid
thiothixene	Navane	Capsule, IM	2–5 mg PO bid–tid
trifluoperazine	†	Tablet, liquid, IM	2–5 mg PO bid
ziprasidone	Geodon	Capsule, injection	20 mg PO bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

ANTIINSOMNIA AGENTS

Insomnia: Characterized by the inability to sleep or remain asleep, which may be caused by situations, medications, or psychiatric or medical conditions

MOA: Interact with γ-aminobutyric acid (GABA)–benzodiazepine receptor complexes

Adverse reactions: CNS depression, dizziness, confusion, impaired reflexes

Contraindications/cautions: Alcohol use, CNS depressant use

Special consideration: Potential for abuse

ANTIINSOMNIA AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	CONTROLLED SUBSTANCE
chlordiazepoxide	†	Capsule	5–10 mg PO q hs	Yes
diazepam	Valium	Injection, IV, oral liquid, tablet	2.5–10 mg PO q hs	Yes
eszopiclone	Lunesta	Tablet	2–3 mg PO q hs	Yes
flurazepam	Dalmane	Capsule	15–30 mg PO q hs	Yes
lorazepam	Ativan	Injection, IV, oral liquid, tablet	2–4 mg PO q hs	Yes
ramelteon	Rozerem	Tablet	8 mg PO q hs	No
temazepam	Restoril	Capsule	7.5–30 mg PO q hs	Yes
zaleplon	Sonata	Capsule	5–10 mg PO q hs	Yes
zolpidem	Ambien, Ambien CR	Tablet	5–12.5 mg PO q hs	Yes

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

ATTENTION-DEFICIT DISORDER (ADD) AND ATTENTION–DEFICIT HYPERACTIVITY DISORDER (ADHD) AGENTS

ADD: A physiological disorder found in children showing signs of attention deficit without hyperactivity

ADHD: A physiological disorder in which the patient has difficulty focusing his or her attention in a quiet inattentive manner or displays hyperactivity or a combination of both of these

MOA: Stimulate CNS activity; block reuptake and increase release of norepinephrine and dopamine in extraneuronal space

Adverse reactions: Withdrawal if abrupt discontinuation, depression, psychosis

Contraindications/cautions: Breastfeeding, cardiovascular disease, glaucoma

Special consideration: Potential for abuse and dependency

ATTENTION-DEFICIT DISORDER AND ATTENTION-DEFICIT HYPERACTIVITY DISORDER AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*	CONTROLLED SUBSTANCE
amphetamine/dextroamphetamine	Adderall	Tablet	5–40 mg PO div qd-tid	Yes
atomoxetine	Strattera	Capsule	80 mg PO q AM	No
dexmethylphenidate	Focalin	Tablet	2.5–10 mg PO bid	Yes
dextroamphetamine	Dexedrine	Capsule	5–40 mg PO q AM	Yes
lisdexamfetamine	Vyvanse	Capsule	30 mg PO q AM	Yes
methylphenidate	Ritalin	Tablet	5–15 mg PO bid–tid	Yes

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

ANTICONVULSANT AGENTS

Epilepsy: A neurologic disorder defined as paroxysmal, recurring seizures. It involves disturbances of neuronal electrical activity. Seizures can be partial, generalized (grand mal, petit mal, myoclonic, and atonic), or status epilepticus.

MOA: Block the firing of neurotransmitters, resulting in a raised level of depolarization

Adverse reactions: Sedation and loss of cognitive processes

Contraindications/cautions: Hypersensitivity to TCAs, bone marrow depression

Special Considerations

- Monotherapy is preferred over polytherapy unless the patient is not responding to monotherapy.
- A large number of drug interactions may occur with anticonvulsants because of induction or inhibition.
- Divalproex should be taken with water, not with carbonated drinks.

ANTICONVULSANT AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	CONTROLLED SUBSTANCE
carbamazepine	Tegretol	Tablet, chewable tablet, suspension	Up to 1200 mg/day in 3–4 divided doses	No
clonazepam	Klonopin	Tablet	1.5–20 mg PO qd	Yes
diazepam	Valium	Injection, IV, oral liquid, tablet	Dosage varies	Yes
divalproex	Depakote	Tablet	15–60 mg/kg day in divided doses 2–3 times per day	No
fosphenytoin	Cerebyx	IM, IV	4–6 mg Pe/kg/day IM/IV qd–tid	No
gabapentin	Neurontin	Capsule, suspension	900–3600 mg PO qd	No
lacosamide	Vimpat	Tablet, IV	100–200 mg PO/IV bid	No
lamotrigine	Lamictal	Tablet	100–500 mg PO qd	No
levetiracetam	Keppra	Tablet	1000–3000 mg PO qd	No
oxcarbazepine	Trileptal	Oral liquid, tablet	600–2400 mg PO qd	No
phenobarbital	Luminal	Tablet, solution, IM, IV	100 mg PO qd; dosage varies for injectable forms	Yes
phenytoin	Dilantin	Tablet, capsule, suspension, IV	200–400 mg PO qd	No
pregabalin	Lyrica	Capsule	150–600 mg PO qd	No
primidone	Mysoline	Tablet, suspension	250–1000 mg PO qd	No
tiagabine	Gabitril	Capsule	32–56 mg PO qd	No
topiramate	Topamax	Tablet	200 mg PO bid	No
valproic acid	Depakene	Capsule, syrup, IV	Up to 1750 mg PO qd	No
zonisamide	Zonegran	Capsule	100–600 mg PO qd	No

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

ANTIPARKINSON AGENTS

Parkinson Disease: A progressive disorder of the basal ganglia associated with a loss or deficiency of dopamine; symptoms include tremors, muscle rigidity, loss of balance, hypokinesia and bradykinesia

MOA: Potentiate CNS dopaminergic responses

Adverse reactions: Nausea, vomiting, cardiac arrhythmias, drowsiness, postural hypotension, insomnia, constipation, diarrhea

Contraindications/cautions: Abrupt withdrawal, depression

Special Considerations

- Therapy is aimed at symptomatic relief.
- Numerous side effects may occur, resulting in a continual change of therapy.
- Alcohol should be avoided.

ANTIPARKINSON AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
amantadine	Symmetrel	Capsule, syrup	100 mg PO bid
apomorphine	Apokyn	Injection (SC)	0.2–0.6 mL SC prn
benztropine	Cogentin	Tablet, IM, IV	1–2 mg PO/IM/IV q hs
bromocriptine	Parlodel	Tablet, capsule	10–30 mg PO qd
entacapone	Comtan	Tablet	200 mg PO per dose

Continued

ANTIPARKINSONIAN AGENTS—cont'd

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
levodopa–carbidopa	Sinemet	Tablet	Individualized dose PO tid–qid
levodopa–carbidopa–entacapone	Stalevo	Tablet	1 tab PO q3–8h
pramipexole	Mirapex	Tablet	0.5 mg–1.5 mg PO tid
rasagiline	Azilect	Tablet	1 mg PO qd
ropinirole	Requip	Tablet	3–6 mg PO tid
rotigotine transdermal system	Neupro	Transdermal	4–6 mg/24 h q24h
selegiline	Eldepryl	Tablet	5 mg PO bid
tolcapone	Tasmar	Tablet	100 mg PO tid
trihexyphenidyl	†	Capsule, elixir, tablet	6–10 mg PO qd div tid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

MULTIPLE SCLEROSIS AGENTS

Multiple sclerosis: An autoimmune disease in which the myelin sheaths around nerves degenerate, resulting in a loss of muscles and eyesight
MOA: Variable depending on agent
Adverse reaction: Photosensitivity
Contraindication/caution: Hypersensitivity to albumin

Special Considerations

- Products require special storage.
- Copaxone is given daily, Betaseron is administered every other day, and Avonex is administered once weekly.

EXAMPLES OF MULTIPLE SCLEROSIS AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
dalfampridine	Ampyra	Tablet	10 mg po q12h
glatiramer acetate	Copaxone	Injection, SC	20 mg SC qd
interferon β-1a	Avonex	Single-dose vial, SC	30 mcg IM q wk
interferon β-1b	Betaseron	SC injection	0.25 mg SC qod
mitoxantrone	Novantrone	IV	12 mg/m2 IV × q3mo

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†Not available as a Branded Drug

ALZHEIMER DISEASE AGENTS

Alzheimer disease: A chronic progressive disease resulting in memory loss, confusion, impaired judgment, personality changes, disorientation, and a loss of language skills
MOA: Reversibly bind to and inactivate acetylcholinesterase (cholinesterase inhibitor)
Adverse reactions: Nausea, vomiting, diarrhea
Contraindications/cautions: Cardiac conduction defects, asthma, or chronic obstructive pulmonary disease (COPD)
Special consideration: No drugs can reverse the cognitive abnormalities of Alzheimer disease.

ALZHEIMER DISEASE AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
donepezil	Aricept	Tablet	5–23 mg PO q hs
galantamine	†	Oral liquid, tablet	8–12 mg PO bid
memantine	Namenda	Tablet	10 mg PO bid
rivastigmine	Exelon	Capsule, oral liquid	3–6 mg PO bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†Not available as a branded drug.

CONDITIONS AND TREATMENTS FOR THE RESPIRATORY SYSTEM

Asthma: Characterized by reversible small airway obstruction, progressive airway inflammation, and increased airway responsiveness from both endogenous and exogenous stimuli; symptoms include wheezing, dyspnea, and coughing

Bronchitis: A condition in which the lungs' defense mechanisms have been destroyed by cigarette smoke, occupational dusts, fumes, environmental pollution, or bacterial infection; characterized by a cough that produces a purulent, green, or blood-soaked sputum

Emphysema: Destruction of alveoli, walls, or air sacs of the lungs, resulting in an obstruction of the airflow on expiration; may be caused by cigarette smoke, air pollution, occupational exposure, or genetic factors

Cystic fibrosis: Characterized by an increased secretion of viscous mucus results in hypoxia and can be fatal

BRONCHODILATORS

Indications: Airway obstruction, COPD, reversible bronchospasms associated with bronchitis and emphysema

MOA: Cause the β2 receptors to relax the smooth muscles, resulting in a decrease of bronchospasms

Adverse reactions: CNS stimulation, which may result in nervousness, tremors, anxiety, nausea, palpitations, tachycardia, arrhythmias

Contraindications/cautions: Ischemic heart disease, hypertension, seizure disorders

Special Considerations

- Patients may overmedicate themselves to control their asthma.
- Ipratropium solution needs to be protected from light.
- Salmeterol needs to be stored at room temperature and protected from freezing temperatures and direct sunlight.
- A salmeterol canister should be stored with the nozzle end down.

BRONCHODILATORS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
albuterol	Proventil HFA, ProAir HFA, Ventolin HFA	Aerosol, capsule, solution, syrup, tablet, inhaler	2 puffs inhaled q4–6h
epinephrine	Primatene and Bronkaid Mist, Adrenalin, Epi-Pen	SC, IM, IV	0.3–0.5 mg SC/IM q 20 min × 3 doses prn
formoterol fumarate	Foradil	Capsule	1 cap inhaled q12h
ipratropium	Atrovent HFA	Inhaler, nasal spray	2 puffs inhaled qid
ipratropium–albuterol	Combivent	Aerosol	1–2 puffs inhaled qid
levalbuterol	Xopenex HFA	Inhaler	2 puffs inhaled q4–6h prn
pirbuterol	Maxair	Inhaler	1–2 puffs inhaled q4–6h prn
salmeterol	Serevent Diskus	Inhaler, inhalant disks	50 mcg inhaled q12h
terbutaline	†	Injection, tablet	2.5 mg PO tid; max 15 mg/qd
tiotropium	Spiriva Handihaler	Powdered capsule placed in a Handihaler	1 cap inhaled qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†Not available as a branded drug.

XANTHINE DERIVATIVES

Indications: Used to treat lung disease that is unresponsive to other medications; used as a bronchodilator in reversible airway obstruction caused by asthma, chronic bronchitis, or emphysema

MOA: Reverse bronchospasm associated with antigens and irritants; improve contractility of diaphragm

Contraindications/cautions: Peptic ulcer disease, seizure disorders, arrhythmias

Special Considerations

- Blood levels need to be maintained at 8 to 20 mcg/m.
- Theophylline may interact with macrolide and fluoroquinolone antibiotics.

XANTHINE DERIVATIVES

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
aminophylline	†	Tablet, liquid, IM, IV	380–760 mg/day PO/IV div q6–8h
theophylline	Uniphyl, Theo-24, Elixophyllin	Capsule, tablet, solution	300–600 mg/day PO div q6–8h

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†Not available as a branded drug.

LEUKOTRIENE INHIBITORS

Indications: Prophylaxis and long-term treatment of asthma
MOA: Block the effects of leukotrienes, resulting in blocking of tissue inflammatory responses such as edema
Adverse reactions: Headache, severe asthma
Contraindication/caution: Hepatic disease
Special consideration: Patients using Singulair must be older than 6 years of age.

LEUKOTRIENE INHIBITORS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
montelukast	Singulair	Tablet	10 mg PO q PM
zafirlukast	Accolate	Tablet	20 mg PO bid
zileuton	Zyflo CR	Tablet	1200 mg PO bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

CORTICOSTEROIDS

MOA: Stimulate adenylate cyclase and inhibit inflammatory cells
Adverse reactions:
Inhaled corticosteroids: Oral candidiasis, irritation and burning of the nasal mucosa, hoarseness, dry mouth
Oral corticosteroids: Facial hair on women, breast development in men, "buffalo hump" or "moon face," edema, weight gain, and easy bruising
Contraindications/cautions: Unhealed nasal surgery or trauma wound, unhealed nasal septal ulcer, tuberculosis infection
Special considerations: Long-term oral dosing needs to be tapered off to avoid nightmares.

CORTICOSTEROIDS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
beclomethasone	Beconase AQ	Inhaler	1–2 sprays/nostril bid
dexamethasone	†	Solution, tablet	0.75–0.9 mg/day PO div q6–12h
flunisolide	†	Inhaler	2 sprays/nostril bid–tid
fluticasone	Flovent, Flonase	Inhaler	2 sprays/nostril qd
fluticasone–salmeterol	Advair	Inhaler	1 puff inhaled bid
methylprednisolone	Medrol	Tablet	7.5–60 mg PO qd–qod
mometasone furoate	Nasonex	Nasal spray	2 sprays/nostril qd
prednisolone	Orapred, Pediapred	Oral liquid, tablets	40–60 mg/day PO div qd–bid × 3–10 days
prednisone	†	Oral liquid, tablet	40–60 mg/day PO div qd–bid × 3–10 days
triamcinolone	Nasacort AQ	Inhaler	1–2 sprays in each nostril qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†Not available as a branded drug.

MAST CELL STABILIZERS

MOA: Inhibit inflammatory cells
Indications: Prophylaxis; has no use in an acute attack
Adverse reactions: Patients using cromolyn may experience an unpleasant taste after inhalation, hoarseness, dry mouth, and stuffy nose.
Contraindications/cautions: Patients younger than 2 years of age, arrhythmias

Special Considerations

- Airway passages must be open before use; therefore, a bronchodilator is used first in conjunction with mast cell stabilizers.
- Patient compliance is an obstacle because of dosing four times per day.

MAST CELL STABILIZER

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
cromolyn	Gastrocom	Oral†	200 mg PO qid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†Cromolyn is available as a nasal spray (Nasalcrom), nebulizer solution, and oral solution.

LONG-ACTING BRONCHODILATOR/STEROID INHALER

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
fluticasone–salmeterol	Advair Diskus	Inhalation	1 puff inhaled bid
budesonide–formoterol	Symbicort	Inhalation	2 puffs inhaled bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

MUCOLYTIC AGENTS

MOA: Break apart glycoprotein, resulting in a reduction of viscosity and easier movement and removal of secretions

Contraindications/cautions: Inadequate cough, upper GI bleed

Adverse reaction: Acetylcysteine has an unpleasant odor and taste that may cause noncompliance.

MUCOLYTIC AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
acetylcysteine	†	Solution	3–5 mL of 20% solution in nebulizer tid–qid
dornase alfa	Pulmozyme	Solution	2.5 mg in nebulizer qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

TUBERCULOSIS AGENTS

Tuberculosis is a slow, progressive respiratory disease with symptoms of weight loss, fever, night sweats, malaise, and loss of appetite. A major issue with tuberculosis is patient compliance because of the length of therapy and number of medications a patient may be taking. Asymptomatic patients will receive isoniazid daily for 12 months; patients with clinical symptoms are treated with at least two medications.

MOA: Bactericidal; inhibit lipid and nucleic acid synthesis

Adverse reactions: Hypersensitivity reactions, epigastric discomfort

Contraindications/cautions: Acute hepatic disease, tyramine-containing foods, histamine-containing foods

Special consideration: Patients should avoid alcohol.

TUBERCULOSIS AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
cycloserine	Seromycin	Capsule	500–750 mg PO qd div bid–qid
ethambutol	Myambutol	Tablet	15–25 mg/kg/day
isoniazid (INH)	Laniazid, Nydrazid	Tablet	5 mg/kg/day
isoniazid–pyrazinamide–rifampin	Rifater	Tablet	1 tablet q day
isoniazid–rifampin	Rifamate	Tablet	2 caps PO qd
ofloxacin	Floxin	IV, tablet	200–400 mg PO q12h
rifampin	Rifadin	Capsule, IV	10 mg/kg/day
rifapentine	Priftin	Tablet	150 mg PO twice weekly for 2 months followed by once a month for 4 months
streptomycin	—	Injection, IV	500 mg–1 g administered IM three times a week for first 3 months

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

SMOKING

Smoking increases the risk of heart disease, COPD, and stroke. Acute risks include shortness of breath, aggravation of asthma, impotence, infertility, and increased serum carbon monoxide concentration. Smoking cessation results in a reduced risk of lung, laryngoesophageal, oral, pancreatic, bladder, and cervical cancer and coronary artery disease.

EXAMPLES OF SMOKING CESSATION AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	RX OR OTC
bupropion	Zyban	Tablet	150 mg PO bid × 7–12 wk	RX
nicotine	Nicoderm CQ, Nicotrol, Nicotrol NS, Nicorette,	Transdermal patch, gum, spray, tablet	Apply one patch daily; 6–16 cartridges inhaled daily; 2 mg PO q1–2h × 6 wk	OTC
varenicline	Chantix	Tablet	1 mg PO bid × 11 wk	RX

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

CONDITIONS AND TREATMENTS FOR THE DIGESTIVE SYSTEM

Gastritis: A stomach mucosal irritation and inflammation that can be linked to stress, medications, infection, autoimmune disease, alcohol, bile reflux, *Helicobacter pylori* infection, or NSAID use and is characterized by belching, nausea, vomiting, bloating, and a burning sensation

Gastroenteritis: An inflammation of the lining of the intestines caused by a virus, bacteria, or parasite that has symptoms of diarrhea, abdominal pain, vomiting, headache, fever, chills, and loss of appetite

Gastroesophageal reflux disease (GERD): Characterized by radiating burning or chest pain and the presence of an acid taste

Ulcers: Disorders of the upper GI tract caused by excessive acid secretion. Ulcers may be categorized as gastric ulcers, which are local excavations of the gastric mucosa occurring more often in men from the Western hemisphere. Duodenal ulcers occur in the duodenum of the intestine and are usually caused by hypersecretion of acid. Stress ulcers develop from the breakdown of the natural mucosal resistance from severe physiologic stress caused by an illness.

ANTACIDS

MOA: Neutralize stomach acid to prevent reflux
Adverse reactions: Constipation, diarrhea
Contraindications/cautions: GI obstruction, hypercalcemia, hypophosphatemia

Special Considerations

- Increased frequency of administration may result in poor patient compliance.
- Reduces the effectiveness of tetracycline
- Available OTC

ANTACIDS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	RX OR OTC
aluminum hydroxide	†	Tablet, liquid	320–1280 mg PO qid	OTC
aluminum hydroxide–magnesium hydroxide	Maalox, Mylanta	Tablet, liquid	10–20 mL PO qid prn	OTC
magnesium hydroxide	Milk of Magnesia	Tablet, liquid	30–60 mL PO qd	OTC

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

H_2 ANTAGONISTS

MOA: Block gastric acid and pepsin secretion from histamine, gastrin, certain foods, and caffeine; cholinergic stimulation through competitive inhibition at H_2 receptors of the gastric parietal cells
Adverse reactions: Constipation, drowsiness
Contraindications/cautions: Hepatic or renal impairment, elderly patients, chronic pulmonary disease

Special Considerations

- Bedtime dose is extremely important in therapy.
- Drug interactions include aspirin, alcohol, caffeine, and cough and cold preparations.
- Available OTC in lower doses
- Famotidine IV should be stored at room temperature.
- Reconstituted oral suspension can be stored at room temperature and expires in 30 days.

H_2 ANTAGONISTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
cimetidine	Tagamet HB (OTC form available)	Tablet	1 tab PO prn
nizatidine	Axid (OTC form available)	Tablet, capsule	150 mg PO bid
ranitidine	Zantac (OTC form available)	Tablet	150 mg PO bid
famotidine	Pepcid (Pepcid AC; OTC form available)	Tablet, suspension, IM, IV	20–40 mg PO q hs

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

PROTON PUMP INHIBITORS

Indications: Gastroesophageal reflux disease, erosive esophagitis; taken with other agents in treatment of *H. pylori*
MOA: Inhibit the parietal cell adenosine triphosphate pump
Adverse reactions: Diarrhea, dehydration
Contraindications/cautions: Long-term use, high dose, hypomagnesemia

Special Consideration

- Capsules may be opened and the contents placed in applesauce if the patient has difficulty swallowing.

PROTON PUMP INHIBITORS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	AVAILABLE OTC
dexlansoprazole	Dexilant	Capsule	30 mg PO qd × 4 wk	
esomeprazole	Nexium	Capsule	20 mg PO/NG qd × 4–8 wk	
lansoprazole	Prevacid	Capsule, oral powder packets	15 mg PO/NG qd × 8 wk	Yes
omeprazole	Prilosec	Capsule	20 mg PO/NG qd × 4–8 wk	Yes
pantoprazole	Protonix	Tablet, IV	20–40 mg PO/NG qd × 4–8 wk	
rabeprazole	Aciphex	Tablet	20 mg PO qd × 4–16 wk	

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

COATING AGENTS

MOA: Form a protective coat over ulcer against gastric acid, pepsin, and bile salts
Adverse reactions: Constipation
Contraindications/cautions: Renal failure, GI obstruction

COATING AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	AVAILABLE OTC
alginic acid	Gaviscon	Tablet, chewable tablet, liquid	15–30 mL PO qd prn	Yes
sucralfate	Carafate	Tablet, liquid suspension	1 g PO bid–qid	No

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Crohn disease: A congenital or acquired chronic inflammation of the colon characterized by abdominal pain, weight loss and diarrhea

Ulcerative colitis: A congenital or acquired chronic inflammation of the large intestine characterized by symptoms of rectal bleeding and pain

ANTIINFLAMMATORY AGENTS

MOA: Unknown but exerts local antiinflammatory effects
Adverse reactions: Nausea, vomiting, headache
Contraindications/cautions: Salicylates, influenza, varicella or febrile viral infection for patients younger than the age of 20 years

Special Considerations

- Sulfasalazine is contraindicated in patients who are allergic to sulfa drugs and aspirin.
- Binds to iron tablets
- The patient needs to be kept hydrated, and the drug should be taken after meals.
- Stain urine orange-yellow and permanently stain soft contact lenses yellow

ANTIINFLAMMATORY AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
mesalamine	Rowasa, Asacol, Pentasa	Suppository, enema, tablet, capsule	Dosage varies depending on dosage form
sulfasalazine	Azulfidine	Tablet, liquid	2 g/day PO div qid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

OTHER TREATMENTS FOR CROHN DISEASE AND ULCERATIVE COLITIS

GENERIC NAME	BRAND NAME	INDICATION	DOSAGE FORM	DOSAGE*
azathioprine	Imuran	Crohn disease	Tablet	100–250 mg PO qd
balsalazide	Colazal	Ulcerative colitis	Capsule	2.25 g PO tid × 8–12 wk
infliximab	Remicade	Crohn disease	IV	5 mg/kg IV × 1 during wk 0, 2, 6
olsalazine	Dipentum	Ulcerative colitis	Capsule	500 mg PO bid
pancrelipase	†	Exocrine pancreatic insufficiency	Capsule	500–2500 lipase units/kg PO with meals or snacks

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Diarrhea: Loose, watery, and frequent stool and is considered chronic (long term) if it continues for more than 4 weeks
Adverse reactions: Constipation, respiratory depression, drowsiness
Contraindications/cautions: Pseudomembranous colitis, severe volume depletion

Special Considerations

- Diarrhea may lead to dehydration of the individual.
- May mask more serious conditions, including malabsorption of drugs and nutrients

ANTIDIARRHEALS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	AVAILABLE OTC	CONTROLLED SUBSTANCE
attapulgite	Kaopectate	Liquid, tablet	30 mL PO q 30–60 min prn	Yes	No
bismuth subsalicylate	Pepto Bismol	Tablet, caplet, liquid	2 tabs or 30 mL PO q 30–60 min	Yes	No
diphenoxylate with atropine	Lomotil	Tablet, liquid	1–2 tabs PO bid-qid prn		Yes
loperamide	Imodium, Imodium AD (OTC)	Caplet, capsule, liquid	4 mg PO × 1 dose; then 2 mg PO after each loose stool	Yes	No

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Constipation: The result of low-fiber diets; decreased colon content, increased colon pressure, and decreased propulsive motility

Emollients, Lubricants, and Saline Laxatives

MOA: Emollient laxatives draw water into the colon, resulting in bowel evacuation

Adverse reactions: Nausea, vomiting, diarrhea
Contraindications/cautions: Fecal impaction, appendicitis, GI obstruction

EMOLLIENTS, LUBRICANTS, AND SALINE LAXATIVES

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	RX OR OTC
dioctyl calcium sulfosuccinate	Surfak	Tablet, capsule, liquid	1 cap PO qd prn	OTC
docusate sodium	Colace	Tablet, capsule, microenema	50–300 mg/day PO div qd–bid prn	OTC
mineral oil	†	Solution	15–45 mL PO div q8–24h	OTC
magnesium hydroxide	Milk of Magnesia	Liquid	30–60 mL PO qd prn	OTC

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Stimulant Laxatives

MOA: Increase gut activity from mucosal stimulation
Adverse reactions: Diarrhea, allergic reactions such as hives, and peripheral swelling

Contraindications/cautions: GI obstruction, elderly use

STIMULANT LAXATIVES

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	RX OR OTC
bisacodyl	Dulcolax	Tablet, suppository	1–3 tabs PO qd prn; 1 supp pr qd prn	OTC
senna	Senokot	Tablet, syrup, granules	2–4 tabs PO q hs prn	OTC

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Bulk-Forming Laxatives

MOA: Increase fiber in the diet, resulting in intestinal peristalsis
Adverse reactions: Abdominal cramps, diarrhea, nausea

Contraindications/cautions: Acute abdomen, appendicitis, fecal impaction
Special considerations/cautions: Considered the safest to use; patients should drink plenty of water

BULK-FORMING LAXATIVES

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	RX OR OTC
methylcellulose	Citrucel, Fiber Trim	Tablet, powder	1 scoop PO qd–tid prn	OTC
lactulose	†	Solution	15–30 mL PO qd–bid	RX
psyllium hydrophilic mucilloid	Metamucil	Powder	3.4 g PO qd–tid prn	OTC

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Bowel Evacuant Laxatives

Indication: Bowel cleansing before GI examination
MOA: Increase osmolarity of bowel fluids
Adverse reactions: Anaphylaxis, electrolyte imbalance, seizures
Contraindications/cautions: Toxic colitis, GI obstruction, intestinal perforation

Special Considerations

- The patient should fast for at least 3 hours before administration.
- Eight ounces should be taken every 10 minutes until 4 L is consumed.

Example: polyethylene glycol–electrolyte solution (e.g., GoLYTELY or NuLYTELY)

BOWEL EVACUANT LAXATIVES

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
lubiprostone	Amitiza	Capsule	24 mcg PO bid
polyethylene glycol	GoLYTELY, NuLYTELY, Colyte	Powder	8 oz q 10 min until clear

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

ANTIEMETICS

Indication: Used to treat side effect of nausea, which may be associated with various medications
MOA: Inhibit the impulse going from the chemotrigger zone to the stomach
Adverse reaction: Drowsiness
Contraindication/caution: Congenital long QT syndrome

Special Considerations

- Phenothiazines may cause hypotension and must be used cautiously in children because of the potential for overdosage, resulting in seizures.
- Promethazine suppositories need to be refrigerated and protected from light.

ANTIEMETICS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE
chlorpromazine	†	Tablet, capsule	10–25 mg PO q4–6h prn
dimenhydrinate	Dramamine	Tablet, chewable tablet, oral solution	1–2 tabs PO q4–6h prn
granisetron	†	Tablet, IV	2 mg PO × 1 dose; then 1 mg PO q12h × 2 doses; 10 mcg/kg IV × 1 dose
hydroxyzine HCl	†	Tablet, IM	25–100 mg q4–6h prn
meclizine	Antivert, Bonine	Tablet	25–100 mg/day PO div bid–tid
metoclopramide	Reglan	IM, IV	1–2 mg IM/IV × 1 dose
ondansetron	Zofran	Tablet, IV	Dosages may vary
prochlorperazine	†	Tablet, capsule	5–10 mg PO q6–8h
promethazine	†	Tablet, IM, IV	12.5–25 mg PO/IM/IV q4–6h
trimethobenzamide	Tigan	Capsule, IM	300 mg PO/IM tid–qid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

ANTIFLATULENT AGENTS

Indications: Flatulence, gastric bloating, postoperative gas pains
MOA: Reduce surface tension, resulting in gas bubbles being released more easily
Adverse reaction: Diarrhea, nausea
Contraindications/cautions: Intestinal perforation, GI obstruction
Examples: Simethicone (Gas-X, Mylicon, Phazyme)

ANTIOBESITY AGENTS

Obesity: Males: 25% of total body weight over ideal body weight
Females: 35% of total body weight over ideal body weight

MOA: Unknown
Adverse reactions: CNS stimulation, dizziness, fatigue, insomnia, dry mouth, nausea, abdominal discomfort, constipation, hypertension, palpitations, arrhythmias
Contraindications/cautions: Pulmonary hypertension, hyperthyroidism, glaucoma

Special Considerations

- All are controlled substances, except Xenical.
- Both federal and state controlled substance regulations must be followed regarding processing, filling, and record keeping.

ANTI-OBESITY AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*	CONTROLLED SUBSTANCE
diethylpropion	†	Tablet	25 mg PO tid prn meals	Yes
phentermine	Adipex P	Tablet	37.5 mg PO qd	Yes
orlistat	Xenical, Alli	Capsule	Take during or ½ h pc	No

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

CONDITIONS AND TREATMENTS FOR THE URINARY SYSTEM

Diuretics: Maintain balance of water, electrolytes, acids, and bases in the body

THIAZIDE DIURETICS

Indications: Adjunctive therapy in cardiovascular diseases, such as hypertension
MOA: Promote sodium and water excretion in the urine, resulting in lower sodium levels in blood vessels and a reduction in vasoconstriction
Adverse reactions: Hypokalemia, hypomagnesemia, hyperuricemia, hyperglycemia, hypercalcemia, photo sensitivity
Contraindications/cautions: Hypersensitivity to sulfonamides, anuria, renal or hepatic impairment
Special consideration: Patients may be advised to take potassium supplements or to add bananas or oranges to their diet.

THIAZIDE DIURETIC

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
hydrochlorothiazide	†	Tablet	12.5–200 mg PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

LOOP DIURETICS

Indications: Adjunctive therapy in cardiovascular diseases, hypertension
MOA: Inhibit reabsorption of sodium and chloride in the ascending loop of Henle and distal renal tubules, resulting in urinary excretion of water
Adverse reactions: Low levels of sodium, chloride, magnesium, calcium, potassium
Contraindications/cautions: Anuria, hepatic coma, electrolyte imbalances

Special Considerations

- Diuretics should be taken early in the day to avoid nocturia (frequent urination during the night).
- Discolored furosemide tablets or solution should be discarded.

LOOP DIURETICS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
bumetanide	†	Tablet, injection	0.5–2 mg qd
ethacrynic acid	Edecrin	Tablet, injection	25–100 mg div qd–tid
furosemide	†	Tablet, oral solution, IM, IV	40–120 mg div qd–bid
torsemide	Demadex	Tablet, IV	20–200 mg qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

POTASSIUM-SPARING DIURETICS

Indications: Adjunctive therapy in cardiovascular issues, hypertension
MOA: Exchange of sodium excreted in urine to returning potassium to the body
Adverse reactions: Hyperkalemia, arrhythmias, gynecomastia in males
Contraindications/cautions: Anuria, renal impairment, hyperkalemia
Special consideration: Should be avoided in patients taking angiotensin-converting enzyme (ACE) inhibitors owing to potassium-sparing effect

POTASSIUM-SPARING DIURETICS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
amiloride	†	Tablet	5–10 mg PO qd
spironolactone	Aldactone	Tablet	25–200 mg PO qd
triamterene	Dyrenium	Capsule	100 mg PO bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

COMBINATION DIURETIC PRODUCTS

Indications: Adjunctive therapy in cardiovascular issues, hypertension
Adverse reactions: Hyperkalemia; patients taking Maxzide may experience a change in their urine color to blue-green
Contraindications/cautions: Anuria, renal impairment
Special consideration: Should not be given to patients taking ACE inhibitors

COMBINATION DIURETIC PRODUCTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
bisoprolol–hydrochlorothiazide	Ziac	Tablet	1 tab PO qd
spironolactone–hydrochlorothiazide	Aldactazide	Tablet	1–4 tab PO div qd–bid
triamterene–hydrochlorothiazide	Dyazide, Maxzide	Capsule, tablet	1–2 cap (tab) PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

α-BLOCKERS

Benign prostatic hypertrophy: An enlargement of the prostate of a man as he ages, resulting in difficult urination
MOA: Relax smooth muscles, especially in the prostatic tissue, resulting in a reduction of urinary symptoms
Adverse reactions: Headache, orthostatic hypotension, dizziness
Contraindications/cautions: Hepatic impairment, cataract surgery

α-BLOCKERS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
alfuzosin	Uroxatral	Tablet	10 mg PO qd
doxazosin	Cardura	Tablet	1–8 mg PO qd
prazosin	Minipress	Capsule	0.5–1 mg PO bid
tamsulosin	Flomax	Tablet	0.4 mg PO qd
terazosin	Hytrin	Capsule, tablet	1–5 mg PO q hs

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

RENAL DISEASE AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
cinacalcet	Sensipar	Tablet	Individualize dose PO bid–qid
darbepoetin	Aranesp	Injection	Individualize dose SC/IV
epoetin alfa	Epogen, Procrit	Injection, IV	Individualize dose SC/IV
iron dextran	InFeD	Injection, IV	0.5 mL IM/IV as test dose
sevelamer	Renagel	Tablet	800–1600 mg PO tid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

DRUGS USED TO TREAT PROSTATIC CARCINOMAS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
flutamide	†	Capsule	250 mg PO q8h
goserelin	Zoladex	Implant	3.6 mg SC q 28 days × 4 doses
leuprolide	Eligard	Implant	7.5 mg SC q mo
megestrol	Megace ES	Oral liquid, tablet	625 mg PO qd
nilutamide	Nilandron	Tablet	150 mg PO qd × 30 d

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

MISCELLANEOUS TREATMENS FOR URINARY CONDITIONS

Urinary tract infections: Presence of bacteria in the urinary tract with localized symptoms that include blood in the urine, fever, and burning sensation

Urex or Hiprex (Methenamine)

Indication: UTI
MOA: Bactericidal
Adverse reactions: Nausea, dyspepsia, dysuria, rash
Contraindications/cautions: Renal impairment, hepatic insufficiency, dehydration

Special Considerations

- Citrus products and antacids should be avoided when this medication is taken.
- Sulfonamides are contraindicated.

Pyridium or Azo-Standard (Phenazopyridine)

Indication: Dysuria
MOA: Produces topical analgesia
Adverse reactions: Urine discoloration, rash, pruritus
Contraindications/cautions: Glomerulonephritis, uremia, renal impairment
Special consideration: Should be taken with an antibiotic for 2 days

Ditropan (Oxybutynin)

Indication: Overactive bladder
MOA: Antagonizes acetylcholine at muscarinic receptors
Adverse reactions: Dry mouth, dizziness, somnolence, constipation
Contraindications/cautions: Urinary retention, gastric retention, uncontrolled angle-closure glaucoma

Detrol (Tolterodine)

Indication: Antagonizes acetylcholine receptors
MOA: Anticholinergic
Adverse reactions: Dry mouth, headache, constipation, abdominal pain
Contraindications/cautions: Uncontrolled angle-closure glaucoma, gastric retention, urinary retention

CONDITIONS AND TREATMENTS FOR THE CARDIOVASCULAR SYSTEM

DYSRHYTHMIA

Dysrhythmia, formerly referred to as an arrhythmia, is an irregular heartbeat resulting from a malfunction of the cardiac conduction system

- Atrial flutter
- Atrial fibrillation
- Bradycardia: Abnormally slow heart rate
- Tachycardia: Abnormally rapid heart rate

Membrane-Stabilizing Agents

MOA: Slow the movement of ions into the cardiac cells, resulting in a reduction of the action potential
Adverse reactions: Nausea, vomiting, dizziness
Contraindications/cautions: Cardiogenic shock, second- or third-degree atrioventricular (AV) block

Special Considerations

- Procainamide and quinidine are extremely similar and have been interchanged in therapy.
- Lidocaine is drug of choice for emergency IV therapy.

MEMBRANE-STABILIZING AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
disopyramide	Norpace	Capsule	150 mg PO q6h
flecainide	Tambocor	Tablet	5–300 mg PO div q8–12h
lidocaine	Xylocaine	IV	1–4 mg/min IV infusion
procainamide	†	Tablet, capsule, IM, IV	1–6 mg/min IV
mexiletine	†	Tablet	200 mg PO q8h
propafenone	†	Tablet	150–300 mg PO q8h
quinidine	†	Tablet, IM, IV	Dosage varies by condition

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Antiarrhythmics

MOA: Prevent the release of various transmitters and prolong the action potential
Adverse reactions: Hypotension, bradycardia, mental depression, decreased sexual ability
Contraindications/cautions: Cardiogenic shock, second- or third-degree AV block, pregnancy
Special considerations: IV amiodarone must be mixed in a glass container with D5W.

ANTIARRHYTHMICS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
amiodarone	Cordarone	Tablet, IV	200–600 mg PO qd
dronedarone	Multaq	Tablet	400 mg PO bid
sotalol	Betapace	Tablet	80–160 mg PO q12h

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Calcium Channel Blockers

MOA: Prevent movement of calcium ions through slow channels, resulting in a reduction through the AV node, reduction in sinoatrial (SA) node action, and relaxation of coronary artery smooth muscle
Adverse reactions: Bradycardia, hypotension, heart block, cardiac failure, constipation, headache, dizziness
Contraindications: Second- or third-degree AV block, atrial fibrillation
Special consideration: Diltiazem must be stored in a light-resistant container.

CALCIUM CHANNEL BLOCKERS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
diltiazem	†	Capsule, tablet, IM, IV	30–90 mg qid
diltiazem	Cardizem CD	Capsule	180-360 mg qd
diltiazem	Cardizem LA	Caplet	180-360 mg qd
verapamil	Calan SR, Verelan	Tablet, capsule	180–480 mg/day PO div qd–bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

CONGESTIVE HEART FAILURE

The pumping ability of the heart is unable to meet the metabolic needs of the body's tissues, resulting in the heart pumping less blood than it receives; blood accumulates in the chambers of the heart.

Cardiac Glycosides

Lanoxin (Digoxin)

MOA: Increases the force of contraction; increases the effective refractory period of the AV node; and affects the SA node through direct stimulation
Adverse reactions: Nausea, vomiting, arrhythmias
Contraindications: Ventricular fibrillation, ventricular tachycardia, sick sinus syndrome

Special Considerations

- Concern for digoxin toxicity
- A symptom of digoxin toxicity is seeing a green-blue halo.

Angiotensin-Converting Enzyme (ACE) Inhibitors

MOA: Inhibit the conversion of angiotensin I to angiotensin II. Lower quantities of angiotensin II increase plasma renin activity and reduce aldosterone secretion.
Adverse reactions: A dry, unproductive cough; dizziness occurs during the first few days of therapy; angioedema and possible postural hypotension
Contraindications/cautions: ACE inhibitor angioedema history, hereditary, idiopathic, pregnancy

Special Considerations

- ACE inhibitors have a potassium-sparing effect; therefore, one must be aware of possibility of hyperkalemia.
- Should be avoided in patients receiving lithium

ANGIOTENSIN-CONVERTING ENZYME (ACE) INHIBITORS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
benazepril	Lotensin	Tablet	5–20 mg PO qd
captopril	Capoten	Tablet	12.5–50 mg PO tid
enalapril	Vasotec	Tablet	2.5–20 mg PO bid
fosinopril	†	Tablet	10–40 mg PO qd
lisinopril	Prinivil, Zestril	Tablet	5–20 mg PO qd
perindopril	Aceon	Tablet	4–16 mg PO qd
quinapril	Accupril	Tablet	5–20 mg PO bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Angiotensin II Receptor Antagonists (ARBs)

MOA: Block the action of angiotensin II at its receptors
Adverse reactions: Angioedema, cough
Contraindications/cautions: Pregnancy, renal artery stenosis, renal or hepatic impairment
Special consideration: If patient is pregnant, medication must be discontinued immediately or fetal or neonatal morbidity or mortality may occur.

ANGIOTENSIN II ANTAGONISTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
candesartan	Atacand	Tablet	32 mg PO qd
valsartan	Diovan	Capsule	40–160 mg PO bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

MYOCARDIAL INFARCTION

The heart muscle does not receive enough oxygen because of a reduced blood supply, and muscle cells die. Myocardial infarction (MI) can be prevented through behavior modifications, which include eliminating smoking, controlling diabetes, reducing hypertension through diet and lifestyle modification, exercising three times per week, reducing calories to meet ideal weight, decreasing alcohol consumption, reducing cholesterol and triglycerides, and using aspirin therapy if appropriate. Beta-blockers are used and should be tapered appropriately after the occurrence of MI.

Beta-Blockers

MOA: Block response to beta stimulation, resulting in a reduction in the heart rate, myocardial contractility, blood pressure, and myocardial demand
Adverse reactions: Heart depression, bronchoconstriction, impotence, fatigue, depression, bradycardia
Contraindications/cautions: Sinus bradycardia, second- or third-degree AV block, heart failure
Special consideration: Discontinuation should be tapered to reduce the likelihood of angina.

BETA-BLOCKERS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
atenolol	Tenormin	Tablet, IV	100 mg/day PO div qd–bid
carvedilol	Coreg	Tablet	25 mg PO bid
metoprolol	Lopressor	Tablet	100 mg PO bid
propranolol	Inderal	Tablet, capsule	180–240 mg/day PO div tid–qid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

ANGINA PECTORIS

Chest pain is experienced because of an imbalance between oxygen supply and demand; may be in the form of stable angina, variant angina, or unstable angina.

Nitrates

MOA: Relax vascular smooth muscle, resulting in lower venous return and cardiac filling and therefore decreased tension in cardiac walls and coronary vessels are dilated
Adverse reactions: Orthostatic hypotension, flushing
Contraindications/cautions: Cardiomyopathy, constrictive pericarditis, anemia

Special Considerations

- Nitroglycerin inhalant is flammable.
- Nitroglycerin injection needs to be protected from light.
- Medication should not be stopped abruptly but should be tapered.

NITRATES

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
isosorbide dinitrate	Dilatrate-SR, Sorbitrate	Tablet, capsule	40–80 mg PO qd–bid
isosorbide mononitrate	Imdur	Tablet	30–60 mg PO q AM
nitroglycerin	Nitrostat, Nitrobid, Nitro-Dur, Transderm-Nitro	Spray, tablet, capsule, ointment, injection, IV, transdermal patch	0.3–0.6 mg SL q 5 min; 0.5–2 inch topical q4–6h; 0.2–0.4 mg/h patch qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Calcium Channel Blockers (CCBs)

MOA: Inhibit calcium ions from entering "slow channels" of the vascular smooth muscle and the myocardium, resulting in relaxation of the coronary smooth muscle and coronary vasodilation and a decrease in oxygen demand
Adverse reactions: Constipation, drowsiness
Contraindications/cautions: Sick sinus syndrome, second- or third-degree AV block, hypotension

Special Considerations

- Should be taken with food
- Caffeine should be limited in quantity.
- Nifedipine liquid-filled capsules need to be protected from light.

CALCIUM CHANNEL BLOCKERS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
diltiazem	Dilacor XR	Capsule, tablet, IV	120–240 mg PO qd
nicardipine	†	Capsule, injection	20–40 mg PO tid
nifedipine	Procardia	Capsule, tablet	10–20 mg PO tid
verapamil	Calan SR, Verelan, Covera-HS	Tablet, capsule, IV	80–120 mg PO tid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Beta-Blockers

MOA: Slow the heart rate, causing decreased myocardial contractility and lowered blood pressure, resulting in a decrease in oxygen demand.
Adverse reactions: Bradycardia, hypotension, fatigue, dizziness
Contraindications/cautions: Sinus bradycardia, second- or third-degree AV block, heart failure
Special considerations/cautions:

- May mask symptoms of hypoglycemia and hyperthyroidism
- Medication should be tapered off when therapy is discontinued.

BETA-BLOCKERS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
atenolol	Tenormin	Tablet, IV	50–200 mg PO qd
metoprolol	Lopressor, Toprol XL	Tablet, IV	50–200 mg PO bid
nadolol	Corgard	Tablet	40–80 mg PO qd
propranolol	Inderal	Capsule, tablet, solution	80–320 mg PO div bid–qid

RECENTLY APPROVED AGENT FOR ANGINA

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
ranolazine	Ranexa	Extended-release tablet	500–1000 mg PO bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

HYPERTENSION

Systolic pressure (cardiac output) greater than 140 mm Hg and diastolic pressure (total peripheral resistance) greater than 90 mm Hg; the disease does not have symptoms.

Diuretics

MOA: Reduce total peripheral resistance
Adverse reaction: Possible hypokalemia depending on agent used
Contraindications/cautions: Anuria, hepatic coma, electrolyte imbalance
Special consideration: Should be taken early in the day to eliminate the possibility of nocturia

DIURETICS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
chlorothiazide	†	Tablet, IM, IV	250–500 mg PO qd–bid
furosemide	Lasix	Tablet, oral solution†, IM†, IV†	10–40 mg PO bid
hydrochlorothiazide	†	Tablet	12.5-50 mg PO qd
spironolactone	Aldactone	Tablet	25–50 mg PO qd
triamterene–hydrochlorothiazide	Dyazide, Maxzide	Capsule, tablet	1–2 tabs PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Calcium Channel Blockers

MOA: Dilate arterioles, resulting in a reduction in total peripheral resistance, energy consumption, and oxygen requirement
Adverse reactions: Drowsiness, peripheral edema, headache, palpitations
Contraindications/cautions: Severe coronary artery disease, severe aortic stenosis, congestive heart failure

Calcium Channel Blockers

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
amlodipine	Norvasc	Tablet	5–10 mg PO qd
felodipine	Plendil	Tablet	2.5–10 mg PO qd
isradipine	DynaCirc CR	Capsule	5 mg PO qd
nicardipine	Cardene SR	Capsule	30–60 mg PO bid
nifedipine	Procardia XL	Capsule	30–90 mg PO qd
verapamil	Calan SR, Verelan, Covera-HS	Tablet, capsule, IV	180–480 mg/day PO div qd–bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Angiotensin-Converting Enzyme (ACE) Inhibitors

MOA: Block ACE to prevent the conversion of angiotensin I to angiotensin II, resulting in a reduction in total peripheral resistance and improved elasticity of arteries

Adverse reactions: Cough, hypotension, dizziness, fatigue
Contraindications/cautions: ACE inhibitor angioedema (history, hereditary or idiopathic), pregnancy
Special consideration: If patient is pregnant, medication must be discontinued immediately or fetal or neonatal morbidity or mortality may occur.

ANGIOTENSIN-CONVERTING ENZYME (ACE) INHIBITORS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
benazepril	Lotensin	Tablet	20–40 mg PO qd
captopril	Capoten	Tablet	25–50 mg PO bid–tid
enalapril	Vasotec	Tablet	10–40 mg PO qd
fosinopril	†	Tablet	20–40 mg PO qd
lisinopril	Prinivil, Zestril	Tablet	10–40 mg PO qd
quinapril	Accupril	Tablet	20–80 mg PO qd
perindopril	Aceon	Tablet	4–8 mg PO qd
ramipril	Altace	Capsule	2.5–20 mg PO div qd–bid
trandolapril	Mavik	Tablet	2–4 mg PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Angiotensin II Receptor Antagonists

MOA: Bind to angiotensin II receptors and block vasoconstrictive effects of the arteries
Adverse reactions: URI, fatigue, dyspepsia
Contraindications/cautions: Pregnancy, renal or hepatic impairment

Special consideration: If patient is pregnant, medication must be discontinued immediately or fetal or neonatal morbidity or mortality may occur.

ANGIOTENSIN II RECEPTOR ANTAGONISTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
azilsartan	Edarbi	Tablet	80 mg PO qd
losartan	Cozaar	Tablet	25–100 mg PO div qd–bid
telmisartan	Micardis	Tablet	20–80 mg PO qd
valsartan	Diovan	Capsule	80–320 mg PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Beta-Blockers

MOA: Block beta-receptor response to adrenergic response, resulting in decreased heart rate, myocardial contractibility, blood pressure, and myocardial response

Adverse reactions: Bradycardia, hypotension, fatigue
Contraindications/cautions: Sinus bradycardia, second- or third-degree AV block, heart failure
Special consideration: Avoid abrupt cessation.

BETA-BLOCKERS (CARDIOSELECTIVE)

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
acebutolol	Sectral	Capsule	400–800 mg PO qd
atenolol	Tenormin	Tablet	50–100 mg PO qd
metoprolol	Lopressor, Toprol XL	Tablet	50–200 mg PO bid

BETA-BLOCKERS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
carvedilol	Coreg	Tablet	6.25 mg PO bid
labetalol	Trandate	Tablet	200–400 mg PO bid
nadolol	Corgard	Tablet	40–80 mg PO qd
propranolol	Inderal	Capsule, tablet, solution, IV	80–240 mg PO bid
timolol	†	Tablet	10–20 mg PO bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Central Nervous System Agents

MOA: Stimulate α_2-adrenergic responses in the brain and reduce sympathetic outflow from the vasomotor center in the brain, resulting in decreased heart rate, cardiac output, and total peripheral resistance

Adverse reactions: Drowsiness, fatigue, depression, fluid retention
Contraindications/cautions: Avoid abrupt withdrawal; cardiovascular disease, severe coronary artery disease

CENTRAL NERVOUS SYSTEM AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
clonidine	Catapres	Tablet, patch, IV	0.1–0.3 mg PO bid
guanfacine	Tenex	Tablet, liquid	1–3 mg PO q hs
methyldopa	†	Tablet, oral suspension, IV	250–500 mg PO bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Peripherally Acting Agents

MOA: Block α stimulation to peripheral nerves, resulting in vasodilation and hypotension

Adverse reaction: Hypotension
Contraindications/cautions: Hypotension, hepatic impairment, cataract surgery

PERIPHERALLY ACTING AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
doxazosin	Cardura	Tablet	1–4 mg PO qd
prazosin	Minipress	Capsule	3–7 mg PO bid
terazosin	Hytrin	Capsule	1–5 mg PO q hs

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Vasodilators

MOA: Reduce arteriole smooth muscle, resulting in lower peripheral resistance

Adverse reactions: Tachycardia, palpitations, flushing, headache
Contraindications/cautions: Coronary artery disease, mitral valve rheumatic heart disease

VASODILATORS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
fenoldopam	Corlopam	IV	0.1–1 mcg/kg/min IV
hydralazine	†	Tablet	10–50 mg PO qid
minoxidil	†	Tablet	10–40 mg PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Combination Products

MOA: An additive effect to lower blood pressure and reduce the number of side effects

Special consideration: Fewer side effects because medications are in lower dosages

COMBINATION AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
amlodipine–benazepril	Lotrel	Capsule	1 cap PO qd
benazepril–hydrochlorothiazide	Lotensin HCT	Tablet	1 tab PO qd
enalapril–hydrochlorothiazide	Vaseretic	Tablet	1 tab PO qd
irbesartan–hydrochlorothiazide	Avalide	Tablet	1 tab PO qd
losartan–hydrochlorothiazide	Hyzaar	Tablet	1 tab PO qd
telmisartan–hydrochlorothiazide	Micardis HCT	Tablet	1 tab PO qd
trandolapril–verapamil	Tarka	Tablet	1 tab PO qd
valsartan–hydrochlorothiazide	Diovan HCT	Tablet	1 tab PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

STROKE

Interruption of the oxygen supply to a specific area of the brain caused by a rupture or obstruction (clot) of the blood vessel, resulting in a loss of consciousness; complications may include retinopathy, neuropathy, vascular problems, or kidney damage; may be ischemic or hemorrhagic

Transient ischemic attack (TIA): A temporary reduction in oxygen and blood in a portion of the brain

Anticoagulants

MOA: Prevent proper clot formation while maintaining adequate coagulation

Adverse reactions: Bleeding; urine may turn red-orange; feces may turn red or black

Contraindications/cautions: Hypersensitivity to pork products, active major bleeding, thrombocytopenia

Special Considerations

- Warfarin injection must be protected from light.
- Patients should avoid foods rich in vitamin K if warfarin is taken.
- Many drug interactions occur with warfarin. Mephyton is given to treat an overdose of warfarin.
- Blood clotting must be monitored through prothrombin time or international normalized ratio testing.
- Heparin is to be given either IV or subcutaneously but never intramuscularly.
- Protamine sulfate is used to treat overdoses of heparin.

ANTICOAGULANTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
argatroban	Argatroban	Injection	2 mcg/kg/min IV
bivalirudin	Angiomax	IV	0.75 mg/kg/IV × 1 dose; then 1.75 mg/kg/h up to 4 h; then may continue 0.2 mg/kg/h IV up to 20 h
dabigatran	Pradaxa	Tablet	150 mg PO bid
dalteparin	Fragmin	SC	5000 units SC qd × 5–10 d
enoxaparin	Lovenox	SC	1 mg/kg SC q12h
fondaparinux	Arixtra	Injection	2.5 mg SC qd × 5–9 d
heparin	Heparin	IV	5000 units SC q8–12h
lepirudin	Refludan	IV	0.15 mg/kg/h IV
tinzaparin	Innohep	SC	175 units/kg SC qd
warfarin	Coumadin	Tablet	2–10 mg PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Antiplatelet Agents

MOA: Interfere with chemical reactions that cause platelets to clot
Adverse reactions: Nausea, dyspepsia, diarrhea, abdominal pain
Contraindications/cautions: Active bleeding, GI bleed, intracranial hemorrhage
Special consideration: Have been shown to have diminished efficacy in poor metabolizers

ANTIPLATELET AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
abciximab	ReoPro	IV	0.125 mcg/kg/min IV × 12 h
alteplase	Activase	IV	0.9 mg/kg IV over 60 min
aspirin	—	Tablet	75–325 mg PO qd
clopidogrel	Plavix	Tablet	75 mg PO qd
eptifibatide	Integrilin	IV	2 mcg/kg/min IV
reteplase	Retavase	IV	10 units IV × 2
tenecteplase	TNKase	IV	30–50 mg IV depending on body weight
ticlopidine	Ticlid	Tablet	250 mg PO bid
tirofiban	Aggrastat	IV	0.1 mcg/kg/min infusion

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

HYPERLIPIDEMIA

Hyperlipidemia is an elevation of one or more of the lipoprotein levels.

- Blood cholesterol levels per 100 mL of blood:
  - 240 mg: at risk
  - Less than 200 mg: desirable
  - 135 mg: more desirable
- Blood low-density lipoprotein levels per 100 mL of blood:
  - 160 mg: high risk
  - 139 to 159 mg: borderline risk
  - Less than 139 mg: desirable

Atherosclerosis: A buildup fatty materials or plaque, usually cholesterol, in the arterial blood vessels

HMG-COA Reductase Inhibitors

MOA: Inhibit the enzyme that catalyzes the rate-limiting step in cholesterol synthesis
Adverse reactions: GI upset, headache, muscle pain, fever
Contraindications/cautions: Hepatic disease, elevated liver function test (LFT) results, pregnancy, breastfeeding
Special consideration: LFTs should be conducted every 6 months.

HMG-COA REDUCTASE INHIBITORS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
atorvastatin	Lipitor	Tablet	10–80 mg PO qd
fluvastatin	Lescol	Capsule	20–80 mg PO div qd–bid
lovastatin	Mevacor	Tablet	10–80 mg PO q PM
pravastatin	Pravachol	Tablet	10–80 mg PO qd
rosuvastatin	Crestor	Tablet	5–40 mg PO qd
simvastatin	Zocor	Tablet	5–40 mg PO q PM

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Fibric Acid Derivatives

MOA: Unknown
Adverse reactions: Headache, nausea, vomiting, diarrhea, skin rash, alteration in liver and kidney function
Contraindications/cautions: Gallbladder disease, hepatic or renal impairment

FIBRIC ACID DERIVATIVES

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
fenofibrate	TriCor	Capsule	145 mg PO qd
gemfibrozil	Lopid	Tablet, capsule	600 mg PO bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Bile Acid Sequestrants

MOA: Form a nonabsorbable complex with bile acids in the intestine

Adverse reactions: Nausea and vomiting
Contraindication/caution: Biliary obstruction

BILE ACID SEQUESTRANTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
cholestyramine	Questran (Light)	Powder	4–8 g PO bid
colesevelam	Welchol	Tablet	3750 mg PO qd
colestipol	Colestid	Tablet, granule	2–16 g/day PO div qd–qid

OTHER CHOLESTEROL-LOWERING AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
amlodipine–atorvastatin	Caduet	Tablet	1 tab PO qd
ezetimibe	Zetia	Tablet	10 mg PO qd
ezetimibe–simvastatin	Vytorin	Tablet	1 tab PO q PM
niacin–lovastatin	Advicor	Tablet	1–2 tabs PO q hs

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

NARCOTIC AND OPIOID ANALGESICS

Indication: Acute and chronic pain
MOA: Narcotic and opioid analgesics interact with specific receptor sites and have an effect on the CNS. The body produces endorphins, enkephalins, and dynorphins. These substances are released by the brain after the release of stimuli caused by pain. An increase in the level of pain results in an increase in the release of these substances. There is a decrease in the nerve transmission to the CNS, resulting in a decrease in the sensation of pain. Narcotic and opioid analgesics respond to the same receptors as endorphins, enkephalins, and dynorphins.
Adverse reactions: Respiratory depression, constipation, mental confusion, nausea, vomiting

Contraindications/cautions: Elderly patients, hepatic or renal impairment, drug abuse history

Special Considerations

- Have a potential for tolerance and addiction
- All opiates are controlled substances, and one must adhere to both federal and state laws regarding processing, dispensing, and maintaining proper records of controlled substances.
- Increased fluid intake is recommended along with stool softeners to combat constipation.
- May provide analgesia, sedation, euphoria, or dysphoria during pain management

NARCOTICS AND OPIOIDS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	CONTROLLED SUBSTANCE SCHEDULE
acetaminophen with codeine	Tylenol with Codeine	Capsule, tablet, IM, IV, SC, elixir	15–60 mg codeine PO q4–6h prn	III
butorphanol (nasal spray)	†	Nasal spray, IM, IV	0.5–2 mg IV q3–4h; 1 mg in one nostril q3–4h	IV
codeine	†	Tablet	15–60 mg PO q4–6h prn	II
fentanyl	Duragesic	Transdermal patch, IV	25–100 mcg/h patch q72h; 50–100 mcg IV q1–2h prn	II
hydrocodone/homatropine	†	Tablet	1 tab PO q4–6h prn	III
hydrocodone–acetaminophen	Lortab, Vicodin	Tablet	2.5–10 mg hydrocodone PO q4–6h prn	III
hydromorphone	Dilaudid	Tablet, syrup, liquid, IM, IV, SC	2-8 mg PO q3–4h prn; 1–4 mg SC/IM/IV q3–6h	II
meperidine	Demerol	Tablet, syrup, IM, IV, SC	50–150 mg PO/SC/IM q3–4h	II
methadone	Dolophine	Oral concentrate, oral solution, tablet	2.5–10 mg PO q8–12h prn	II
morphine	MS Contin	Tablet	15–30 mg PO q8–12h	II

NARCOTICS AND OPIOIDS—cont'd

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	CONTROLLED SUBSTANCE SCHEDULE
oxycodone	OxyContin	Capsule, liquid, tablet	10 mg PO q12h	II
oxycodone-acetaminophen	Percocet, Tylox	Tablet, capsule	5–10 mg oxycodone PO q6h	II
oxycodone–aspirin	Percodan	Tablet	1 tab PO q6h prn	II
pentazocine	Talwin	Tablet, IM, IV, SC	30 mg IM/IV/SC q3–4h prn	IV
pentazocine–naloxone	Talwin Nx	Tablet	1–2 tabs PO q3–4h prn	IV

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

NONNARCOTIC ANALGESICS

Nonsteroidal Antiinflammatory Drugs (NSAIDs)

Indications: Conditions for which antipyretic, analgesic, and antiinflammatory agents are used

MOA: Inhibit prostaglandin synthesis, preventing the sensitization of the pain receptors

Contraindications/cautions: Aspiring- or NSAID-induced asthma, aspirin triad, pregnancy in the third trimester

Adverse reactions: Stomach irritation, drowsiness, nausea, abdominal cramps, jaundice, rash

NONSTEROIDAL ANTIINFLAMMATORY DRUGS (NSAIDs)

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
diclofenac	Cataflam	Tablet	50 mg PO tid
diclofenac–misoprostol	Arthrotec	Tablet	1 tab PO bid–qid
diflunisal	†	Tablet	500 mg PO q12h
etodolac	†	Tablet, capsule	200–400 mg PO q6–8h
fenoprofen	Nalfon	Tablet, pulvule	200 mg PO q4–6h prn
flurbiprofen	Ansaid, Ocufen	Tablet, ophthalmic drops	50–100 mg PO bid–tid
ibuprofen	Motrin IB, Advil	Tablet, liquid, drops, chewable tablets	300–800 mg PO tid–qid
indomethacin	†	Capsule, IV, suppository	25 mg PO tid
ketorolac	†	Tablet, IM, IV	10 mg PO q4–6h
nabumetone	†	Tablet	1000–2000 mg PO qd div qd–bid
naproxen	Anaprox, Naprosyn, Naprelan	Tablet, caplet	250–500 mg PO q12h
oxaprozin	Daypro	Caplet	1200 mg PO qd
piroxicam	Feldene	Capsule	20 mg PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Cyclooxygenase-2 Inhibitors

Indications: Rheumatoid arthritis, osteoarthritis, menstrual cramps, acute pain

MOA: Block cyclooxygenase-2 (COX-2) enzymes produced during inflammation

Contraindications/cautions: Aspirin- or NSAID-induced asthma, pregnancy in the third trimester

Adverse effects: GI distress and fluid retention

CYCLOOXYGENASE-2 INHIBITOR

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
celecoxib	Celebrex	Capsule	200 mg PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Aspirin

Indications: Conditions treated with analgesic, antipyretic, antiinflammatory, or antirheumatic agents. Low-dose aspirin is used for its antiplatelet effects to prevent MI.
MOA: Reduce fever by increasing blood flow to the skin and inhibiting prostaglandin and thromboxane synthesis.
Adverse reactions: Stomach ulceration, antiplatelet aggregation effects leading to bleeding, anemia, prolonged pregnancy and labor, tinnitus, dizziness, headache, mental confusion
Contraindications/cautions: Aspirin- or NSAID-induced asthma, aspirin triad, GI bleed, GI ulcer

Special Considerations

- Should not be given to children who have been exposed to any viral infection, such as chickenpox; may result in Reye syndrome
- Should not be given to patients who are taking warfarin

Acetaminophen

Indications: Conditions treated with analgesics and antipyretics
MOA: Mechanism has not been established
Adverse reactions: May increase bleeding in patients taking warfarin; may damage liver and therefore should not be given to patients with liver disease or alcoholics
Contraindications/cautions: Hepatic or renal impairment; limitation on daily alcohol intake. Caution should be noted when patient is taking multiple prescriptions or OTC medications because taking acetaminophen may result in overdose if taken with alcohol.
Migraine headache: Caused by a decrease in serotonin levels in the body, resulting in the release of neuropeptides that travels to the meninges of the brain, resulting in dilation and an inflammation of the blood vessels

Selective 5-HT Receptor Agonists

Indication: Migraine headaches
MOA: Stimulate serotonin receptors in the cerebral and temporal arteries, which causes vasoconstriction, which in turn inhibits neural transmission, resulting in excessive vasoconstriction of the cranial arteries
Adverse reactions: Tingling warm sensation, chest discomfort, dizziness, vertigo
Contraindications/cautions: Uncontrolled hypertension, ischemic heart disease, coronary vasospasm
Special consideration: Sumatriptan injection needs to be protected from light.

SELECTIVE 5-HT RECEPTOR AGONISTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
almotriptan	Axert	Tablet	6.25–12.5 mg PO × 1 dose
eletriptan	Relpax	Tablet	20–40 mg PO × 1 dose
frovatriptan	Frova	Tablet	2.5 mg PO × 1 dose
rizatriptan	Maxalt, Maxalt MLT	Tablet	5–10 mg PO × 1 dose
sumatriptan	Imitrex	Tablet, SC solution, inhaler	25–100 mg PO x1 dose; 4–6 mg SC × 1 dose; 5–20 mg in one nostril × 1 dose
sumatriptan/naproxen	Treximet	Tablet	1 tab PO × 1 dose
zolmitriptan	Zomig	Tablet	1.25–2.5 mg PO × 1 dose

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

MISCELLANEOUS MIGRAINE MEDICATIONS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
aspirin–butalbital–caffeine	Fiorinal	Tablet	1–2 tabs PO q4h
butorphanol nasal	†	Nasal spray	1 mg in one nostril q3–4h
ergotamine–caffeine	Cafergot	Tablet	1–2 tabs PO q 30 min prn

AUTOIMMUNE MEDICATIONS

Disease-Modifying Antirheumatic Drugs (DMARDs)

Indication: Rheumatoid arthritis
MOA: Inhibit lymphocytes and cytokine activity
Adverse reactions: URI symptoms, headache, rash
Contraindications/cautions: Active infection, concurrent live vaccination, patients 65 years of age and older

DISEASE-MODIFYING ANTIRHUEMATIC DRUGS (DMARDs)

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
abatacept	Orencia	IV	Dosage varies by body weight
adalimumab	Humira	Injection	40 mg SC q 2 wk
anakinra	Kineret	Injection	100 mg SC q24h
auranofin	Ridaura	Capsule	3 mg PO bid
azathioprine	Imuran	Tablet	1–2.5 mg/kg/day PO div qd–bid
cyclophosphamide	†	Injection, IV, tablet	1.5–3 mg/kg PO daily
etanercept	Enbrel	Injection	50 mg SC q wk
hydroxychloroquine	Plaquenil	Tablet	200–400 mg PO qd
infliximab	Remicade	IV	3 mg/kg IV × 1 on wk 0, 2, 6
leflunomide	Arava	Tablet	10–20 mg PO qd
methotrexate	†	Injection, IV, tablet	7.5–25 mg PO/IM q wk
penicillamine	Cuprimine	Capsule	250–500 mg PO bid–tid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

CONDITIONS AND TREATMENTS FOR THE SKELETAL SYSTEM

Osteoporosis: Thinning of bone tissue and loss of bone density over time

BISPHOSPHONATES

Indication: Osteoporosis
MOA: Inhibits bone resorption by osteoclasts
Adverse reactions: Abdominal pain, acid regurgitation, nausea
Contraindications/cautions: Hypocalcemia, abnormal esophageal peristalsis

Special Considerations

- It should be taken 30 minutes before the first meal, beverage, or medication of the day.
- The medication should be taken with 6 to 8 oz of water to avoid esophageal burning.
- The patient should not lie down for at least 30 minutes after taking the medication.

BISPHOSPHONATES

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
alendronate	Fosamax	Tablet	10 mg/day or 70 mg weekly
alendronate + vitamin D	Fosamax with vitamin D	Tablet	10 mg/day or 70 mg weekly
etidronate	Didronel	Tablet, IV	5–10 mg/kg per day
ibandronate	Boniva	Tablet	One tablet daily
risedronate	Actonel	Tablet	5 mg/day or 35 mg/week or 150 mg/month
tiludronate	Skelid	Tablet	400 mg PO qd × 3 mo
zoledronic acid	Zometa	IV	4 mg IV q 3–4 wk

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

SELECTIVE ESTROGEN RECEPTOR MODULATOR (SERM)

Evista (Raloxifene)

Indication: Osteoporosis
MOA: Inhibits estrogen receptors
Adverse reactions: Hot flashes, infection, influenza-like symptoms, arthralgia
Contraindications/cautions: Thromboembolism, pregnancy, breastfeeding

SELECTIVE ESTROGEN REPLACEMENT MODULATOR

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
raloxifene	Evista	Tablet	60 mg/day

OTHER BONE DISEASE AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
denosumab	Prolia	Solution	650 mg SC q 6 mo
teriparatide	Forteo	IV	20 mg SC qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

CONDITIONS AND TREATMENTS FOR THE ENDOCRINE SYSTEM

HYPOTHYROIDISM

Congenital hypothyroidism (cretinism) is an iodine deficiency disease found in children. The symptoms in adults include apathy, decreased heart rate, and depression. Symptoms in children include short stature, thick tongue, possible enlarged thyroid, lowered voice pitch, myxedema, puffy face, reduced mental acuity, and weight gain.

Hypothyroidism Agents

Indications: Thyroid replacement therapy
Adverse reactions: Cardiotoxicity and hyperthyroidism
Contraindications/cautions: Thyrotoxicosis, acute MI, adrenal insufficiency

Special Considerations:

- Patients should undergo thyroid-stimulating hormone tests.
- Levothyroxine has a narrow therapeutic index, which requires caution when switching between different generic versions of levothyroxine.
- Levothyroxine injection needs to be used promptly after reconstitution.

HYPOTHYROIDISM AGENTS (MUST BE INDIVIUALIZED)

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
levothyroxine	Synthroid, Levothroid, Levoxyl	Tablet, injection	100–125 mcg PO qd
liothyronine	Cytomel	Tablet	25–75 mcg qd
liotrix	Thyrolar	Tablet	1 tab PO qd
thyroid	Armour Thyroid	Tablet	60–120 mg PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

HYPERTHYROIDISM (GRAVES DISEASE)

Hyperthyroidism is an excessive secretion of thyroid hormones that may be caused by thyroid nodules, an excessive iodine intake, or a tumor causing overproduction of thyroid-stimulating hormone. Symptoms include decreased menses, diarrhea, exophthalmos, heat intolerance, nervousness, perspiration, tachycardia, and possible weight loss.

Hyperthyroid Agents

MOA: Therapy, surgery
Adverse reactions: Fever, sore throat, unusual bleeding or bruising, headache, malaise
Contraindications/cautions: Breastfeeding, pregnancy

EXAMPLES OF HYPERTHYROID AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
methimazole	Tapazole	Tablet	15–30 mg PO qd
propylthiouracil	*†	Tablet	100–150 mg PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No brand name drug available; available only as a generic.

HORMONE REPLACEMENT THERAPY (HRT)

Indication: Estrogen replacement therapy relieves symptoms of estrogen deficiency that include vasomotor instability, drying and atrophy of vaginal mucosa, insomnia, irritability, and mood changes.
MOA: Suppress follicle-stimulating hormone secretion
Adverse reactions: Nausea, bloating, weight gain, breast tenderness, breast cancer, possible breakthrough bleeding
Contraindications/cautions: Undiagnosed vaginal bleeding, breast cancer, pregnancy

Special Considerations

- All estrogen products should be dispensed with a patient package insert.
- Conjugated estrogen therapy is cyclic.
- Whereas Estraderm and Vivelle are applied twice weekly, Climara is applied weekly.

ESTROGENS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
conjugated estrogen	Premarin	Tablet, cream	0.3–1.25 mg PO qd
conjugated estrogen–medroxyprogesterone	Prempro, Premphase	Tablet	1 tab PO qd
estradiol	Estrace	Tablet, cream	1–2 mg PO qd
estradiol–levonorgestrel	Climara, Climara Pro	Patch	1 patch 1×/wk
estradiol–norethindrone	Activella, CombiPatch	Tablet, transdermal patch	1 tab PO qd; 1 patch 2×/wk
estropipate	†	Tablet, cream	0.75–6 mg PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

PROGESTINS

Indications: Treatment of menstrual dysfunction, such as uterine bleeding, amenorrhea, dysmenorrhea, and endometriosis
MOA: Inhibit luteinizing hormone secretion by means of a negative feedback on the hypothalamic anterior pituitary axis
Contraindications/cautions: Undiagnosed vaginal bleeding, breast cancer, genital organ cancer
Adverse reactions: Weight gain, depression, fatigue, acne, hirsutism

PROGESTINS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE†
medroxyprogesterone	Provera	Tablet	5–10 mg PO qd × 5–10 days
norethindrone	Micronor	Tablet	1 tab PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

ADDISON DISEASE

Addison disease is a deficiency of glucocorticoids and mineralocorticoids that is treated with corticosteroids. Symptoms of Addison disease include debilitating weakness, weight loss, hyperpigmentation of the skin, reduced blood pressure, low sodium and glucose levels, and hyperkalemia.

CUSHING DISEASE

Cushing disease results from an overproduction of steroids or excessive administration of corticosteroids over an extended period. Symptoms include a protruding abdomen and fat over the shoulder blades.

Corticosteroids

MOA: Combine with steroid receptors in cytoplasm
Indications: Arthritis, dermatitis, allergic reactions, asthma, hepatitis, systemic lupus erythematosus, inflammatory bowel disease for glucocorticoid replacement in Addison disease or other forms of adrenal insufficiency
Contraindications/cautions: Diabetes, tuberculosis, affective disorders
Adverse reactions: Stomach irritation, hypertension from sodium retention, slow wound healing, thinning of skin, peptic ulcer disease, increased infections, reduced white blood cell function, truncal obesity, moon face, buffalo hump, hyperglycemia, hypokalemia, osteoporosis, alterations in mood, manic-depressive behavior, cataracts

EQUIVALENCY OF CORTICOSTEROIDS COMPARED WITH THE DAILY SECRETION OF HYDROCORTISONE (20 mg)

CORTICOSTEROID	BRAND NAME	EQUIVALENCY (mg)	ANTIINFLAMMATORY POTENCY
betamethasone	Diprolene	0.6	25.0
cortisone	Cortone	25.0	0.8
dexamethasone	Decadron	0.75	30.0
hydrocortisone	Hydrocortisone	20.0	1.5
methylprednisolone	Medrol	4.0	5.0
prednisolone	Pediapred	5.0	4.0
prednisone	Deltasone	5.0	3.0
triamcinolone	Aristocort	4.0	5.0

SIDE EFFECTS OF CORTICOSTEROIDS

TYPE OF EFFECT	SIDE EFFECT
Cardiovascular	Hypertension
Dermatologic	Impaired wound healing, thinning of the skin, petechiae, purpura
Gastrointestinal	Peptic ulcer disease, pancreatitis
Immune system	Infections and reduction of white blood cell function
Metabolic	Redistribution of fat deposits, acne, hirsutism, growth suppression, hyperglycemia, hypokalemia, sodium and water retention
Musculoskeletal	Osteoporosis, vertebral compression
Neuropsychiatric	Alterations in mood; manic-depressive, psychotic, suicidal, or schizophrenic tendencies
Ophthalmic	Cataracts and glaucoma

DIABETES

- **Gestational diabetes:** Occurs during the second and third trimester of pregnancy; can be treated with exercise, diet, and insulin
- **Type 1 diabetes (insulin-dependent diabetes mellitus [IDDM] or juvenile-onset diabetes):** Individual's body is unable to produce insulin, so he or she becomes insulin dependent.
- **Type 2 diabetes (non–insulin-dependent diabetes mellitus [NIDDM] or adult-onset diabetes):** Condition that occurs in individuals who have an impaired insulin secretion and are often insulin resistant; treatment includes medication and weight reduction through diet and exercise
- **Secondary diabetes:** Onset caused by taking various medications, such as oral contraceptives, beta-blockers, diuretics, calcium channel blockers, glucocorticoids, and phenytoin

Oral Hypoglycemic Agents

Second-Generation Sulfonylureas

MOA: Promote release of insulin from the beta cells of the pancreas; and lower blood glucose levels
Adverse reactions: Diarrhea, nausea, hypoglycemia, dizziness
Contraindications/cautions: Diabetic ketoacidosis, near term pregnancy, renal or hepatic impairment
Special consideration: Adjunct to exercise and diet

Enzyme Inhibitors

MOA: Inhibit intestinal wall enzymes that convert saccharides into glucose, resulting in lowering of postprandial hyperglycemia
Adverse reactions: Abdominal pain, diarrhea, and flatulence

Contraindications/cautions: Patients with cirrhosis, inflammatory bowel disease, colon ulceration, intestinal obstruction
Special consideration: Must be monitored every 3 months for 1 year and then periodically as directed

Biguanides

MOA: Decrease glucose production by the liver and improve insulin sensitivity
Adverse reactions: Nausea, metallic aftertaste, weight loss
Contraindications/cautions: Renal dysfunction or disease, metabolic acidosis, diabetic ketoacidosis
Special consideration: Need to be titrated upward over a period of weeks

Glitazones

MOA: Improve cellular response to insulin
Adverse reactions: Increased plasma volume, elevated high-density lipoprotein levels
Contraindications/cautions: Type 1 diabetes mellitus, diabetic ketoacidosis

HYPOGLYCEMIC AGENTS

GENERIC NAME	BRAND NAME	AGENT TYPE	DOSAGE FORM	DOSAGE*
acarbose	Precose	Enzyme inhibitor	Tablet	50–100 mg PO tid
glimepiride	Amaryl	Second-generation sulfonylureas	Tablet	1–4 mg PO qd
glipizide	Glucotrol, Glucotrol XL	Second-generation sulfonylureas	Tablet	5–10 mg PO qd
glyburide	DiaBeta, Glynase, Micronase	Second-generation sulfonylureas	Tablet	1.25–20 mg PO qd
metformin	Glucophage, Glucophage XR	Biguanide	Tablet	850 mg PO bid
miglitol	Glyset	Enzyme inhibitor	Tablet	50–100 mg PO tid
nateglinide	Starlix	Meglitinide	Tablet	60–120 mg PO tid before meals
repaglinide	Prandin	Meglitinide	Tablet	0.5–4 mg PO ac
pioglitazone	Actos	Glitazone	Tablet	15–30 mg PO qd
Sitagliptin	Januvia	DPP-4 inhibitor	Tablet	100 mg PO qd
pramlintide	Symlin	Amylin analogue	Injection	15 mcg SC q ac
Combination Products				
glipizide–metformin	Metaglip		Tablet	1–2 tabs PO qd–bid
glyburide–metformin	Glucovance		Tablet	1–2 tabs PO bid
repaglinide–metformin	PrandiMet		Tablet	Individualize dose bid–tid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Injectable Hypoglycemic Agents

MOA: Variable depending on the class of medication
Adverse reactions: Hypoglycemia, blurry vision, hypersensitivity, hypertension
Contraindications: Hypoglycemia

Comments

- Humulin insulin can be stored at room temperature for 1 month.
- Humalog insulin requires a prescription.
- Regular insulin is the only type of insulin that can be used IV.

INJECTABLE HYPOGLYCEMIC AGENTS

GENERIC NAME	BRAND NAME	DURATION OF ACTION
exenatide injection	Byetta	Long acting
insulin detemir injection	Levemir	Long acting
insulin injection	Regular Iletin I	Rapid
	Regular Iletin II	Rapid
	Novolin R	Rapid
isophane insulin	NPH Iletin I	Intermediate
	Humulin N	Intermediate
isophane insulin suspension and insulin injection	Humulin 70/30	Intermediate
isophane insulin suspension and insulin injection	Humulin 50/50	Intermediate
insulin glulisine	Apidra	Rapid
insulin zinc suspension; extended lente	Humulin Ultralente	Long acting
insulin analog injection	Humalog	Rapid
insulin glargine	Lantus	Long acting
liraglutide (rDNA origin)	Victoza	Long acting

CONDITIONS AND TREATMENTS FOR THE REPRODUCTIVE SYSTEM

ORAL CONTRACEPTIVES

Indication: Prevent pregnancy
MOA: Suppress ovulation by interfering with production of hormones that regulate the menstrual cycle and alter the cervical mucus
Adverse reactions: Potential for heart attack, stroke, and thromboembolic disease. Other side effects include nausea, weight gain, breast tenderness, and depression.
Contraindications/cautions: Smokers, pregnancy, breast cancer, endometrial cancer
Special consideration: Oral contraceptives must be dispensed with a patient package insert.

EXAMPLES OF ORAL CONTRACEPTIVES

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
estradiol valerate–dienogest	Natazia	Tablet	1 tab PO qd
ethinyl estradiol–desogestrel	Cyclessa, Desogen, Kariva, Mircette, Ortho-Cept	Tablet	1 tab PO qd
ethinyl estradiol–drospirenone	Yasmin, Yaz	Tablet	1 tab PO qd
ethinyl estradiol–ethynodiol diacetate	Demulen	Tablet	1 tab PO qd × 21 days (21 day pack) or 1 tab PO qd × 28 days (28-day pack)
ethinyl estradiol–etonogestrel	NuvaRing	Ring	Insert one ring vaginally for 3 weeks; remove ring and dispose; wait 1 week and repeat
ethinyl estradiol–levonorgestrel	Seasonique	Tablet	1 tab PO qd × 91 days and repeat
ethinyl estradiol–norelgestromin	Ortho Evra	Patch	1 patch weekly for 3 weeks; stop for 1 week and resume
ethinyl estradiol–norethindrone	Estrostep Fe, Femhrt, Loestrin Fe, Ovcon, Ortho Novum	Tablet	1 tab PO qd
ethinyl estradiol–norgestimate	Ortho Tri-Cyclen, Ortho Tri-Cyclen Lo	Tablet	1 tab PO qd
ethinyl estradiol–norgestrel	Lo/Ovral, Low-Ogestrel	Tablet	1 tab PO qd
Emergency Contraceptives			
levonorgestrel	Plan B One Choice, Next Step	Tablet	1 tab PO × 1; 1 tab PO q 12 h × 2 doses
Parenteral			
medroxyprogesterone	Depo-Provera	Injection	150 mg IM q mo

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

EXAMPLES OF ORAL CONTRACEPTIVE INTERACTIONS

CLASS	DRUGS	TYPE OF INTERACTION
Antibiotics	Erythromycin, griseofulvin, penicillin, rifampin, tetracycline	May decrease effectiveness of oral contraceptive from interference with enterohepatic cycling of estrogen, resulting in a fluctuation of hormone levels
Anticonvulsants	Tegretol, Dilantin, Mysoline, phenobarbital	Decrease contraceptive action from increased metabolism of hormones
Antifungals	Diflucan, Nizoral, Sporanox	May decrease effectiveness of oral contraceptives
Benzodiazepines	Dalmane, Halcion, Librium, Valium, Xanax	Metabolism of benzodiazepine may be decreased, resulting in an increase in side effects
Bronchodilator	Theophylline	Increased side effects of theophylline resulting from decreased theophylline metabolism
Corticosteroids	Hydrocortisone, methylprednisolone, prednisolone, prednisone	Increased effects from inhibition of metabolism by oral contraceptives
Lipid-lowering agents	Atromid-S	Decreased oral contraceptive effect
Tricyclic antidepressants	Elavil, Tofranil	Increased side effects of tricyclic antidepressants

Erectile dysfunction A man's inability to achieve or maintain an erection due to a lack of blood flowing to the penis

ERECTILE DYSFUNCTION AGENTS

MOA: Inhibit phosphodiesterase type 5, enhancing the effects of nitric oxide–activated increase in cGMP

Adverse reactions: Headache, flushing , dyspepsia, visual
Contraindications/cautions: Patients with pulmonary veno-occlusive disease; patients taking nitrates should not take because of possible MI

ERECTILE DYSFUNCTION AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORM	DOSAGE*
sildenafil	Viagra	Tablet	1 tab PO qd
tadalafil	Cialis	Tablet	1 tab PO qd
vardenafil	Levitra	Tablet	1 tab PO qd

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

CONDITIONS AND TREATMENTS FOR THE INTEGUMENTARY SYSTEM

Psoriasis: Consists of patches of red, scaly skin, usually on the elbows and knees; may be caused by illness, injury, or emotional stress

PSORIASIS AGENTS

MOA: Regulate skin cell production and proliferation
Adverse reactions: Skin irritation, burning, rash, pruritus
Contraindications/cautions: Hypercalcemia, vitamin D toxicity

PSORIASIS MEDICATIONS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	SPECIAL CONSIDERATIONS
acitretin	Soriatane	Capsule	25–50 mg PO qd	
alefacept	Amevive	Injection	15 mg IM q wk × 12 wk	
calcipotriene	Dovonex	Cream, ointment	Apply bid	Patient should wash hands after each application
cyclosporine	Neoral	Capsule, oral liquid	2.5-4 mg/kg/day PO div bid	
methotrexate	†	Tablet, IM, IV	10–25 mg PO/IM q wk	May inhibit normal cell growth
pimecrolimus	Elidel	Cream	Apply bid	
tacrolimus	Protopic	Ointment	Apply bid	

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

Acne vulgaris: An infection of the sebaceous glands that may produce pustules, papules, comedones, and scars

ACNE VULGARIS AGENTS

MOA: Remove keratinocytes in the sebaceous follicle by loosening the horny cells at the mouth of the ducts, resulting in easy sloughing

Adverse reactions: Erythema, scaling, dryness
Contraindications/cautions: Photosensitivity, sunburn, eczema
Special consideration: Hands should be washed after each application.

ACNE VULGARIS AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	SPECIAL CONSIDERATIONS
adapalene	Differin	Gel	Apply q hs	Water based; causes less irritation than Retin-A
azelaic acid	Azelex	Cream	Apply bid	Thin film should be applied to affected area twice per day
clindamycin-benzoyl peroxide	BenzaClin	Gel	Apply bid	
tretinoin	Retin-A	Cream, gel, lotion	Apply q hs	Avoid exposure to sun; hands should be washed after each use; may cause severe irritation
tretinoin	Renova	Cream	Apply q hs	Has a more moisturizing effect than Retina-A
benzoyl peroxide	Brevoxyl	Lotion	Apply qd–bid	

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Actinic keratoses: A small, rough spot occurring on skin that has been chronically exposed to the sun and generally measure in size between 2 and 6 mm in diameter

ACTINIC KERATOSES AGENTS

Indications: Antiproliferative agents for skin cancer
MOA: Interfere with a cell's ability to reproduce

Adverse reactions: Itching, burning, soreness, tenderness, scaling, and swelling
Contraindications/cautions: Poor nutritional state, myelosuppression, infection
Special consideration: May cause transient burning of the skin

ACTINIC KERATOSES AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	SPECIAL CONSIDERATIONS
aminolevulinic acid	Levulan Kerestick	Topical solution	Apply q 8 wk	
diclofenac	Solaraze	Gel	Apply bid × 60–90 days	
fluorouracil	Efudex	Cream, solution	Apply bid 2–4 wk	Proper hand washing should be followed; avoid direct sunlight; needs to be disposed of properly because it is an antineoplastic agent

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

TOPICAL ANTIFUNGALS

MOA: Prevent the synthesis of ergosterol, which is needed for fungal cell membranes

Adverse reactions: Irritation, burning, stinging, pruritus; inhibit fungal cytochrome P450 associated with azole drugs

Contraindications/cautions: None identified

TOPICAL ANTIFUNGAL AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	SPECIAL CONSIDERATIONS
butenafine	Mentax	Cream	Apply qd–bid × 7–14 days	Used to treat athlete's foot, jock itch, and ringworm; used daily for 4 weeks
ciclopirox	Loprox	Cream, lotion	Apply bid × 4 wk	Available OTC
clotrimazole	Lotrimin, Mycelex	Cream, lotion, vaginal, troche	Apply bid; 1 app q h s × 7 nights; 10 mg po 5×/day × 14 days	Available OTC
clotrimazole–betamethasone	Lotrisone	Cream, lotion	Apply bid	
econazole	†	Cream	Apply qd	
griseofulvin	†	Tablet, capsule, oral suspension	375 mg PO qd × 2–6 wk	Fungal infections of the hair, skin, and nails; avoid exposure to sun; take with a fatty meal
miconazole	Monistat	Cream, vaginal, IV, spray	Dosage varies based upon condition	OTC; used to treat vulvovaginal candidiasis
nystatin	Mycostatin	Cream, ointment, oral suspension, capsule	Apply bid–tid	Commonly used to treat children with candidiasis; patients are told to swish and swallow
nystatin–triamcinolone	†	Cream, ointment	Apply bid	
oxiconazole	Oxistat	Cream, lotion	Apply qd–bid × 14 days	
sertaconazole	Ertaczo	Cream	Apply bid × 4 wk	
sulconazole	Exelderm	Cream	Apply qd–bid × 3–4 wk	
terbinafine	Lamisil	Cream, tablet	250 mg PO qd × 2–12 wk	Taken orally once per day for 6 weeks for fingernail infections and for 12 weeks for toenail infections; may be pulse dosed
tolnaftate	Tinactin	Liquid, powder, cream, solution	Apply bid	OTC

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

TOPICAL CORTICOSTEROIDS

MOA: Suppress the hypothalamic–pituitary axis
Indications: Dermatitis, psoriasis, eczema, rashes
Contraindication/caution: None identified
Adverse reactions: Burning skin, contact dermatitis, pruritus

Special Considerations

- Creams and ointments should not be considered interchangeable.
- Topicals should not be occluded with a covering.
- A thin layer should be applied sparingly to the affected area.
- Corticosteroids should not be used for more than 2 weeks.

TOPICAL CORTICOSTEROIDS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
amcinonide	†	Cream, lotion, ointment	Apply bid–tid
betamethasone 0.05%	Diprolene	Cream, gel, ointment	Apply qd–bid
clobetasol 0.05%	Temovate	Cream, ointment	Apply bid
desoximetasone 0.25%	Topicort	Cream, ointment	Apply bid
diflorasone 0.05%	†	Ointment	Apply bid–qid
fluocinolone	†	Cream, ointment	Apply bid–qid
fluocinonide 0.05%	†	Cream, ointment, solution	Apply bid–tid
halobetasol 0.05%	Ultravate	Cream, ointment	Apply qd–bid
hydrocortisone butyrate	Locoid	Cream, ointment, solution	Apply bid–tid
hydrocortisone valerate	Westcort	Cream, ointment	Apply qd–qid
mometasone 0.1%	Elocon	Ointment	Apply qd
triamcinolone	Kenalog	Cream, lotion, ointment	Apply × 2 sec tid–qid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

TOPICAL ANTIBIOTICS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*
bacitracin–neomycin–polymyxin B	Triple Antibiotic	Ointment	Apply qd–tid
clindamycin	Cleocin T	Cream, gel, lotion, solution	Apply bid
erythromycin	†	Gel, solution	Apply bid
mafenide	Sulfamylon	Cream, topical solution	Apply qd–bid
metronidazole	MetroGel, MetroCream	Gel, cream	Apply bid
mupirocin	Bactroban	Ointment	Apply tid × 7–14 days
neomycin–polymyxin B	Neosporin	Ointment	Apply qd-tid
silver sulfadiazine	Silvadene	Cream	Apply qd–bid

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

CONDITIONS AND TREATMENTS FOR THE OPHTHALMIC SYSTEM

Glaucoma: A chronic disorder characterized by abnormally high internal eye pressure that destroys the optic nerve and may cause loss of vision. Three types of glaucoma exist: open-angle, narrow-angle, and secondary glaucoma.

GLAUCOMA AGENTS

MOA: Reduce intraocular pressure
Adverse reactions: Blurred vision, hyperemia, pruritus
Contraindications/cautions: Ocular inflammation
Special consideration: Drug treatment cannot cure the disease but can control it.

GLAUCOMA AGENTS

GENERIC NAME	BRAND NAME	OPHTHALMIC DOSAGE FORMS	DOSAGE*	COMMENTS
apraclonidine	Iopidine	Solution	1–2 gtt in eye(s) tid	
betaxolol	Betoptic S	Solution, suspension	1–2 gtt in eye(s) bid	
bimatoprost	Lumigan	Solution	1 gtt in eye(s) q PM	
brimonidine	Alphagan P	Solution	1 gtt in eye(s) tid	Reduces fluid production in the eye
brinzolamide	Azopt	Solution	1 gtt in eye(s) tid	Should not be taken with carbonic anhydrase inhibitors
dorzolamide	Trusopt	Solution	1 gtt in eye(s) tid	Bitter taste may be present after administration
latanoprost	Xalatan	Solution	1 gtt in eye(s) q PM	May cause light-colored eyes to turn brown; should be stored in the refrigerator
timolol	Timoptic, Timoptic XE	Solution	1 gtt in eye(s) qd–bid	
travoprost	Travatan Z	Solution	1 gtt in eye(s) q PM	

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.

Conjunctivitis (pink eye): An acute inflammation of the conjunctiva that is caused by viruses, bacteria, fungi, or allergies

OTHER OPHTHALMIC AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	CLASSIFICATION
alcaftadine	Lastacaft	Solution	1 gtt in eye(s) qd	Allergy
bacitracin	†	Ointment	Apply in eye(s) q3–4h	Antibiotic
ciprofloxacin	Ciloxan	Solution	1–2 gtt in eye(s) q2h while awake; then q4h × 12 days	Antibiotic
cromolyn sodium	Crolom	Solution	1–2 gtt in eye(s) 4–6 × day	Mast cell stabilizer
cyclosporine	Restasis	Solution	1 gtt in eye(s) q12h	NSAID
dexamethasone	†	Ointment	1 gtt in eye(s) tid–qid	Corticosteroid
diclofenac	Voltaren	Solution	1 gtt in eye(s) qid × 2 wk	NSAID
flurbiprofen	Ocufen	Solution	Dosage varies based on condition	NSAID
gatifloxacin	Zymar	Solution	1 gtt in eye(s) q2h up to 8× × 2d; then 1 gtt qid × 5 days	Antibiotic
gentamicin	Garamycin	Solution, ointment	1–2 gtt in eye(s) bid–tid	Antibiotic
ketorolac	Acular	Solution	1 gtt in eye(s) qid	NSAID
levofloxacin	†	Solution	1–2 gtt in eye(s) q2h while awake; then q4h while awake × 5 days	Antibiotic
naphazoline	Naphcon A	Solution	1–2 gtt in eye(s) prn	OTC decongestant
ofloxacin	Ocuflox	Solution	1–2 gtt in eye(s) q2–4h × 2 days; then 1–2 gtt qid × 5 days	Antibiotic
olopatadine	Patanol	Solution	1 gtt in eye(s) bid	Antihistamine
sulfacetamide-prednisolone	Blephamide	Ointment, solution, suspension	2 gtt in eye(s) q4h while awake	Corticosteroid
sulfacetamide sodium	Bleph-10	Ointment, solution	1–2 gtt in eye(s) q2–3h × 7–10 days	Antibiotic
tobramycin- dexamethasone	Tobradex	Ointment, solution	1–2 gtt in eye(s) q4–6h	Corticosteroid
trifluridine	Viroptic	Solution	1 gtt in eye(s) q2h while awake until reepithelization; then 1 gtt q4h while awake for 7 days	Antiviral

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.
NSAID, Nonsteroidal antiinflammatory drug; *OTC,* over the counter.

Otitis media: An infection of the middle ear often caused by an inflammation of the Eustachian tube

OTIC AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	DOSAGE*	COMMENTS
antipyrine-benzocaine	†	Solution	2–4 gtt in ear(s) tid × 2–3 days	Analgesic
carbamide peroxide	Debrox	Solution	5–10 gtt in ear(s) bid	Wax dissolver
neomycin–polymyxin B–hydrocortisone	†	Suspension, solution	4 gtt in ear(s) tid–qid	Antibiotic

*Please note that all dosages are for adults and expressed in oral dosages unless otherwise indicated.
†No longer available as a branded drug.

CHEMOTHERAPY AGENTS

ALKYLATING AGENTS

MOA: Form irreversible cross-links in DNA, resulting in cells being unable to reproduce
Adverse reactions: Myelosuppression, hair loss, nausea, vomiting, appetite, weight loss
Contraindications: Bone marrow depression, pregnancy during first trimester, breastfeeding

ANTIBIOTICS

MOA: Inhibit DNA-dependent RNA synthesis; delay or inhibit mitosis
Adverse reactions: Myelosuppression, alopecia, nausea, vomiting
Contraindications/cautions: Impaired cardiac function, hepatic or renal suppression

ANTIMETABOLITES

MOA: Participates as an "imposter" in essential cell reaction, resulting in nonfunctional functions to prevent normal functions of key enzymes
Adverse reactions: Myelosuppression, alopecia, nausea, vomiting, diarrhea
Contraindications/cautions: Myelosuppression, pregnancy, anemia

PLANT ALKALOIDS

MOA: Prevent formation of functional spindle fibers needed for cell division
Adverse reactions: Neurotoxicity, myelosuppression, alopecia, nausea, vomiting, extravasation, anemia
Contraindication/caution: Breastfeeding

CYTOTOXIC CHEMOTHERAPY AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	CLASSIFICATION
bleomycin	Blenoxane	IV, IM, SC	Antibiotic
busulfan	Myleran	Tablet	Alkylating
chlorambucil	Leukeran	Tablet	Alkylating
cisplatin	Platinol	IV, tablet	Alkylating
cyclophosphamide	Cytoxan	Tablet, injection	Alkylating
cytarabine	Cytosar-U	SC, IM, IV	Antimetabolite
daunorubicin	Cerubidine	IV	Antibiotic
doxorubicin	Adriamycin	IV	Antibiotic
epirubicin	Ellence	IV	Antimetabolite
etoposide	*	Capsule, IV	Plant alkaloid
fluorouracil (5-FU)	Efudex	Cream, IV, topical solution	Antimetabolite
hydroxyurea	Hydrea	Capsule	Antimetabolite
lomustine (CCNU)†	CeeNU	Capsule	Alkylating
melphalan	Alkeran	IV	Alkylating
mercaptopurine	Purinethol	Tablet	Antimetabolite
methotrexate	Rheumatrex	IM, IV, tablet	Antimetabolite
mitomycin C	Mutamycin	IV	Antibiotic
temozolomide	Temodar	Capsule	Antibiotic
thioguanine (6TG)*	Tabloid	Tablet	Antimetabolite
thiotepa	*	IV	Alkylating
valrubicin	Valstar	Injection into the bladder	Antimetabolite
vinblastine	Velban	IV	Plant alkaloid
vincristine	Oncovin	IV	Plant alkaloid

*No longer available as a branded drug.
†Both The Joint Commission and the Institute for Safe Medication Practices are against using abbreviations for medications; however, physicians may still use these abbreviations.

HORMONES

MOA: Inhibit synthesis of adrenal steroids
Adverse reactions: Hot flashes, transient tumor flare, headache
Contraindication/caution: Pregnancy

HORMONE AGENTS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	TARGET
aminoglutethimide	*	Tablet	Breast, prostate
anastrazole	Arimidex	Tablet	Breast cancer
exemestane	Aromasin	Tablet	Breast cancer
flutamide	*	Capsule	Prostate
goserelin	Zoladex	Implant, SC	Prostate, endometriosis, metastatic breast cancer
letrozole	Femara	Tablet	Breast cancer
leuprolide	Lupron Depot	SC	Prostate carcinoma, endometriosis
megestrol	Megace	Suspension, tablet	Breast, endometriosis
tamoxifen	*	Tablet	Breast

*No longer available as a branded drug.

BIOLOGICAL RESPONSE MODIFIERS

GENERIC NAME	BRAND NAME	DOSAGE FORMS	ADVERSE EFFECTS
aldesleukin	Proleukin	IV	Hypotension, diarrhea, fever or chills
interferon α-2a	Roferon	IM, IV, SC	Weight loss, metallic taste, nausea, vomiting, abdominal cramps
interferon α-2b	Intron	IM, IV, SC	Changes in mental status, sore throat, fever, fatigue, unusual bleeding
interferon β-1a	Avonex	IM	Myalgia, fever, chills, malaise, fatigue
interferon β-1b	Betaseron	SC	Myalgia, fever, chills, malaise, fatigue

TARGETED ANTICANCER AGENTS

GENERIC NAME	BRAND NAME	TREATMENT
bevacizumab injection	Avastin	Treatment of metastatic colorectal disease
cetuximab injection	Erbitux	Treatment of metastatic colorectal disease
clofarabine injection	Clolar	Treatment of relapsed or refractory pediatric acute lymphoblastic leukemia
dasatinib	Sprycel	Treatment for adults with chronic myeloid leukemia
erlotinib	Tarceva	Treatment of advanced and non–small cell lung cancer
panitumumab	Vectibix	Treatment for metastatic colorectal carcinoma
pemetrexed disodium injection	Alimta	Treatment of mesothelioma and non–small cell lung cancer
sorafenib tosylate	Nexavar	Treatment of advanced renal cell carcinoma
vorinostat	Zolinza	Treatment of patients with cutaneous T-cell lymphomas
nelarabine	Arranon	Treatment of T-cell lymphoblastic leukemia

Refer to Appendix C for a listing of the top 200 medications prescribed.

VITAMINS, ELECTROLYTES, AND NUTRITIONAL SUPPLEMENTS

VITAMINS

Vitamins are essential organic constituents found in many food products and are necessary for normal metabolic functions. They may be either water soluble or fat soluble. Fat-soluble vitamins accumulate in large stores, primarily in the liver. Deficiencies may lead to disease after periods of restricted intake. Excessive intake may result in toxicity. Water-soluble vitamins are easily eliminated by the kidneys on a daily basis.

EXAMPLES OF WATER-SOLUBLE VITAMINS

VITAMIN	GENERIC NAME	FUNCTIONS	SOURCES
B_1	Thiamine	Coenzyme in carbohydrate metabolism; deficiency results in beriberi	Pork, liver, kidney, whole cereal, grains, beans, and yeast
B_2	Riboflavin	Maintains integrity of mucous membranes and metabolic energy pathways	Milk, liver, kidney, cereals, and green vegetables
B_3	Nicotinic acid	Involved in fat synthesis, electron transport, and protein metabolism; deficiencies result in diarrhea, dementia, and dermatitis; prevents pellagra	Liver, yeast, lean meats, peanuts, and beans
B_5	Pantothenic acid	Deficiencies may result in fatigue, headache, sleepiness, nausea, GI pain, and disturbances of coordination	Vegetables, cereals, yeast, and liver
B_6	Pyridoxine	Coenzyme in amino acid and fatty acid metabolism	All plants and animals
B_9	Folic acid	Needed for the production of healthy RBCs	Liver and fresh green vegetables
B_{12}	Cyanocobalamin	Intrinsic factor for the production of RBCs; deficiency is seen in pernicious anemia	Animal tissue
Biotin		Deficiency is characterized by dermatitis and anorexia	Yeast, egg yolk, vegetables, nuts, and cereals
C	Ascorbic acid	Maintaining normal cell membrane permeability promotes wound healing and antiinflammatory ability; prevents scurvy	Green plants, tomatoes, citrus fruits

GI, Gastrointestinal; *RBC,* red blood cell.

EXAMPLES OF FAT-SOLUBLE VITAMINS

VITAMIN	GENERIC NAME	USES	SOURCES
A	Retinol	Prevents keratomalacia	Milk, butter, cheese, liver, and fish oils
D_2	Ergocalciferol	Prevents rickets in small children and prevents osteomalacia in adults	Butter, milk, cheese, egg yolk, and fish oils
D_3	Cholecalciferol		
E	Tocopherols	Antioxidant for unsaturated fatty acids; deficiency is characterized by irritability, edema, and hemolytic anemia	Soybean oil, wheat germ, rice germ, nuts, corn, butter, eggs, and leafy green vegetables
K	Phytonadione	Formation of prothrombin	Leafy green vegetables, wheat bran, soybeans

MINERALS

- Calcium: Needed for proper muscle and nerve function; necessary for proper bone and tooth formation; prevention of osteoporosis
- Chromium: Aids in metabolism of sugars
- Copper: Needed for proper blood formation
- Iodine: Needed for proper thyroid function
- Iron: Needed for red blood cell formation
- Magnesium: Needed for muscle function
- Potassium: Needed for heart and nerve function; cellular homeostasis
- Sodium: Needed for nerve and muscle formation; cellular homeostasis
- Sulfur: Needed for energy production and cellular function
- Zinc: Needed for proper immune function

Refer to Appendix D for a listing of the common vitamins.

HERBAL MEDICATIONS

NAME	USES
Aloe vera	Wound and burn healing
American ginseng	Energy, stress, immune system builder
Basil	Reducing gas
Bilberry	Eye and vascular disorders
Black cohosh	Menopause, premenstrual syndrome, mild depression, arthritis
Cascara sagrada	Laxative
Cat's claw	Antiinflammatory, antimicrobial, antioxidant, immunosupportive
Catnip tea	Diarrhea
Cayenne	Eliminates chills and discomfort from colds; promotes the healing of ulcers
Chamomile	Calming agent, sedative
Chasteberry	Premenstrual syndrome
Chondroitin	Osteoarthritis
Cinnamon	Gas, diarrhea, upset stomach
Cramp bark	Menstrual cramping
Cranberry	UTI
Dandelion	Water retention associated with premenstrual syndrome
Dill	Gas and indigestion
Dong quai	Anemia, energy (females), menopause, dysmenorrhea, premenstrual syndrome
Echinacea	Boosts immune system
Evening primrose oil	Premenstrual syndrome
Fennel	Stomach cramps and gas
Feverfew	Headaches; prophylaxis for migraine
Ginger	Antiemetic, antiinflammatory, GI distress
Glucosamine	Osteoarthritis and rheumatoid arthritis
Goldenseal	Boosts immune system
Grapeseed	Antioxidant, allergies, circulation
Green tea	Anticancer, antioxidant, lowers cholesterol
Hop tea	Sleeping aid
Isoflavones	Cancer prevention, decreased bone loss, lower cholesterol, menopausal symptoms
Kava	ADD, ADHD, anxiety, sedation
Lomatium	Antiviral agent for the flu, immunostimulant
Lungwort	URI
Marshmallow root	Scratchy throat, ulcers, colitis
Melatonin	Insomnia
Milk thistle	Antioxidant, liver disease
Panax	Energy, stress, immune system builder
Passionflower	Tranquilizer
Peppermint	Upset stomach
Saw palmetto	Benign prostatic hyperplasia
Siberian ginseng	Athletic performance, stress, immune builder
Skullcap	Tension headaches, irritability and anxiety associated with premenstrual syndrome, stress
Slippery elm bark	Sore throat
St. John's wort	Depression, improves immune system
Valerian	Sedative, analgesic, nervous tension
White willow bark	Aspirin substitute (analgesic, antipyretic, and antiinflammatory)
Wild yam	Female vitality

ADD, Attention-deficit disorder; *ADHD,* attention-deficit hyperactivity disorder; *URI,* upper respiratory infection; *UTI,* urinary tract infection.

Refer to Appendix E for a listing of the common OTC products.

OVER-THE-COUNTER MEDICATIONS

BRAND NAME	GENERIC NAME	DRUG PROPERTIES
Actifed	pseudoephedrine and triprolidine	Decongestant, antihistamine
Advil	ibuprofen	Analgesic, antipyretic, antiinflammatory
Afrin	oxymetazoline	Decongestant
Aleve	naproxen sodium	Analgesic, antipyretic, antiinflammatory
Anbesol	benzocaine and phenol	Topical anesthetic
Aspercreme	trolamine salicylate	Topical analgesic
Bayer Aspirin	aspirin	Analgesic, antipyretic, antiinflammatory
Benadryl	diphenhydramine	Antihistamine
Benylin	diphenhydramine	Antitussive
Betadine	povidone iodine	Topical antiseptic
Bonine	meclizine	Antiemetic
Bufferin	aspirin	Analgesic, antipyretic, antiinflammatory
Caladryl	pramoxine, camphor, and calamine	Protectant
Carmex	menthol, camphor, alum, and salicylic acid	Protectant
Cepastat	phenol	Anesthetic
Chlor-Trimeton	chlorpheniramine	Antihistamine
Chloraseptic	benzocaine and menthol	Topical anesthetic
Citrucel	methylcellulose	Laxative
Claritin	loratadine	Antihistamine
Colace	docusate sodium	Stool softener
Compound W	salicylic acid	Keratolytic
Cortaid	hydrocortisone	Antiinflammatory
Delsym	dextromethorphan	Antitussive
Dimetapp	brompheniramine	Antihistamine and decongestant
Donnagel	attapulgite	Antidiarrheal
Doxidan	docusate calcium	Stool softener
Dramamine	dimenhydrinate	Antiemetic
Dulcolax	bisacodyl	Laxative
DuoFilm	salicylic acid	Keratolytic
Ecotrin	aspirin	Analgesic, antipyretic, antiinflammatory
Emetrol	phosphorated carbohydrates	Antiemetic
Excedrin	acetaminophen, aspirin, and caffeine	Analgesic, antipyretic, antiinflammatory
Femstat-3	butoconazole	Antifungal
Fibercon	polycarbophil	Laxative
Gas-X	simethicone	Antiflatulent
Gaviscon	aluminum hydroxide and magnesium trisilicate	Antacid
Gly-Oxide	carbamide peroxide	Oral antiseptic
Gyne-Lotrimin	clotrimazole	Antifungal
Imodium AD	loperamide	Antidiarrheal
Ivy Dry	tannic acid, benzocaine, menthol, and camphor	Astringent
Kaopectate	attapulgite	Antidiarrheal
Lactinex	*Lactobacillus*	Lactose intolerance
Listerine	thymol, eucalyptol, methyl salicylate, and menthol	Oral antiseptic
Lotrimin AF	clotrimazole	Antifungal
Maalox	aluminum hydroxide and magnesium hydroxide	Antacid
Metamucil	psyllium hydrophilic mucilloid	Laxative
Micatin	miconazole	Antifungal
Mineral Ice	menthol	Topical muscle relaxant
Monistat	miconazole	Antifungal
Motrin IB	ibuprofen	Analgesic, antipyretic, antiinflammatory
Motrin	ibuprofen	Analgesic, antipyretic, antiinflammatory
Mylanta	aluminum hydroxide and magnesium hydroxide	Antacid
Mylanta Gas	simethicone	Antiflatulent
Mylicon Drops	simethicone	Antiflatulent

Continued

BRAND NAME	GENERIC NAME	DRUG PROPERTIES
Myoflex	trolamine salicylate	Topical analgesic
Naphcon A	pheniramine and naphazoline	Decongestant
NasalCrom	cromolyn sodium	Antihistamine
Neo-Synephrine	phenylephrine	Decongestant
Neosporin	polymyxin B sulfate, neomycin, and bacitracin	Topical antibiotic
Nicoderm	nicotine transdermal	Smoking cessation
Nicorette	nicotine polacrilex	Smoking cessation
Nicotrol	nicotine transdermal	Smoking cessation
Nix	permethrin	*Pediculus* infestation
NoDoz	caffeine	Central nervous system stimulant
Ocean	normal saline	Nasal moisturizer
Orabase-B	benzocaine	Oral anesthetic
Orajel	benzocaine	Oral anesthetic
Orudis KT	ketoprofen	Analgesic, antiinflammatory
Oxy 5, Oxy 10	benzoyl peroxide	Acne agent
Pepcid AC	famotidine	Antiulcer
Pepto-Bismol	bismuth subsalicylate	Gastrointestinal distress
Percogesic	phenyltoloxamine citrate and acetaminophen	Analgesic
Peri-Colace	docusate sodium and casanthranol	Stool softener and laxative
Peroxyl	hydrogen peroxide	Topical antiseptic
Phazyme	simethicone	Antiflatulent
Phillips Milk of Magnesia	magnesium hydroxide	Laxative
Primatene Mist	epinephrine	Bronchodilator
RID	pyrethrin	*Pediculus* infestation
Riopan	hydroxy magnesium and simethicone	Antacid
Robitussin	guaifenesin	Expectorant
Rogaine	minoxidil	Hair replacement
Senokot	senna concentrate	Laxative
Sominex	diphenhydramine	Sleep
Sucrets	hexylresorcinol and dyclonine	Oral anesthetic
Sudafed	pseudoephedrine	Decongestant
Tagamet	cimetidine	Antiulcer
Tavist-D	clemastine fumarate and pseudoephedrine	Antihistamine, decongestant
Tears Naturale	hydroxypropyl methylcellulose	Lubricant
Tinactin	tolnaftate	Antifungal
Tums	calcium carbonate	Antacid
Tylenol	acetaminophen	Analgesic, antipyretic
Zantac 75	ranitidine	Antiulcer
Zilactin	tannic acid	Cold sores
Zostrix	capsaicin	Topical muscle relaxant

CHAPTER 1 REVIEW QUESTIONS

1. Which of the following is not a condition for a medication to be considered therapeutically equivalent?
   a. Can be administered by an approved route
   b. Same active ingredient
   c. Same dosage form
   d. Same strength or concentration

2. Which of the following is an example of an ACE inhibitor?
   a. Amlodipine
   b. Calan
   c. Corgard
   d. Vasotec

3. Which of the following medications is indicated for the treatment of depression?
   a. Alprazolam
   b. Escitalopram
   c. Lorazepam
   d. Ramelteon

4. Which of the following is the generic name for Singulair?
   a. Albuterol
   b. Montelukast
   c. Theophylline
   d. Zileuton

5. Which of the following is a long-acting insulin?
   a. Insulin analog injection
   b. Insulin glulisine
   c. Insulin glargine
   d. Isophane insulin

6. Which of the following medications is affected by vitamin K?
   a. Clonidine
   b. Dabigatran
   c. Heparin
   d. Warfarin

7. Which of the following medications must be monitored through a blood test?
   a. Buspirone
   b. Hydroxyzine
   c. Levothyroxine
   d. Pseudoephedrine

8. Which of the following suffixes indicates the drug is a beta blocker?
   a. -alol
   b. -olol
   c. -pamide
   d. -pril

9. Which of the following medications is an ACE inhibitor used in the treatment of congestive heart failure?
   a. Capoten
   b. Cozaar
   c. Diovan
   d. Zestoretic

10. Which of the following medications may be used in the treatment of influenza?
    a. Amantadine
    b. Acyclovir
    c. Penciclovir
    d. Valacyclovir

11. Which of the following medications will discolor the urine?
    a. Amoxicillin
    b. Oxybutynin
    c. Phenazopyridine
    d. Tolterodine

12. Which of the following is a proton pump inhibitor?
    a. Cimetidine
    b. Ranitidine
    c. Rabeprazole
    d. Sucralfate

13. Which of the following medications is used in the treatment of glaucoma?
    a. Ciprofloxacin
    b. Dexamethasone
    c. Latanoprost
    d. Naphazoline

14. Which drug classification would be used in treating herpes?
    a. Antiviral
    b. Fusion inhibitor
    c. Nonnucleoside reverse transcriptase inhibitor
    d. Protease inhibitor

15. Which of the following medications is used to abort a migraine headache?
    a. Aspirin
    b. Celecoxib
    c. Ibuprofen
    d. Sumatriptan

16. Which of the following diuretics is often taken with a potassium supplement?
    a. Amiloride
    b. Hydrochlorothiazide
    c. Spironolactone
    d. Triamterene

17. Which of the following hypoglycemic medications is classified as a biguanide?
    a. Glipizide
    b. Glyburide
    c. Metformin
    d. Repaglinide

18. Which of the following medications if used during pregnancy may result in a birth defect?
    a. Amoxicillin
    b. Clotrimazole
    c. Methyldopa
    d. Tetracycline

19. Which of the following is the generic name for Lexapro?
    a. Duloxetine
    b. Escitalopram
    c. Fluoxetine
    d. Paroxetine

20. Which of the following OTC medications does not possesses antiinflammatory properties?
    a. Acetaminophen
    b. Aspirin
    c. Ibuprofen
    d. Naproxen

21. Which of the following drug classifications will reduce the effectiveness of oral contraceptives?
    a. Antibiotics
    b. Anticonvulsants
    c. Antifungals
    d. All of the above

22. Which of the following is the generic name for Plavix?
    a. Clopidogrel
    b. Enoxaparin
    c. Heparin
    d. Warfarin

23. For which of the following conditions is Januvia indicated?
    a. Chronic obstructive pulmonary disease
    b. Congestive heart failure
    c. Diabetes
    d. Herpes

24. Which medication is the drug of choice for a cardiac arrhythmia?
    a. Digoxin
    b. Furosemide
    c. Lisinopril
    d. Triamterene

25. Which of the following antibiotics if taken with dairy products or antacids will result in a reduction of its effectiveness?
    a. Amoxicillin
    b. Cephalexin
    c. Erythromycin
    d. Tetracycline

26. Which of the following is the generic name for Diovan?
    a. Irbesartan
    b. Losartan
    c. Olmesartan
    d. Valsartan

27. Which of the following medications is a protease inhibitor?
    a. Combivir
    b. Epivir
    c. Kaletra
    d. Trizivir

28. Which of the following medications is indicated in the treatment of angina?
    a. Isosorbide dinitrate
    b. Isosorbide mononitrate
    c. Nitroglycerin
    d. All of the above

29. Which of the following is the brand name for ipratropium–albuterol?
    a. Combivent
    b. Combivir
    c. Compazine
    d. Synercid

30. Which of the following medications is indicated in the treatment of bipolar disease?
    a. Amitriptyline
    b. Imipramine
    c. Lithium
    d. Pregabalin

31. Which of the following drug classifications should be taken with food or milk to avoid stomach distress?
    a. Beta-blockers
    b. Cephalosporins
    c. NSAIDs
    d. Proton pump inhibitors

32. Which of the following medications must be initiated in a hospital?
    a. Amiodarone
    b. Bretyllium
    c. Dronedarone
    d. Sotalol

33. Tyramine-containing foods and wines should be avoided if a patient is taking which of the following drug classifications?
    a. Cephalosporins
    b. COX-2 inhibitors
    c. Monoamine oxidase inhibitors
    d. NSAIDs

34. Which of the following medications is not indicated for hypothyroidism?
    a. Levothyroxine
    b. Liothyronine
    c. Liotrix
    d. Methimazole

35. Which of the following vitamins is not water soluble?
    a. B_2
    b. Biotin
    c. C
    d. D_3

36. Which of the following medications is indicated for insomnia?
    a. Etodolac
    b. Ibuprofen
    c. Valproic acid
    d. Zolpidem

37. Which of the following herbal products may be used as a laxative?
    a. Cascara sagrada
    b. Chondroitin
    c. Cranberry
    d. Glucosamine

38. Which of the following is classified as a hormone agent used as chemotherapy agent?
    a. Cisplatin
    b. Etoposide
    c. Interferon α-2a
    d. Tamoxifen

39. Which of the following topical preparations is indicated for acne vulgaris?
    a. Ciclopirox
    b. Miconazole
    c. Tolnaftate
    d. Isotretinoin

40. Which of the following glaucoma agents must be refrigerated?
    a. Brimonidine
    b. Latanoprost
    c. Timolol
    d. Travoprost

41. Which of the following foods provide(s) a source of vitamin C?
    a. Cereals
    b. Egg yolk
    c. Liver
    d. Tomatoes

42. Which of the following is not an NSAID?
    a. Diclofenac
    b. Ibuprofen
    c. Meperidine
    d. Piroxicam

43. Which of the following medications is an example of a disease-modifying antirheumatic drug (DMARD)?
    a. Enbrel
    b. Humira
    c. Orencia
    d. All of the above

44. Which of the medications is indicated in the treatment of psoriasis?
    a. Adapalene
    b. Azelaic acid
    c. Calcipotriene
    d. Fluorouracil

45. Which of the following is the generic name for Glucovance?
    a. Glipizide–metformin
    b. Glyburide–metformin
    c. Pioglitazone
    d. Repaglinide

46. Which of the following is the generic name for Seroquel?
    a. Aripripazole
    b. Magnesium
    c. Olanzapine
    d. Quetiapine

47. Which of the following drug classifications is not indicated in the treatment of depression?
    a. Benzodiazepines
    b. Monoamine oxidase inhibitors
    c. Selective serotonin reuptake inhibitors
    d. Tricyclic antidepressants

48. Which of the following medications indicated for ADHD is not a controlled substance?
    a. Adderall
    b. Cylert
    c. Ritalin
    d. Strattera

49. What is the generic name for Viagra?
    a. Sildenafil
    b. Selegilene
    c. Tadalafil
    d. Vardenafil

50. Which of the following is a side effect of aluminum hydroxide?
    a. Constipation
    b. Diarrhea
    c. Electrolyte imbalance
    d. Metallic taste

51. Which of the following is true when taking Fosamax?
    a. Lie down after taking the medicine.
    b. Take the medicine at bedtime.
    c. Take with food.
    d. Take with water.

52. To which drug classification does furosemide belong?
    a. Beta-blocker
    b. Calcium channel blocker
    c. HMG COA reductase inhibitor
    d. Loop diuretic

53. What is the generic name for Lyrica?
    a. Divalproex
    b. Gabapentin
    c. Pregabalin
    d. Primidone

54. Which of the following medications should be taken with food?
    a. Latanoprost
    b. Ondansetron
    c. Prednisone
    d. Timolol

55. Which of the following medications may result in drowsiness as a side effect?
    a. Benadryl
    b. Caltrate
    c. Sudafed
    d. Tylenol

56. Which of the following is the brand name for simvastatin?
    a. Crestor
    b. Mevacor
    c. Zetia
    d. Zocor

57. Which of the following is the generic name for Nasonex?
    a. Budesonide
    b. Fluticasone
    c. Momentasone
    d. Triamcinolone

58. What does the "HCT" represent in Benicar HCT?
    a. Hydralazine
    b. Hydrochlorothiazide
    c. Hydrocodone
    d. Hydrocortisone

59. Which of the following medications would not be used to treat hyperthyroid disease?
    a. Levothyroxine
    b. Medroxyprogesterone
    c. Mmethimazole
    d. Zolmitriptan

60. Which of the following medications affects the clotting of platelets?
    a. Clopidogrel
    b. Enoxaparin
    c. Heparin
    d. Warfarin

61. What is the brand name for amoxicillin trihydrate–potassium clavulanate?
    a. Augmentin
    b. Ceftin
    c. Cipro
    d. Ketek

62. Which of the following medications is used to treat bacterial infections?
    a. Acyclovir
    b. Cephalexin
    c. Clotrimazole
    d. Stavudine

63. Which of the following agents is an expectorant?
    a. Guaifenesin
    b. Cetrizine
    c. Loratadine
    d. Oxymetazoline

64. Which of the following medications could be used to treat anxiety?
    a. Alprazolam
    b. Carbamazepine
    c. Cephalexin
    d. Valproic acid

65. What electrolyte does Klor-Con provide to the body?
    a. Calcium
    b. Magnesium
    c. Potassium
    d. Sodium

66. For what condition is Actonel indicated?
    a. Acne vulgaris
    b. Arrhythmia
    c. Osteoporosis
    d. Parasites

67. What is the active ingredient in Tylenol?
    a. Acetaminophen
    b. Aspirin
    c. Ibuprofen
    d. Naproxen

68. What is the generic name for Flomax?
    a. Doxazosin
    b. Dutasteride
    c. Tamsulosin
    d. Terazosin

69. Which of the following vitamins is fat soluble?
    a. A
    b. B_1
    c. B_6
    d. C

70. Which of the following pregnancy categories indicates that adequate studies in pregnant women have failed to show a risk to fetuses in the first trimester and there is no evidence of risk in later trimesters?
    a. Category A
    b. Category B
    c. Category C
    d. Category D

71. What is the generic name for Detrol LA?
    a. Flutamide
    b. Prazosin
    c. Terazosin
    d. Tolterodine

72. Which of the following medications is indicated to treat bipolar disease and epilepsy?
    a. Carbamazepine
    b. Lithium
    c. Olanzapine–fluoxetine
    d. Risperidone

73. To which drug classification does Singulair belong?
    a. Antihistamine
    b. Bronchodilator
    c. Leukotriene inhibitor
    d. Xanthine derivative

74. Which of the following medications is indicated for arrhythmias?
    a. Cogentin
    b. Multaq
    c. Seroquel
    d. Zerit

75. What is the generic name for Aricept?
    a. Donepezil
    b. Memantine
    c. Rivastigmine
    d. Tacrine

Chapter 2

Pharmacy Law and Regulations

Chapter Objectives

Upon completion of Chapter 2, the pharmacy technician student will be able to

1. Differentiate between pharmacy ethics and legislation affecting the practice of pharmacy.
2. Compare and contrast the role of a pharmacist and a pharmacy technician in the medication delivery process.
3. Do the following regarding pharmacy law:
   - List individuals who have prescribing authority with medications.
   - Identify legislation that has affected the practice of pharmacy and explain how it affects daily pharmacy operations.
   - Differentiate between the information found on a prescription drug manufacturer's labeling and over-the-counter (OTC) labeling.
   - Differentiate between the various Drug Enforcement Agency (DEA) forms used when dealing with controlled substances.
   - Verify that a DEA number is valid.
   - Discuss the regulatory requirements for dispensing controlled substances.
   - State the conditions that medication does not need to be packaged in a child-resistant container.
   - Express the importance of the Omnibus Budget Reconciliation Act of 1990 (OBRA '90) and its impact on patient care.
   - Discuss the importance of the Health Insurance Portability and Accountability Act (HIPAA) and how it affects patient information.
4. Identify various restricted drug programs and the processes associated with each in the filling of prescriptions for that medication.
5. Discuss generic substitution, state-specific prescription transfer regulations, and the requirements of pharmacy record retention.
6. Discuss pharmacy standards, including:
   - Explain the importance of United States Pharmacopeia (USP) <795> on nonsterile compounding.
   - Identify pharmacy standards, including the importance of USP <797> and its impact on infection control.
7. Discuss the regulatory requirements for the handling and disposing of hazardous waste.
8. Explain facility, equipment, and supply requirements required by the states' Boards of Pharmacy and identify required pharmacy resources.
9. Do the following regarding pharmacy regulatory agencies:
   - List the various organizations that affect the practice of pharmacy and identify their roles in pharmacy.
   - Explain the various types of drug recalls.
10. Discuss employee performance evaluation techniques.

PTCB Knowledge Domains

- **2.1** Storage, handling, and disposal of hazardous substances and wastes (e.g., Material Safety Data Sheets [MSDS])
- **2.2** Hazardous substances exposure, prevention, and treatment (e.g., eyewash, spill kit, MSDS)
- **2.4** Controlled substance documentation requirements for receiving, ordering, returning, loss or theft, and destruction (DEA)
- **2.5** Formula to verify the validity of a prescriber's DEA number (DEA)
- **2.6** Record keeping, documentation, and record retention (e.g., length of time prescriptions are maintained on file)
- **2.7** Restricted drug programs and related prescription-processing requirements (e.g., thalidomide, isotretinoin, clozapine)
- **2.8** Professional standards related to data integrity, security, and confidentiality (e.g., HIPAA, backing up and archiving)
- **2.9** Requirement for consultation (e.g., OBRA '90)
- **2.10** Food and Drug Administration's (FDA's) recall classification
- **2.11** Infection control standards (e.g., laminar air flow, clean room, hand washing, cleaning counting trays, countertop, and equipment) (OSHA, USP <795> and <797>)
- **2.12** Record keeping for repackaged and recalled products and supplies (The Joint Commission [TJC], Boards of Pharmacy [BOP])
- **2.13** Professional standards regarding the roles and responsibilities of pharmacists, pharmacy technicians, and other pharmacy employees (TJC, BOP)
- **2.15** Facility, equipment, and supply requirements (e.g., space requirements, prescription file storage, cleanliness, reference materials) (TJC, USP, BOP)

ExCPT Knowledge Domains

- **1.1** Overview of technician duties and general information
  - ***1.1.1*** The role of pharmacists and pharmacy technicians
  - ***1.1.2*** Functions that a technician may and may not perform
  - ***1.1.4*** Pharmacy security
- **1.2** Controlled substances
  - ***1.2.1*** Difference among the controlled substances schedules
  - ***1.2.2*** Refills, partial refills, filing, and prescription transfers
  - ***1.2.3*** Correct procedures for handling Schedule V sales
  - ***1.2.4*** Controlled Substance Act
  - ***1.2.5*** DEA numbers
- **1.3** Other laws and regulations
  - ***1.3.1*** Federal Privacy Act
  - ***1.3.2*** Generic substitution (include brand vs. generic products)
  - ***1.3.3*** Professionals with prescribing authority (and acronyms)
  - ***1.3.4*** Child-resistant packaging
  - ***1.3.5*** Role of government agencies (e.g., BOP, DEA, FDA)
  - ***1.3.6*** Manufacture drug package labeling
  - ***1.3.7*** OTC package labeling

PHARMACEUTICAL, MEDICAL, AND LEGAL DEVELOPMENTS THAT HAVE AFFECTED THE PRACTICE OF PHARMACY

- American Society of Health-System Pharmacists' *White Paper on Pharmacy Technicians*
- Computerization: Method of processing, storing, and transferring prescriptions
- Online adjudication: Method of billing insurance companies and ensuring payment for services
- Faxes: Method of transmitting prescriptions and medication orders from a physician's office to a pharmacy
- Personal digital assistants: Method of transmitting prescriptions to a pharmacy
- Medicare Prescription Drug, Improvement, and Modernization Act of 2003
- Drug Reimportation Reform: Currently being examined
- Orphan Drug Act: Promotes development of pharmaceutical products with small markets
- Reducing the amount of time a drug is covered by a patent, resulting in generic drugs becoming available earlier
- Revising the protocol for the development of acquired immunodeficiency syndrome (AIDS) medications
- Process for converting prescription medications to over-the-counter (OTC) status
- Allowing pharmacists to prescribe in specific situations
- Third-party health care providers
- Automation
- Electronic prescribing

ETHICS

Ethics are defined as a study of standards and moral judgment; it is a moral philosophy that is

influenced by a particular group, society, philosophy, religion, or profession. According to *Remington The Science and Practice of Pharmacy* ethics and laws are related in that both share the social purpose of encouraging the right conduct. Whereas laws are enacted by the government to achieve a goal, ethics are embraced by a profession without the involvement of government. The American Pharmacists Association has issued a code of ethics for pharmacy technicians.

AMERICAN PHARMACISTS ASSOCIATION'S CODE OF ETHICS FOR PHARMACISTS

PREAMBLE

Pharmacists are health professionals who assist individuals in making the best use of medications. This code, prepared and supported by pharmacists, is intended to state publicly the principles that form the fundamental basis of the roles and responsibilities of pharmacists. These principles, based on moral obligations and virtues, are established to guide pharmacists in relationships with patients, health professionals, and society.

- A pharmacist respects the covenantal relationship between the patient and pharmacist.
- A pharmacist promotes the good of every patient in a caring, compassionate, and confidential manner.
- A pharmacist respects the autonomy and dignity of each patient.
- A pharmacist acts with honesty and integrity in professional relationships.
- A pharmacist maintains professional competence.
- A pharmacist respects the values and abilities of colleagues and other health professionals.
- A pharmacist serves individual, community, and societal needs.
- A pharmacist seeks justice in the distribution of health resources.

AMERICAN PHARMACISTS ASSOCIATION'S CODE OF ETHICS FOR PHARMACY TECHNICIANS

PREAMBLE

Pharmacy technicians are health care professionals who assist pharmacists in providing the best possible care for patients. The principles of this code, which apply to pharmacy technicians working in any and all settings, are based on the application and support of the moral obligations that guide the pharmacy profession in relationships with patients, health care professionals, and society.

- A pharmacy technician's first consideration is to ensure the health and safety of the patient and to use knowledge and skills to the best of his or her ability in serving others.
- A pharmacy technician supports and promotes honesty and integrity in the profession, which includes a duty to observe the law, maintain the highest moral and ethical conduct at all times, and uphold the ethical principles of the profession.
- A pharmacy technician assists and supports the pharmacist in the safe, efficacious, and cost-effective distribution of health services and health care resources.
- A pharmacy technician respects and values the abilities of pharmacists, colleagues, and other health care professionals.
- A pharmacy technician maintains competency in his or her practice and continually enhances his or her professional knowledge and expertise.
- A pharmacy technician respects and supports the confidentiality of a patient's records and discloses pertinent information only with proper authorization.
- A pharmacy technician never assists in the dispensing, promoting, or distribution of medications or medical devices that are not of good quality or do not meet the standards required by law.
- A pharmacy technician does not engage in any activity that will discredit the profession and will expose, without fear or favor, illegal or unethical conduct in the profession.
- A pharmacy technician associates with and engages in the support of organizations that promote the profession of pharmacy through the use and enhancement of pharmacy technicians.

ROLES AND RESPONSIBILITIES OF PHARMACISTS, PHARMACY TECHNICIANS, AND OTHER PHARMACY EMPLOYEES

Pharmacists typically do the following:

- Fill prescriptions, verifying instructions from physicians on the proper amounts of medication to give to patients.
- Check whether the prescription will interact negatively with other drugs that a patient is taking or conditions the patient has.
- Instruct patients on how and when to take a prescribed medicine.

- Advise patients on potential side effects they may experience from taking medicines.
- Advise patients about general health topics, such as diet, exercise, and managing stress, and on other issues, such as what equipment or supplies would be best for a health problem.
- Complete insurance forms and work with insurance companies to be sure that patients get the medicines they need.
- Oversee the work of pharmacy technicians and pharmacists in training (interns).
- Keep records and do other administrative tasks.
- Teach other health care practitioners about proper medication therapies for patients.

The primary duty of a pharmacy technician is to assist the pharmacist. Pharmacy technicians provide technical assistance in the pharmacy but are not involved in professional judgmental duties, such as counseling patients. The following sections list duties associated with community, institutional (e.g., hospital), and managed care pharmacy technicians.

RESPONSIBILITIES OF COMMUNITY PHARMACY TECHNICIANS

- Help patients who are dropping off or picking up prescription orders.
- Enter prescription orders into the computer.
- Create a profile of the patient's health and insurance information in the computer or update the patient's profile.
- Assist the pharmacist, under direct supervision, in the practice of pharmacy in accordance with local, state, federal, and company regulations.
- Communicate with insurance carriers to obtain payment for prescription claims.
- At point of sale, verify that customers receive correct prescriptions.
- Complete weekly distribution center medication orders, place orders on shelves, and verify all associated paperwork.
- Assist the pharmacist with filling and labeling prescriptions.
- Prepare the pharmacy inventory.
- Screen telephone calls for the pharmacist.
- Communicate with prescribers and their agents to obtain refill authorization.
- Compound oral solutions, ointments, and creams.
- Prepackage bulk medications.
- Maintain an awareness of developments in the community and the pharmaceutical field that relate to job responsibilities and integrate them into own practices.
- Assist in training new employees.
- Assist other pharmacy technicians.
- Assist pharmacist in scheduling and maintaining workflow.
- Maintain knowledge of loss-prevention techniques.

RESPONSIBILITIES OF INSTITUTIONAL PHARMACY TECHNICIANS

- Rotate through all work areas of the pharmacy.
- Transport medications, drug-delivery devices, and other pharmacy equipment from the pharmacy to nursing units and clinics.
- Pick up copies of physician orders, automated medication administration records, and unused medications from the nursing units and return them to the pharmacy.
- Fill patient medication cassettes.
- Prepare medications and supplies for dispensing, including the following:
  - Repackaging bulk medications, compounding ointments, creams, oral solutions, and other medications
  - Compounding nonsterile preparations
  - Preparing chemotherapeutic agents
  - Compounding total parenteral nutrition (TPN) solutions
  - Compounding large-volume and small-volume intravenous (IV) mixtures
  - Packaging and preparing drugs being used in clinical investigations
  - Preparing prescriptions for outpatients
  - Checking continuous unit-dose medications
  - Controlling and auditing narcotics and stock substances
  - Restocking crash carts
- Assist pharmacists with entering medication orders into the computer system.
- Prepare inventories, order drugs and supplies from the storeroom, receive drugs, and stock shelves in various pharmacy locations.
- Screen telephone calls.
- Perform monthly nursing unit inspections, maintain workload records, and collect quality assurance data.
- Assist in training new employees.
- Assist other pharmacy technicians.
- Coordinate insurance billing, including third-party prescriptions.
- Deliver unit dose to automated dispensing technology, such as a Pyxis machine.
- Triage telephone and window inquiries.

RESPONSIBILITIES OF MANAGED CARE PHARMACY TECHNICIANS

- Under the supervision of a pharmacist, perform daily handling of ongoing pharmacy benefit

telephone calls from members, pharmacy providers, and physicians.
- Troubleshoot third-party prescription claims questions with an understanding of online rejections and plan parameters.
- Develop and maintain an electronic service log of all telephone calls with complete follow-up history.
- Develop a trending report on the aforementioned service calls with an eye toward forecasting possible trends in pharmacy service.
- Provide as-needed telephone and administrative support for the department.

PHARMACY LAW

Note: This review book examines federal laws affecting the practice of pharmacy. Federal law takes precedence over state law unless the state law is stricter than the federal law, in which case the state law takes precedence. Every pharmacy technician must be aware of the state laws affecting the practice of pharmacy in his or her state.

PRESCRIBING AUTHORITY

Each state determines the requirements for those individuals permitted to prescribe medications within the state. This prescribing authority may be limited or restricted by the state. Individuals with prescribing authority include:
- Medical doctors (MDs)
- Physician assistants (PAs)
- Nurse practitioners (NPs)
- Dentists (DDS and DMDs; limited to prescribing dental medications)
- Optometrists (ODs)
- Osteopaths (DOs)
- Podiatrists (DPMs)
- Veterinarians (DVMs; can only prescribe for animals)

PURE FOOD AND DRUG ACT OF 1906

- Enacted in 1906 to prohibit the interstate transportation or sale of adulterated and misbranded food or drugs

FOOD, DRUG, AND COSMETIC ACT OF 1938 (FDCA 1938)

- The U.S. Food and Drug Administration (FDA) was created under FDCA 1938.
- Requires that all new drug applications be filed with the FDA
- Clearly defined adulteration and misbranding of drugs and food products

Adulteration

- Consisting "in whole or in part of any filthy, putrid, or decomposed substance"
- "Prepared, packed, or held under unsanitary conditions"
- Prepared in containers "composed, in whole or in part, of any poisonous or deleterious substance"
- Containing unsafe color additives
- Claimed to be or represented as drugs recognized "in an official compendium" but differing in strength, quality, or purity of the drugs

Misbranding

- Labeling that is "false or misleading in any particular way"
- Packaging that does not bear a label containing the name and place of business of the manufacturer, packer, or distributor or an accurate quantity of contents or is not conspicuously and clearly labeled with information required by the act
- Failure to carry a label indicating "Warning—May be habit forming" if the product is habit forming
- Failure to "bear the established name of the drug and in case it carries more than two or more active ingredients, the quantities of the ingredients, the amount of alcohol and also including—whether active or not—the established name and quantity of certain other substances described in the act"
- Failure to label "adequate directions for use" or "adequate warnings against use in certain pathological conditions"
- Products that are "dangerous to health when used in the dosage or manner or duration prescribed, recommended or suggested in the labeling"

Manufacturer Drug Labeling

The following information is required on all manufacturer's drug labels:
- Name and place of business of manufacturer, packer, or distributor
- National Drug Code number
- Adequate directions for use
- No misleading statements
- Statement of ingredients
- Prominence of required label statements
- Spanish-language version of certain required statements
- Expiration date
- Manufacturer lot or control numbers
- Declaration of presence of FD&C Yellow No. 5 or FD&C Yellow No. 6 in certain drugs for human use

- Declaration of presence of phenylalanine as a component of aspartame in OTC and prescription drugs for human use
- Prescription drugs containing sulfites; required warning statements
- Labeling for systemic antibacterial drug products
- Bar code label requirements
- Exceptions or alternatives to labeling requirements for human drug products held by the Strategic National Stockpile

Over-the-Counter Package Labeling

The FDA requires the following on all OTC packages:

- Drug's name and place of business of manufacturer, packer, or distributor of drugs and devices
- National Drug Code number
- Active ingredient
- Established name of a drug
- Inactive ingredient
- Content requirements
- "Purpose" or "Purposes" followed by the general pharmacologic category(ies) or the principal intended action(s) of the drug or, when the drug consists of more than one ingredient, the general pharmacologic categories or the principal intended actions of each active ingredient
- "Use" or "Uses," followed by the indication(s)
- "Warning" or "Warnings" and "Do not use" followed by all contraindications for use with the product, including, "Ask a doctor before use if you have" (a particular condition), "Ask a doctor or pharmacist before use if you are"(taking specific medications), "When using this product" followed by the side effects that the consumer may experience, "Stop use and ask a doctor if" followed by any signs of toxicity or other reactions that would necessitate immediately discontinuing use of the product, a pregnancy and breastfeeding warning, a "Keep out of reach of children" warning, and an accidental overdose or ingestion warning
- "Directions" followed by the directions for use
- "Inactive ingredients" followed by a listing of the established name of each inactive ingredient
- "Questions?" or "Questions or comments?" followed by the telephone number of the manufacturer to answer questions about the product

DURHAM-HUMPHREY ACT OF 1951

An amendment to FDCA 1938 requiring all products to have adequate directions for use unless they contain the federal legend "Caution: Federal law prohibits its dispensing without a prescription."

- Separated drugs into two categories: legend and nonlegend (OTC). A legend drug requires a prescription, but an OTC drug does not. Prescription medications require the supervision of a physician.
- Allows verbal prescriptions over the telephone
- Allows refills to be called in from a physician's office

KEFAUVER-HARRIS AMENDMENT OF 1962

- Requires all medications in the United States to be pure, safe, and effective
- Established procedures for both drug applications and investigational drugs
- Drug manufacturers are required to be responsible for Good Manufacturing Process

COMPREHENSIVE DRUG ABUSE PREVENTION AND CONTROL ACT OF 1970

The Drug Enforcement Agency (DEA) was created and placed under the supervision of the Department of Justice. Controlled substances are placed in one of five schedules (classifications or categories) based on a potential for abuse and accepted medical use in the United States.

Drug Schedules

Schedule I medications have no accepted medical use in the United States and possess an extremely high potential for abuse.

Examples of Schedule I narcotics:

- "Crack" cocaine
- Crystal methamphetamine
- Ecstasy
- Hashish
- Hash oil
- Heroin
- Lysergic acid diethylamide (LSD)
- Marijuana
- Mescaline
- Opium
- Phencyclidine palmitate (PCP)
- Peyote
- Psilocybin
- Rohypnol ("roofies")

Schedule II medications have a medical use but possess a high abuse potential with severe psychological or physical dependency (Table 2-1).

Schedule III drugs have accepted medical use, and the abuse potential is less than with Schedule I and II drugs (Table 2-2).

Schedule IV preparations abuse potential is less than with Schedule III drugs, but administration may lead to limited physical or psychological dependence.

TABLE **2-1** **Examples of Schedule II Medications**

BRAND NAME	GENERIC NAME
Adderall	amphetamine and dextroamphetamine
Amytal	amobarbital
Cocaine	cocaine
Codeine	codeine
Demerol	meperidine
Dexedrine	dextroamphetamine
Dilaudid	hydromorphone
Dolophine	methadone
Duragesic	fentanyl
Morphine sulfate	morphine
Numorphan	oxymorphone
OxyContin	oxycodone
Percocet	acetaminophen and oxycodone
Percodan	aspirin and oxycodone
Ritalin	methylphenidate
Seconal	secobarbital

Schedule V medications abuse potential is less than with Schedule IV drugs; this schedule includes exempt narcotics.

Drug Enforcement Agency Registration

- Every facility that dispenses controlled substances must be registered with the DEA.
- The pharmacy registers with the DEA by submitting a DEA Form 224.
- The pharmacy must renew this registration every 3 years.

Ordering and Receipt

- Schedule II medications are ordered by properly completing a DEA Form 222 (a triplicate order form) or submitting it electronically.
- It must be signed by the individual in whose name the DEA registration is listed.

TABLE **2-2** **Examples of Schedules III and IV Medications**

BRAND NAME	GENERIC NAME	SCHEDULE
Ambien	zolpidem	IV
Anexsia	acetaminophen + hydrocodone	III
Ativan	lorazepam	IV
Bontril	phendimetrazine	III
Butisol	butabarbital	IV
Cylert	pemoline	IV
Dalmane	flurazepam	IV
Fastin	phentermine	IV
Fioricet with Codeine	acetaminophen + butalbital + caffeine + codeine	IV
Fiorinal	aspirin + butalbital + caffeine	IV
Fiorinal with Codeine	aspirin + butalbital + caffeine + codeine	IV
Halcion	triazolam	IV
Klonopin	clonazepam	IV
Librium	chlordiazepoxide	IV
Lomotil	diphenoxylate + atropine	IV
Lorcet	acetaminophen + hydrocodone	III*
Lortab	acetaminophen + hydrocodone	III*
Phenobarbital	phenobarbital	IV
Restoril	temazepam	IV
Robitussin A-C	guaifenesin + codeine	IV
Soma with Codeine	carisoprodol + codeine	III
Sonata	zaleplon	IV
Stadol	butorphanol	IV
Talwin	pentazocine	IV
Talwin Nx	pentazocine + naloxone	IV
Tranxene	clorazepate	IV
Tussionex	chlorpheniramine + hydrocodone	III*
Tylenol with Codeine	acetaminophen + codeine	III
Valium	diazepam	IV
Vicodin	acetaminophen + hydrocodone	III*
Vicoprofen	ibuprofen + hydrocodone	III*
Xanax	alprazolam	IV

*Hydrocodone-containing products are being considered to be reclassified as Schedule II drugs.

- A DEA Form 222 is valid for only 60 days.
- A paper DEA Form 222 must be completed with a typewriter, pen, or indelible pencil.
- Only one item per line, with a maximum of 10 different items per form, is permitted.
- The number of lines ordered must be totaled on the bottom of the form.
- Unused forms must be kept in a secure location in the pharmacy.
- On receipt of medication, the number of packages must be recorded on a retained copy of Form 222, and the form must be dated and signed by the pharmacist (Figure 2-1).
- The pharmacist may not use ditto marks for the date or signature.
- The invoice or packing slip, in addition to the completed DEA Form 222, must be retained in a secure location of the pharmacy for a minimum of 2 years.

Schedules III to V:

- Drugs in Schedules III, IV, and V may be ordered by any method (written, faxed, or verbal).
- After receipt, the invoice or packing slip must be dated, signed, stamped with a red C, and retained in a secure location in the pharmacy for a minimum of 2 years.

Retention of Drug Enforcement Agency Records

- DEA records are maintained for a minimum of 2 years, kept separately from other invoices, and kept readily retrievable.
- "Readily retrievable" means separated from normal business records or easily identifiable by an asterisk, a red line, or another visual identifier.
- A red C must be stamped on Schedule III to V records (both prescriptions and medication invoices) if they are filed with other invoices. They must be provided to a DEA representative within 72 hours after request.

Defective DEA Form 222

- A form is considered defective if it is incomplete or illegible or shows signs of alteration, erasure, or change.
- Defective forms must be kept for a minimum of 2 years and be readily retrievable.

Inventories

- The initial inventory is a complete and accurate inventory of all controlled substances before

See Reverse of PURCHASER'S Copy for Instructions

No order form may be issued for schedule **I** and **II** substances unless a completed application form has been received. (21 CFR 1306-04).

OMB APPROVAL No. 1117-0010

To: (*Name of Supplier*)

STREET ADDRESS

TO BE FILLED IN BY PURCHASER

CITY and STATE

DATE

NATIONAL DRUG CODE

Line No	TO BE FILLED IN BY PURCHASER: No. of Packages	Size of Package	Name of Items	No. of Packages Received	Date Received
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

◀ LAST LINE COMPLETED (*MUST BE 10 OR LESS*)

SIGNATURE OF PURCHASER OR ATTORNEY OR AGENT

Date issued

DEA Registration No.

Name and Address of Registrant

Schedules

Registered no a

No. of the Order Form

DEA Form.222 (Oct. 1902)

U.S. OFFICIAL ORDER FORMS - SCHEDULES I & II
DRUG ENFORCEMENT ADMINISTRATION
PURCHASER'S Copy 3

Figure 2-1 DEA Form 222.

the opening of the first day of business for a pharmacy.
- The biennial inventory is taken every 2 years after initial inventory is taken. An exact count for Schedule II and an estimated count for Schedule III to V drugs must be performed; records must be kept for a minimum of 2 years.
- The perpetual inventory shows controlled substances received by the facility, supplied to other locations, returned to the pharmacy, and dispensed to patients. A perpetual inventory will show the actual number of units of a drug at a particular moment in time.

Return of Controlled Substances

- Controlled substances can be returned only between DEA registrants.
- The DEA Form 222 is the official document for the transfer of Schedule II medications.

Destruction of Outdated or Damaged Controlled Substances

- A DEA Form 41 must be submitted to the DEA, indicating the name, strength, and quantities of controlled substances; the date of destruction; the method of destruction; and witnesses present for the destruction.
- A retail pharmacy may submit one DEA Form 41 each year.
- Hospitals may have "blanket authorization." (Refer to Figure 2-2 for a sample DEA Form 41.)

Theft of Controlled Substances

- After the discovery of a theft of controlled substances, the pharmacy must notify the nearest DEA diversion office, notify local police, and complete a DEA Form 106.
- The pharmacy must send the original copy of the DEA Form 106 to the DEA and retain one copy for its records. Refer to Figure 2-3 for a sample DEA Form 106.

Drug Enforcement Administration Numbers

- A physician is required to have a DEA number if he or she wishes to write prescriptions for controlled substances.
- A DEA number consists of two letters and seven numbers assigned to a physician.
- Institutions, such as hospitals and pharmacies, are required to have a DEA number if controlled substances are dispensed from these locations.
- A licensed practitioner of a hospital may be permitted to use the institutional DEA number but will be assigned a specific identifier.

Verifying a Drug Enforcement Administration Number

- The first letter is an A, B, F, or M.
- The second letter is the first letter of the physician's last name when he or she applied for a DEA number.
- Add the numbers in the first, third, and fifth positions together.
- Add the numbers in the second, fourth, and sixth positions together. Multiply the sum by 2.
- Add both sums of numbers together. The number in the last column farthest from the right should be the same as the seventh digit of the DEA number. For example, what should be the seventh digit in Dr. Andrew Sheen's DEA number if it begins with BS452589?

Add 4+2+8 = 14.
Add 5+5+9 = 19; multiply 19 by 2 and get 38.
Add 14 to 38 and get 52; the last number should be a 2.

Therefore, the correct DEA number for Dr. Andrew Sheen is BS4525892.

Filling of Controlled Substances

- Schedule II prescription can be either handwritten or computer generated but must be signed in ink by the physician with no allowable refills.
- A partial filling is allowed if the remaining quantity is available to the patient within 72 hours.
- A new prescription must be issued by the prescriber if additional quantities are to be provided after 72 hours.
- The pharmacist should notify the physician if the balance cannot be provided to the patient.

Emergency Filling of Schedule II Drug Prescriptions

An oral prescription can be issued to a pharmacy under the following conditions:
- Pharmacist must make a good-faith attempt to identify the physician.
- Prescription is limited to a quantity to treat the patient during this emergency period.
- Pharmacist must reduce order to writing.
- Physician must write a prescription for this emergency quantity, and the pharmacy must receive it within 7 days of the oral order.
- If the pharmacy does not receive the written prescription, the DEA must be notified immediately.

Schedule III to V Drugs

- A prescription may be handwritten or computer generated by a physician's office, but it must be signed by the physician in ink.

OMB Approval No. 1117 - 0007	U. S. Department of Justice / Drug Enforcement Administration **REGISTRANTS INVENTORY OF DRUGS SURRENDERED**	PACKAGE NO.

The following schedule is an inventory of controlled substances which is hereby surrendered to you for proper disposition.

FROM: *(Include Name, Street, City, State and ZIP Code in space provided below.)*

Signature of applicant or authorized agent

Registrant's DEA Number

Registrant's Telephone Number

NOTE: CERTIFIED MAIL (Return Receipt Requested) IS REQUIRED FOR SHIPMENTS OF DRUGS VIA U.S. POSTAL SERVICE. See instructions on reverse (page 2) of form.

NAME OF DRUG OR PREPARATION Registrants will fill in Columns 1,2,3, and 4 ONLY.	Number of Containers	CONTENTS *(Number of grams, tablets, ounces or other units per container)*	Controlled Substance Content, *(Each Unit)*	FOR DEA USE ONLY		
				DISPOSITION	QUANTITY	
					GMS.	MGS.
1	*2*	*3*	*4*	*5*	*6*	*7*
1						
2						
3						
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FORM DEA-41 (9-01) Previous edition dated **6-86** is usable. *See instructions on reverse (page 2) of form.*

Figure 2-2 DEA Form 41.

DEA-41 (6/1986) Pg. 2

NAME OF DRUG OR PREPARATION Registrants will fill in Columns 1,2,3, and 4 ONLY.	Number of Containers	CONTENTS *(Number of grams, tablets, ounces or other units per container)*	Controlled Substance Content, *(Each Unit)*	FOR DEA USE ONLY		
				DISPOSITION	QUANTITY	
					GMS.	MGS.
1	*2*	*3*	*4*	*5*	*6*	*7*
17						
18						
19						
20						
21						
22						
23						
24						

The controlled substances surrendered in accordance with Title 21 of the Code of Federal Regulations, Section 1307.21, have been received in _____packages purporting to contain the drugs listed on this inventory and have been: ** (1) Forwarded tape-sealed without opening; (2) Destroyed as indicated and the remainder forwarded tape-sealed after verifying contents; (3) Forwarded tape-sealed after verifying contents.

DATE _____ DESTROYED BY: _____

** *Strike out lines not applicable.*

WITNESSED BY: _____

INSTRUCTIONS

1. List the name of the drug in column 1, the number of containers in column 2, the size of each container in column 3, and in column 4 the controlled substance content of each unit described in column 3; e.g., morphine sulfate tabs., 3 pkgs., 100 tabs., 1/4 gr. (16 mg.) or morphine sulfate tabs., 1 pkg., 83 tabs., 1/2 gr. (32mg.), etc.

2. All packages included on a single line should be identical in name, content and controlled substance strength.

3. Prepare this form in quadruplicate. Mail two (2) copies of this form to the Special Agent in Charge, under separate cover. Enclose one additional copy in the shipment with the drugs. Retain one copy for your records. One copy will be returned to you as a receipt. No further receipt will be furnished to you unless specifically requested. Any further inquiries concerning these drugs should be addressed to the DEA District Office which serves your area.

4. There is no provision for payment for drugs surrendered. This is merely a service rendered to registrants enabling them to clear their stocks and records of unwanted items.

5. Drugs should be shipped tape-sealed via prepaid express or certified mail (**return receipt requested**) to Special Agent in Charge, Drug Enforcement Administration, of the DEA District Office which serves your area.

PRIVACY ACT INFORMATION

AUTHORITY: Section 307 of the Controlled Substances Act of 1970 (PL 91-513).
PURPOSE: To document the surrender of controlled substances which have been forwarded by registrants to DEA for disposal.
ROUTINE USES: This form is required by Federal Regulations for the surrender of unwanted Controlled Substances. Disclosures of information from this system are made to the following categories of users for the purposes stated.
A. Other Federal law enforcement and regulatory agencies for law enforcement and regulatory purposes.
B. State and local law enforcement and regulatory agencies for law enforcement and regulatory purposes.
EFFECT: Failure to document the surrender of unwanted Controlled Substances may result in prosecution for violation of the Controlled Substances Act.

Under the Paperwork Reduction Act, a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. Public reporting burden for this collection of information is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Drug Enforcement Administration, FOI and Records Management Section, Washington, D.C. 20537; and to the Office of Management and Budget, Paperwork Reduction Project no. 1117-0007, Washington, D.C. 20503.

Figure 2-2, cont'd

REPORT OF THEFT OR LOSS OF CONTROLLED SUBSTANCES

Federal Regulations require registrants to submit a detailed report of any theft or loss of Controlled Substances to the Drug Enforcement Administration.

Complete the front and back of this form in triplicate. Forward the original and duplicate copies to the nearest DEA Office. Retain the triplicate copy for your records. Some states may also require a copy of this report.

OMB APPROVAL
No. 1117-0001

1. Name and Address of Registrant (include ZIP Code)

ZIP CODE

2. Phone No. (Include Area Code)

3. DEA Registration Number
2 ltr. prefix | 7 digit suffix

4. Date of Theft or Loss

5. Principal Business of Registrant (Check one)
1 ☐ Pharmacy
2 ☐ Practitioner
3 ☐ Manufacturer
4 ☐ Hospital/Clinic
5 ☐ Distributor
6 ☐ Methadone Program
7 ☐ Other (Specify)

6. County in which Registrant is located

7. Was Theft reported to Police?
☐ Yes ☐ No

8. Name and Telephone Number of Police Department (Include Area Code)

9. Number of Thefts or Losses Registrant has experienced in the past 24 months

10. Type of Theft or Loss (Check one and complete items below as appropriate)
1 ☐ Night break-in
2 ☐ Armed robbery
3 ☐ Employee pilferage
4 ☐ Customer theft
5 ☐ Other (Explain)
6 ☐ Lost in transit (Complete Item 14)

11. If Armed Robbery, was anyone:
Killed? ☐ No ☐ Yes (How many) _____
Injured? ☐ No ☐ Yes (How many) _____

12. Purchase value to registrant of Controlled Substances taken?
$

13. Were any pharmaceuticals or merchandise taken?
☐ No ☐ Yes (Est. Value)
$

14. IF LOST IN TRANSIT, COMPLETE THE FOLLOWING:

A. Name of Common Carrier

B. Name of Consignee

C. Consignee's DEA Registration Number

D. Was the carton received by the customer?
☐ Yes ☐ No

E. If received, did it appear to be tampered with?
☐ Yes ☐ No

F. Have you experienced losses in transit from this same carrier in the past?
☐ No ☐ Yes (How Many) _____

15. What identifying marks, symbols, or price codes were on the labels of these containers that would assist in identifying the products?

16. If Official Controlled Substance Order Forms (DEA-222) were stolen, give numbers.

17. What security measures have been taken to prevent future thefts or losses?

PRIVACY ACT INFORMATION

AUTHORITY: Section 301 of the Controlled Substances Act of 1970 (PL 91-513).
PURPOSE: Report theft or loss of Controlled Substances.
ROUTINE USES: The Controlled Substances Act authorizes the production of special reports required for statistical and analytical purposes. Disclosures of information from this system are made to the following categories of users for the purposes stated:

A. Other Federal law enforcement and regulatory agencies for law enforcement and regulatory purposes.
B. State and local law enforcement and regulatory agencies for law enforcement and regulatory purposes.

EFFECT: Failure to report theft or loss of controlled substances may result in penalties under Section 402 and 403 of the Controlled Substances Act.

In accordance with the Paperwork Reduction Act of 1995, no person is required to respond to a collection of information unless it displays a ly valid OMB control number. The valid OMB control number for this collection of information is 1117-0001. Public reporting burden for this collection of information is estimated to average 30 minutes per response , including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

FORM DEA - 106 (11-00) *Previous editions obsolete*

CONTINUE ON REVERSE

Figure 2-3 DEA Form 106.

FORM DEA-106 (Nov. 2000) Pg. 2

LIST OF CONTROLLED SUBSTANCES LOST

Trade Name of Substance or Preparation	Name of Controlled Substance in Preparation	Dosage Strength and Form	Quantity
Examples: Desoxyn	**Methamphetamine Hydrochloride**	**5 mg Tablets**	**3 x 100**
Demerol	**Meperidine Hydrochloride**	**50 mg/ml Vial**	**5 x 30 ml**
Robitussin A-C	**Codeine Phosphate**	**2 mg/cc Liquid**	**12 Pints**
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I certify that the foregoing information is correct to the best of my knowledge and belief.

Signature _____ Title _____ Date _____

Figure 2-3, cont'd

- The physician's office may telephone a Schedule III to V prescription in to the pharmacy or may fax one, depending on state law.
- Electronic prescriptions for Schedule III to V are permitted.
- A patient may receive up to five refills within 6 months of the date the prescription was written if authorized.
- Partial fillings are permitted as long as refills are indicated on the original prescription, refills do not exceed the total quantity prescribed by the physician, and no partial filling occurs after 6 months of the original date of the prescription.

Exempt Narcotics (Select Schedule V Medications) and Pseudoephedrine-Containing Products

- Select cough and antidiarrheal prescription items can be purchased by an individual if permitted by state law.
- The quantity dispensed must be in the original manufacturer's container and must not exceed the quantity established by law.
- The purchaser must be at least 18 years of age and must complete the Exempt Narcotic Book with the following information: date purchased, name of purchaser, address of purchaser, name of product and quantity purchased, price of transaction, and pharmacist's signature.
- There is a limit of one container in a 48-hour period.

Facsimile Prescriptions

A faxed prescription for a Schedule III, IV, or V drug may serve as the original prescription. The following situations are exceptions:

- A narcotic Schedule II substance that is to be compounded for direct administration to a patient by parenteral, IV, intramuscular, subcutaneous, or intraspinal infusion
- A Schedule II substance for a resident of a long-term care facility
- A practitioner prescribing a Schedule II narcotic substance for a patient in hospice care, as certified by Medicare under Title XVIII or licensed by the state, may transmit a prescription to the dispensing pharmacy by fax regardless of whether the patient resides in a hospice facility or other care setting. The practitioner's agent may also transmit the prescription to the pharmacy. The practitioner will note on the prescription that it is for a hospice patient.

Electronic Prescriptions for Controlled Substances

Prescriptions for controlled substances in schedules II, III, IV, and V may be transmitted electronically from a physician's office to a pharmacy.

Transferring of Controlled Substance Prescriptions

The DEA allows transfer of the original prescription information for Schedule III, IV, and V controlled substances for the purpose of refill dispensing between pharmacies on a one-time basis. If pharmacies share a real-time online database, however, then the prescription may be transferred up to the maximum number of refills permitted by the law. The following are requirements:

1. The transfer is communicated directly between two licensed pharmacists, and the transferring pharmacist is responsible for the following:
   a. The word "Void" must be written on the face of the invalidated prescription.
   b. On the reverse side of the invalidated prescription must be written the name, address, and DEA number of the pharmacy to which the prescription was transferred and the name of the pharmacist receiving the prescription information.
   c. The date of the transfer and name of the pharmacist transferring the prescription must be recorded.
2. The receiving pharmacist is responsible for the following:
   a. "Transfer" must be written on the face of the transferred prescription.
   b. The following information must be recorded:
      (1) Date of issuance of the original prescription
      (2) Original number of refills authorized on the original prescription
      (3) Date of the original dispensing
      (4) Number of valid refills remaining and dates and locations of previous refills
      (5) Pharmacy's name, address, and DEA registration number and prescription number from which the prescription was transferred
      (6) Name of the pharmacist who transferred the prescription
      (7) Pharmacy's name, address, and DEA registration number and prescription number from which the prescription was originally filled
3. The original and transferred prescription(s) must be maintained for a period of 2 years from the date of the last refill.

Types of Fraudulent Prescriptions

- Legitimate prescription pads are stolen from physicians' offices, and prescriptions are written for fictitious patients.
- Drug abusers may alter the physician's prescription to obtain larger quantities of medications.
- Drug abusers may have prescription pads from legitimate physicians printed with a different callback number that is answered by an accomplice to verify the prescription.
- A drug abuser will call in prescriptions and give his or her own telephone number as a callback number.
- Computers may be used to create prescriptions for nonexistent physicians or to copy legitimate physicians' prescriptions.

Characteristics of Forged Prescriptions

- Prescription looks "too good"; the prescriber's handwriting is too legible.
- Quantities, directions, or dosages differ from usual medical usage.
- The prescription does not comply with the acceptable standard abbreviations or appears to be textbook presentation.
- The prescription appears to be photocopied.
- Directions are written in full with no abbreviations.
- Prescriptions are written in different colored inks, different pens, or different handwriting.
- Zeroes are added to the quantities.

Signs Indicating a Prescription Was Not Issued for a Legitimate Medical Purpose

- The prescriber writes significantly more prescriptions or in larger quantities compared with other practitioners in the area.
- The patient appears to be returning too frequently. For example, a prescription that should last for a month is being refilled biweekly or more frequently.
- The prescriber writes prescriptions for antagonistic drugs, such as stimulants and depressants simultaneously.
- The patient is presenting prescriptions written in the names of other people.
- A number of people appear simultaneously or within a short time bearing similar prescriptions from the same physician.
- "Strangers," individuals who are not regular residents of the community, show up with prescriptions from the same physician.
- The medication prescribed is not within the scope of practice of the doctor.
- Patients may appear to be very talkative and therefore may prevent you from verifying the prescription.

Prevention Techniques for Fraudulent Prescriptions

- Know the prescriber and his or her signature.
- Know the prescriber's DEA registration number.
- Know the patient; check the date of when the prescription was written.
- If there is a discrepancy, the patient must have a plausible reason before the medication is dispensed.
- Any time there is doubt, request proper identification.
- If you believe that you have a forged, altered, or counterfeited prescription, do not dispense the medication; contact the local police.
- If you discover a pattern of prescription abuses, contact the state board of pharmacy (BOP) or the local DEA office.

Prescription Monitoring Programs

In 2005, the federal National All Schedules Prescription Electronic Reporting Act was introduced. The act established an electronic system for practitioner monitoring of the dispensing of controlled substances in Schedules II, III, and IV. The act would have required specific information to be reported, such as a patient identifier, drug dispensed, and quantity dispensed, as well as the prescriber and the dispenser. Although the act was never enacted, the majority of states have enacted either this or similar legislation.

POISON PREVENTION PACKAGING ACT OF 1970

The Poison Prevention Packaging Act of 1970 was enacted to reduce accidental poisoning in children. The act requires that most OTC and legend drugs be packaged in child-resistant containers. A child-resistant container is one that cannot be opened by 80% of children younger than 5 years but can be opened by 90% of adults.

Exceptions for Child-Resistant Containers

- Single-time dispensing of product in noncompliant container as ordered by the prescriber
- Single-time or blanket dispensing of product in noncompliant container as requested by patient or customer in a signed statement
- One noncompliant size of the OTC product for elderly or disabled patients provided that the package contains the warning "This Package for Households Without Young Children" or "Package Not Child Resistant"

- Drugs dispensed to institutionalized patients, provided that these drugs are to be administered by an employee of an institution
- Medications not requiring child-resistant containers:
  - Betamethasone with no more than 12.6 mg per package
  - Erythromycin ethylsuccinate tablets in packages containing no more than 16 g
  - Inhalation aerosols
  - Mebendazole tablets with no more than 600 mg per package
  - Methylprednisolone tablets with no more than 85 mg per package
  - Oral contraceptives taken cyclically in the manufacturer's dispensing package
  - Pancrelipase preparations
  - Powdered anhydrous cholestyramine
  - Powdered colestipol up to 5 g per packet
  - Prednisone tablets with no more than 105 mg per package
  - Sodium fluoride tablets with no more than 264 mg of sodium fluoride per package
  - Sublingual and chewable isosorbide dinitrate in doses of 10 mg or less
  - Sublingual nitroglycerin tablets

OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

- Created the Occupational Safety and Health Administration (OSHA)
- Ensures a safe and healthful workplace for all employees
- Requires a reporting system for job-related injuries and illness
- Attempts to reduce hazards in the workplace and conduct audits to ensure compliance with the Act
- Addresses air contaminants, flammable and combustible liquids, eye and skin protection, and hazard communication standards
- OSHA requires use of Safety Data Sheets (SDSs), which are to be provided by the seller of a particular product to the purchaser.
- Established universal precautions

Safety Data Sheets

The Hazard Communication Standard, revised in 2012, requires that the chemical manufacturer, distributor, or importer provide SDSs (formerly MSDSs or Material Safety Data Sheets) for each hazardous chemical to users to communicate information on these hazards. The information contained in the SDS is largely the same as the MSDS, except now the SDSs are required to be presented in a consistent user-friendly, 16-section format. This brief provides guidance to help workers who handle hazardous chemicals to become familiar with the format and understand the contents of the SDSs.

Section 1: Identification

This section identifies the chemical on the SDS as well as the recommended uses. It also provides the essential contact information of the supplier.

Section 2: Hazards Identification

This section identifies the hazards of the chemical presented on the SDS and the appropriate warning information associated with those hazards.

Section 3: Composition/Information on Ingredients

This section identifies the ingredient(s) contained in the product indicated on the SDS, including impurities and stabilizing additives. This section includes information on substances, mixtures, and all chemicals for which a trade secret is claimed.

Section 4: First Aid Measures

This section describes the initial care that should be given by untrained responders to an individual who has been exposed to the chemical.

Section 5: Fire Fighting Measures

This section provides recommendations for fighting a fire caused by the chemical.

Section 6: Accidental Release Measures

This section provides recommendations on the appropriate response to spills, leaks, or releases, including containment and cleanup practices to prevent or minimize exposure to people, properties, or the environment. It may also include recommendations distinguishing between responses for large and small spills when the spill volume has a significant impact on the hazard.

Section 7: Handling and Storage

This section provides guidance on the safe handling practices and conditions for safe storage of chemicals.

Section 8: Exposure Controls and Personal Protection

This section indicates the exposure limits, engineering controls, and personal protective measures that can be used to minimize worker exposure.

Section 9: Physical and Chemical Properties

This section identifies physical and chemical properties associated with the substance or mixture.

Section 10: Stability and Reactivity

This section describes the reactivity hazards of the chemical and the chemical stability information.

This section is broken into three parts: reactivity, chemical stability, and other.

Section 11: Toxicological Factors

This section identifies toxicologic and health effects information or indicates that such data are not available.

Section 12: Ecological Information (Not Mandatory)

This section provides information to evaluate the environmental impact of the chemical(s) if it were released to the environment.

Section 13: Disposal Considerations (Not Mandatory)

This section provides guidance on proper disposal practices, recycling or reclamation of the chemical(s) or its container, and safe handling practices.

Section 14: Transport Information (Not Mandatory)

This section provides guidance on classification information for shipping and transporting of hazardous chemical(s) by road, air, rail, or sea.

Section 15: Regulatory Information (Not Mandatory)

This section identifies the safety, health, and environmental regulations specific for the product that is not indicated anywhere else on the SDS.

Section 16: Other Information

This section indicates when the SDS was prepared or when the last known revision was made. The SDS may also state where the changes have been made to the previous version.

According to the Hazard Communication, the new SDS requirements will be phased in over the next several years as outlined below:

NEW SAFETY DATA SHEET (SDS) REQUIREMENTS

EFFECTIVE COMPLETION DATE	REQUIREMENT(S)	WHO
December 1, 2013	Train employees on the new label elements and (SDS) format.	Employers
June 1, 2015* December 1, 2015	Compliance with all modified provisions of this final rule, except: "The Distributor shall not ship containers labeled by the chemical manufacturer or importer unless it is a GHS label."	Chemical manufacturers, importers, distributors, and employers
June 1, 2016	Update alternative workplace labeling and hazard communication program as necessary and provide additional employee training for newly identified physical or health hazards.	Employers
Transition Period to the effective completion dates noted above	May comply with 29 CFR 1910.1200 (the final standard), the current standard, or both	Chemical manufacturers, importers, distributors, and employers

*All requirements must be met except the component regarding the distributor, which takes place on December 1, 2015.
CFR, Code of Federal Regulations; *GHS,* Globally Harmonized System of Classification and Labeling of Chemicals.

DRUG LISTING ACT OF 1972

Each drug is assigned a specific 11-digit number to identify it. This number is known as an NDC (National Drug Code) number. The first five digits identify the manufacturer, the next four digits identify the drug product, and the final two digits represent the package size and packaging.

FEDERAL PRIVACY ACT OF 1974

The Privacy Act of 1974 regulates what personal information the federal government can collect about private individuals and how that information can be used.

Under the Privacy Act, people have the right to:

- See the information the government has about you, subject to the act's exemptions
- Change or delete any information that is incorrect, irrelevant, untimely, or incomplete
- Sue the government for violations of the act, including allowing others unauthorized access to your personal information

Similar to the Freedom of Information Act, the Privacy Act provides a legal process for accessing personal information.

ORPHAN DRUG ACT OF 1983

- Orphan drugs are medications for treatment of diseases or conditions of which there are fewer than 200,000 cases in the world.
- It provides tax incentives and exclusive licensing of products for manufacturers to develop and market orphan medications.

HATCH-WAXMAN (ALSO KNOWN AS THE DRUG PRICE COMPETITION AND PATENT TERM RESTORATION) ACT OF 1984

- Encouraged the creation of both generic and new medications by streamlining the process for generic drug approval and by extending patent licenses

PRESCRIPTION DRUG MARKETING ACT OF 1987

- Prohibits the reimportation of a drug into the United States by anyone except the manufacturer
- Forbids the sale or distribution of samples to anyone other than those licensed to prescribe them
- Requires the following label to appear on all medications to be administered to animals: "Caution: Federal law restricts this drug to use by or on an order of a licensed veterinarian"

OMNIBUS BUDGET RECONCILIATION ACT OF 1987

The Omnibus Budget Reconciliation Act of 1987 (OBRA '87) established extensive revisions to Medicare and Medicaid Conditions of Participation regarding long-term care facilities and pharmacy. These include the following:

- Each resident's drug regimen must be free of unnecessary medications.
- Antipsychotic drugs are not to be used unless the patient has a specific condition.
- Patients requiring antipsychotic medication must be documented as having been diagnosed with a condition that warrants its use.
- Patients receiving antipsychotic medication must receive gradual dose tapering. Behavioral modification and drug holidays are used to see if the medication may be discontinued.
- Residents are to be free of any significant medication errors.
- Routine and emergency drugs must be provided to patients.
- Long-term care facilities must have the services of a consultant pharmacist.
- Medications must be labeled according to accepted professional principles.
- Medications must be stored in locked compartments at the proper temperature according to both federal and state laws.

ANABOLIC STEROID CONTROL ACT OF 1990

- Enacted harsher penalties for the abuse of anabolic steroids and their misuse by athletes

OMNIBUS BUDGET RECONCILLIATION ACT OF 1990

OBRA '90 required states to establish drug use review programs consisting of three essential components: (1) prospective drug use review, (2) retrospective drug use review, and (3) educational programs.

The first pharmaceutical service required as a part of prospective drug use review is screening for potential drug therapy problems before a prescription is filled and delivered to the patient. This screening requires the pharmacist to review the drug therapy for therapeutic duplication, drug–disease contraindications, drug–drug interactions (including OTC medications), incorrect drug dosage or duration of drug treatment, drug–allergy interactions, and clinical abuse or misuse.

The second pharmaceutical service required as a part of prospective drug use review is patient counseling. The pharmacist must offer to discuss with the patient matters that the pharmacist, in the exercise of his or her professional judgment, deems significant. Although OBRA '90 establishes rules applicable to Medicaid patients, most states have included this mandate to cover all patients. It thus makes good sense in pharmacy practice to ensure that all individuals are provided the best in health care services. At a minimum, the pharmacist must initiate a dialogue with the patient and offer to discuss the following items:

- The name and description of the medication
- The route, dosage form, dosage, route of administration, and duration of drug therapy
- Special directions and precautions for preparation, administration, and use by the patient
- Common severe side or adverse effects or interactions and therapeutic contraindications that may be encountered, including their avoidance, and the action required if they occur
- Techniques for self-monitoring of the drug therapy
- Proper storage
- Prescription refill information and action to be taken in the event of a missed dose

OBRA '90 also requires the pharmacist to make a reasonable effort to obtain, record, and maintain patient information. The patient profiles must contain, at a minimum, general information that includes the patient's (1) name, (2) address, (3) telephone number, (4) date of birth, and (5) gender. Last, each patient profile must contain the patient's individual history if it is deemed significant.

The second essential component of a state's drug use review program, as required by OBRA '90, is retrospective drug use review. Retrospective drug use review requires "ongoing periodic examination of claims data and other records in order to identify patterns of fraud, abuse, gross overuse, or medically

unnecessary care and implements corrective action when needed." Briefly, the third and final component of a state's drug use review program is educational programming. The educational objective is to improve prescribing and dispensing practices.

FOOD AND DRUG ADMINISTRATION SAFE MEDICAL DEVICES ACT OF 1990

- All medical devices are to be tracked and records maintained for durable medical equipment.

RESOURCE CONSERVATION AND RECOVERY ACT

- The Resource Conservation and Recovery Act (RCRA) is a U.S. law that provides, in broad terms, the general guidelines for the waste management program envisioned by Congress.
- Hazardous waste is a waste with properties that make it dangerous or potentially harmful to human health or the environment. In regulatory terms, RCRA hazardous wastes fall into two categories:
  - Listed wastes, which appear on one of the four hazardous wastes lists established by Environmental Protection Agency (EPA) regulations: the F-list (nonspecific source wastes), K-list (source-specific wastes), P-list, and U-list (discarded commercial chemical products)
  - Characteristic wastes, which exhibit one or more of four characteristics defined by ignitability, corrosivity, reactivity, and toxicity
- Pharmacies arrange for the disposal of their hazardous waste through an outside vendor that must adhere to the regulations contained in the RCRA.

DIETARY SUPPLEMENT HEALTH AND EDUCATION ACT OF 1994

Herbal products are dietary supplements rather than drugs. The manufacturers of supplements are allowed to make claims with regard to general health promotion but not disease claims. According to the Dietary Supplement Health and Education Act (DSHEA), herbal products must meet the following requirements:

- Be labeled as a dietary supplement
- Have labeling that identifies all ingredients by name
- Have labeling that lists the quantity of each ingredient
- Have packaging that identifies the plant and plant part from which the ingredient is derived
- Comply with any standards set by an official compendium
- Meet the quality, purity, and compositional specification
- Have Good Manufacturing Practices followed by the manufacturer

HEALTH INSURANCE PORTABILITY AND ACCOUNTABILITY ACT OF 1996

The purpose of the Health Insurance Portability and Accountability Act (HIPAA) was to improve portability and continuity of health coverage in the group and individual markets; combat waste, fraud, and abuse in health insurance and health care delivery; promote the use of medical savings accounts; improve access to long-term care services and coverage; and simplify the administration of health insurance.

- Requires that health care providers ensure that patient confidentiality be maintained
- Establishes conditions on the use and the disclosure of protected health information (PHI) and requires patient notification on how their PHI will be used
- Patients are entitled to a complete discussion of health care options from the health care provider.
- Patients may request that confidential communication is made in a manner that they think is appropriate.
- Every organization must have a written privacy procedure.
- Training must be provided for all employees.

Protected health information includes the following:

- Any information related to past, present, or future physical and mental health
- Past, present, or future payments for health services received
- Specific care the patient received, is receiving, or is willing to receive
- Any information that can identify the patient as the individual receiving the care such as patient name; Social Security number; date of birth, admission, discharge, or death; telephone and fax numbers; e-mail addresses, medical records or account numbers, or health plan beneficiary numbers; certificate or license numbers; photographs; biometric indicators

Protected health information can only be released by

- Written consent of the patient
- Subpoena
- Mandatory reporting

Components of HIPAA:

- **Title I:** Insurance reform. Protects health insurance coverage for workers and families when they change or lose their jobs
- **Title II:** Administrative simplification. Establishes electronic transaction and Code Set Standards; requires health information privacy

Backup and Archiving Procedures for Stored Data and Documentation

Computer systems must be backed up at regularly scheduled times (possibly daily) to prevent loss of data if the system goes down for any reason.

MEDICARE PRESCRIPTION DRUG IMPROVEMENT AND MODERNIZATION ACT OF 2003

- Provides for a voluntary prescription drug benefit to Medicare beneficiaries
- Adds preventive medical benefits to senior citizens
- Lowers the reimbursement rates for Medicare payment for durable medical equipment.
- Created a national competitive bidding program for durable medical equipment in 2007
- Changed the way Medicare pays for outpatient Part B drugs
- Allowed for a voluntary Medicare-approved discount card program, begun in June 2004
- Medicare Part D prescription plan allows beneficiaries to enroll in either regional- or national-based insurance plans
- Provided for Medication Therapy Management (MTM)

ISOTRETINOIN SAFETY AND RISK MANAGEMENT ACT OF 2004

Isotretinoin (Accutane) is a very powerful medication used to treat acne. Unfortunately, the medication has been found to cause severe birth defects; induce spontaneous abortions; and produce adverse psychiatric effects, including depression, psychosis, suicidal ideation, suicide attempts, and suicide. Components of this legislation include:

- Mandatory registry of all patients, practitioners, and pharmacists
- Education of all practitioners and pharmacists regarding the risks associated with the drug, including birth defects and mental health risks
- A requirement that Accutane and its generic form are prescribed only for severe recalcitrant nodular acne, the medical condition for which Accutane was approved, that is unresponsive to conventional therapy, including antibiotics. Accutane and its generic are often prescribed for mild acne or without other medications being tried first.
- Monthly education of patients, both male and female, regarding the need to avoid pregnancy, as well as completion of a survey to warn the patient of the adverse side effects. Patient visits include one-on-one counseling, and patients or parents must sign an informed consent form.
- Certification of medical offices and clinics as treatment centers. No Internet, phone, or mail order prescriptions may be filled.
- Thirty-day prescription allotments
- A requirement that female patients have monthly pregnancy testing and receive a negative test result before a prescription is renewed
- Appropriate blood testing during treatment and 30 days after treatment
- Yearly evaluation of treatment centers to ensure compliance with program
- Mandatory quarterly reporting of all adverse reactions and mandatory reporting within 15 days of all patient deaths associated with the drug

ANABOLIC STEROID CONTROL ACT OF 2004

On January 20, 2004, the Anabolic Steroid Control Act amended the Controlled Substances Act and replaced the existing definition of anabolic steroid with a new definition. The new definition altered the basis for all future administrative scheduling actions relating to the control of anabolic steroids as Schedule III medications by eliminating the requirement to prove muscle growth. This act increased the number of anabolic steroids to 59 substances. This amendment provided the requirements for handling substances defined as anabolic steroids to include registration, security, labeling and packaging, inventory, record maintenance, prescriptions, disposal, importation and exportation, and criminal liability.

COMBAT METHAMPHETAMINE EPIDEMIC ACT OF 2005

- Placed ephedrine, pseudoephedrine, and phenylpropanolamine in the Controlled Substances Act category "scheduled listed chemical products"
- Products containing ephedrine, pseudoephedrine, and phenylpropanolamine are subject to sales restrictions, storage requirements, and record-keeping requirements.
- The Act specifies a 3.6 g/day base product sales limit, a 9 g/30-day base product purchase limit, a blister package requirement, and mail order restrictions.
- Logbook (written or electronic) requirements have been implemented and require the following: products by name, quantity sold, names and addresses of purchasers, and date and time of sales.

MEDICAID TAMPER-RESISTANT PRESCRIPTION ACT

- Applies to all handwritten prescriptions for covered outpatient drugs; drugs that are transmitted from the prescriber to the pharmacy verbally, by

fax, or through e-prescribing are not affected by this legislation.
- Enforced whenever Medicaid pays any portion of the cost of a prescription

A tamper-resistant prescription pad must include all of the following three characteristics:
- One or more industry-recognized features designed to prevent unauthorized copying of a completed or blank prescription form
- One or more industry-recognized features designed to prevent the erasure or modification of information written on the prescription pad by the prescriber
- One or more industry-recognized features designed to prevent the use of counterfeit prescription forms

If a pharmacy receives a prescription and there are questions regarding whether the prescription meets the requirements of the act, the pharmacy staff may contact the prescriber's office for verification. The pharmacy may accept a faxed prescription from the physician's office until it has obtained tamper-resistant prescription pads. A pharmacy may fill the prescription as an emergency prescription as long as the pharmacy receives documentation from the prescriber's office within 72 hours. A prescription may be transferred from the original pharmacy to another pharmacy by fax or telephone. The second pharmacy does not need to have direct confirmation of the original prescription from the physician.

RESTRICTED DRUG PROGRAMS

CLOZARIL (CLOZAPINE) PROGRAMS

The Clozaril National Registry (CNR) was developed in response to an FDA mandate to ensure the safety of patients treated with Clozaril, which has potentially dangerous side effects, if not strictly monitored. The program includes dedicated 800 numbers for internal clients, consumers, and health care professionals to call for information, education, and patient enrollment.

The Clozaril Administration Registry Enrollment (CARE) is a secured Internet application that facilitates the reporting of white blood cell (WBC) values and absolute neutrophil counts (ANCs) of patients taking brand Clozaril (clozapine) to the CNR. CARE is designed to safeguard patient information, protect patients' privacy, and assist physicians and pharmacists with effective monitoring functionalities.

Clozaril has only been available through a strict monitoring and distribution system to detect the early onset of agranulocytosis. With proper WBC and ANC monitoring and reporting, Clozaril-induced agranulocytosis can be reversible if detected early. Prescribers and pharmacies must be registered before they can treat patients with Clozaril. CARE is designed and developed to streamline this process.

Approved generic manufacturers of clozapine have established similar programs to comply with the FDA mandate.

THALIDOMIDE

Thalidomide is indicated for multiple myeloma, and certain conditions must be adhered to by the patient. Thalidomide must not be taken by women who are pregnant or who could become pregnant while taking this medication. A single dose of thalidomide taken during pregnancy can cause severe birth defects (physical problems present in the baby at birth) or death of the unborn baby. A program called System for Thalidomide Education and Prescribing Safety (STEPS) has been approved by the FDA to make sure that pregnant women do not take thalidomide and that women do not become pregnant while taking thalidomide. All people who are prescribed thalidomide, including men and women who cannot become pregnant, must be registered with STEPS, have a thalidomide prescription from a doctor who is registered with STEPS, and have the prescription filled at a pharmacy that is registered with STEPS in order to receive this medication.

Patients must see their doctors every month during their treatment to talk about their condition and any side effects they may be experiencing. During the patient's visit, the doctor may provide a prescription for up to a 28-day supply of medication with no refills. The patient must have this prescription filled within 7 days. Blood should never be donated if a patient is taking thalidomide.

If a woman is taking thalidomide and can become pregnant, she will need to meet certain requirements during her treatment. A woman will need to meet these requirements even if she has a history of not being able to become pregnant. A woman may be excused from meeting these requirements only if she has not had a period for 24 months in a row or if she has had a hysterectomy.

A woman must use two acceptable forms of birth control for 4 weeks before beginning to take thalidomide, during treatment, and for 4 weeks after treatment. The patient's doctor will inform her about which forms of birth control are acceptable. A woman will use these two forms of birth control at all times unless she can guarantee that she will not have any sexual contact with a man for 4 weeks before, during, and for 4 weeks after treatment.

A woman must have a negative pregnancy test result within the 24 hours before beginning treatment

with thalidomide. In addition, she will also need to be tested for pregnancy in a laboratory weekly during the first 4 weeks of their treatment and then once every 4 weeks if she has regular menstrual cycles or once every 2 weeks if she has irregular menstrual cycles.

A woman should stop taking thalidomide and contact her physician immediately if she thinks she is pregnant; has a late, irregular, or missed menstrual period; experiences any change in menstrual bleeding; or has sex without using two forms of birth control. If a woman becomes pregnant during treatment, the physician is required to call the FDA and the manufacturer.

If a man is prescribed thalidomide, he must be aware that thalidomide is present in his semen and must either use a latex condom or completely avoid any sexual contact with a woman who is pregnant or may become pregnant while taking this medication and for 4 weeks after treatment. Although a man may have had a vasectomy, this is still required. The man must notify his physician immediately if he has had unprotected sex with a woman who can become pregnant or if he thinks for any reason that his partner is pregnant. A man should not donate semen or sperm while taking thalidomide.

GENERIC SUBSTITUTION

Generic substitution laws are state specific. In most states, pharmacists and pharmacy technicians cannot substitute nontherapeutic equivalent products. Some states allow substitution between products as long as state-specific criteria are met, such as having the same active ingredient, dosage form, dose, and route of administration. States may require that a generic drug will be dispensed unless the prescriber indicates otherwise through a specific designation such as "Brand Name Medically Necessary," "Dispense as Written," or "DAW" in the prescriber's own handwriting. Both pharmacists and pharmacy technicians must be familiar with their own state's regulations regarding generic substitution.

STATE-SPECIFIC PRESCRIPTION TRANSFER REGULATIONS

Technicians must be familiar with their state laws regarding the transfer of prescriptions between pharmacies. Federal law states that controlled substance prescriptions can be transferred only one time between pharmacies. Pharmacy technicians may assist the pharmacist in the transfer of prescriptions between pharmacies.

- Transferring a prescription can only occur between two licensed pharmacies, and the pharmacy possessing the original prescription must record the following information in the patient profile: date of the prescription transfer; the name, telephone number, and address of the pharmacy receiving the transferred prescription; the name of the pharmacist receiving the transferred prescription; and the number of refills remaining. "Void" must be written on the original hard copy of the prescription.
- The receiving pharmacy must indicate "Transfer" on the front of the prescription; the date it was received from the other pharmacy; the name of the pharmacist; the name, address, and telephone of the pharmacy; the original date of the original prescription; and the number of refills remaining.
- A pharmacy technician may fax a copy of a prescription to another pharmacy under the supervision of a pharmacist.

PHARMACY RECORD RETENTION

- **Biennial inventory of narcotics:** Must be maintained in the pharmacy
- **Change of pharmacist-in-charge inventory:** Must be maintained in the pharmacy
- **Controlled substance invoices:** Must be maintained in the pharmacy. Schedule II invoices should be attached to pharmacy's copy of the DEA Form 222 with the appropriate dating and signature. Schedule III to V invoices need to be stamped with a red C, dated, and signed by the individual checking the invoice. Schedule III to V invoices need to be kept separate from Schedule II invoices.
- **Exempt narcotic log:** Requires the name and address of purchaser (must be at least 18 years of age), name of product and date sold, seller's signature, and price of the product. The pharmacist must be present for any transaction involving "exempt narcotics."
- **Master formula record:** Work sheets are considered permanent records. Provides directions for compounding and uniform record keeping. Quantities and lot numbers of ingredients used; initials of the preparer and pharmacist who checked the work; and calculations performed to determine how long the compound must be kept.
- **Safety Data Sheets (SDSs):** Documentation required by OSHA; a facility must receive this sheet time every time a hazardous chemical is provided to it. Hazardous chemicals may be either physical or health hazards.
- **Medication administration record (MAR):** Provides documentation that a drug has actually been

dispensed in a hospital or long-term facility. MARs are found in hospitals and long-term care facilities.
- **Nonsterile compounded products:** All recipe information is copied and shows the step-by-step process. The following information is documented: date prepared, name of ingredients, manufacturers of ingredients, lot number and expiration date of each ingredient, amount or weight of each ingredient, dosage form of each ingredient, pharmacy lot number assigned, technician's initials, pharmacist's initials, date dispensed, patient's name, and medical record number. This information must be maintained for a minimum of 2 years.
- **Poison log:** Requires name and address of purchaser (must be at least 18 years of age), name of product and date sold, intended use, seller's signature, and price of product
- **Prescription hard copy:** On the back of the hard copy of the prescription is a copy label with the initials of the pharmacist or technician who filled the prescription. Prescriptions are filed numerically. Electronic backup copies are made at the end of the day. They must be maintained for a minimum of 2 years.
- **Repackaged medications:** All repackaged medications must be maintained on a log with the following information: date, drug, dosage form, manufacturer, manufacturer's lot number, manufacturer's expiration date, pharmacy lot number, pharmacy expiration date, technician, and pharmacist. The information must be readily retrievable.

PHARMACY STANDARDS

UNITED STATES PHARMACOPEIA <795>

United States Pharmacopeia (USP) <795> provides guidance on applying good compounding practices in the preparation of nonsterile compounded formulations for dispensing or administration to humans or animals. USP <795> was recently revised, and the chapter now includes new material; such as categories of compounding (simple, moderate, and complex), new definitions for terms (e.g., beyond-use date, hazardous drug, stability), and criteria for compounding each drug preparation (e.g., suitable compounding environment, use of appropriate equipment).

Areas addressed under USP <795> include:
- The facility
- Equipment
- Stability of the compounded preparation
- Primary packaging
- Sterility
- Stability criteria to include beyond-use dating
- Beyond-use labeling
- Ingredient selection
- Compounding nondrug requirements
- Criteria for compounding capsules, powders, lozenges, tablets, emulsions, solutions, suspensions, suppositories, cream, topical gels, ointments, and pastes
- Compounding process
- Compounding records and documents to include formulation record, compounding record, and SDS file
- Quality control
- Verification
- Patient counseling

Balances must be certified yearly by the state department of taxation.

UNITED STATES PHARMACOPEIA <797>

United States Pharmacopeia <797> is designed to cut down on infections transmitted to patients through pharmaceutical products and to better protect staff working in pharmacies in the course of their exposure to pharmaceuticals. USP <797> contains many procedural training and quality assurance requirements for preparing sterile products. USP <797> affects all health care institutions, pharmacies, physicians' practices, and other facilities in which compounded sterile preparations are prepared, stored, and dispensed.

Facilities affected by USP <797> include facilities where sterile products are prepared according to manufacturer's labeling and where manipulations are performed during the compounding of sterile products that increase the potential for microbial contamination of the end product. It affects facilities where products are compounded using devices or ingredients that are not sterile to prepare compounds that must be sterilized. These products may be biologics, diagnostic agents, drugs, nutrients, or radiopharmaceuticals that include but are not limited to baths and soaks for live organs and tissues, implants, inhalations, injections, irrigations, metered sprays, and ophthalmic and otic preparations.

United States Pharmacopeia <797> addresses the following areas:
- Microbial contamination risk levels, which are defined as low-, medium-, and high-risk conditions
- Personnel training and evaluation in aseptic manipulation skills
- Clean rooms to include anterooms, air classification, physical characteristics of the construction, and gowning procedures
- Barrier isolators
- Formalized quality assurance program
- Minimum requirements for validation

- Cleaning and sanitizing workspaces
- Environmental monitoring
- Verification of automated compounding devices for nutrition compounding

Hand Washing

- No jewelry should be worn in the hood. This includes artificial nails because of microbial growth around or underneath.
- Long hair should be tied back away from the face.
- Hands must be washed after entering the IV area and before entering the laminar flow hood.
- Hands, wrists, and arms to the elbow should be washed with antimicrobial soap and hot water for at least 30 seconds and no more than 90 seconds.

Laminar Flow Hood Maintenance Requirements

- The blower of the laminar airflow hood should be kept on at all times. If it is shut down, then it must be in operation for at least 30 minutes before use.
- The hood is wiped down with 70% isopropyl alcohol beginning with the bar followed by the sides and continuing from the area closest to the filter, working outward and wiping from the top edge of the side to the bottom.
- The bench is cleaned last by beginning from the back of the bench and wiping from side to side and moving outward.
- The laminar flow hood should be cleaned at the beginning of every shift and whenever a spill occurs. Sanitizing agents should not be sprayed because the HEPA filter may become damp and develop a hole.
- The flow hood needs to be certified every 6 months or whenever the HEPA filter becomes wet.

Laminar Hoods and HEPA Filters

These need to be certified a minimum of every 6 months or when the HEPA filter is wetted or the laminar flow hood is moved. Validation is documented evidence that provides a high degree of assurance that the process will produce a product with predetermined specifications.

INFECTION CONTROL STANDARDS

Universal precautions have established and implemented in the practice of pharmacy to reduce the likelihood of transmitting harmful pathogens. These precautions include:

- Wash hands before and after each medical procedure (may use a waterless hand cleaner).
- Wear gloves whenever there is a possibility of coming in contact with blood or other potentially infectious materials (body fluids and tissues).

SANITATION REQUIREMENTS

All pharmacies are required to have potable water for hand and equipment washing; Purified water must be available for nonsterile compounding; water for injection or sterile water for injection or bacteriostatic water for injection is required for sterile compounding. A pharmacy is required to be clean and in a sanitary condition with adequate washing facilities to include hot and cold water, soap or detergent, and air driers or single-service towels. Sewage, trash, and other refuse is to be disposed of in a safe, sanitary, and timely manner. Equipment is to be thoroughly cleaned promptly to avoid cross-contamination of ingredients and preparations. Special precautions are to be taken to clean equipment and compounding areas that contain allergenic ingredients, such as sulfonamides or penicillins.

SANITATION DOCUMENTATION

A pharmacy should have a written and implemented plan that documents periodic environmental monitoring, employee monitoring, and end product evaluation testing that complies with state BOP regulations and USP <795> and USP <797> requirements.

HANDLING AND DISPOSING OF HAZARDOUS WASTE

A hazardous drug is one that exhibits one or more of the following effects in humans or animals: carcinogenicity, teratogenicity, reproductive toxicity, organ toxicity, and genotoxicity.

- Hazardous material is one that may produce an adverse effect on a human being or the environment.
- Infectious waste includes blood, blood products and body fluids, infectious sharps waste, laboratory waste, and animal waste.
- OSHA requires that employees be protected from hazardous drugs and chemicals by using personal protective equipment that includes laboratory coats, gloves, masks, and goggles.
- Hands should be washed before and after donning gloves.
- Nonpowdered gloves should be worn when handling hazardous drugs or waste.
- Hypoallergenic gloves should be available to employees who are allergic to latex.
- Double gloving is required where the first pair of gloves is under the sleeve of the laboratory coat and the second pair of gloves covers the sleeve of the laboratory coat.
- Gloves should be changed hourly or after contamination.
- Gloves should be removed to avoid direct skin contact.

- Face and eye protection should be used whenever splashes, sprays, or aerosols of hazardous drugs could result in eye, nose, or mouth contamination.
- Spill kits must be available in areas where hazardous drugs are being prepared.
- OSHA requires that bags containing materials contaminated with hazardous drugs should be labeled "Hazardous Drug Waste."
- "Hazardous Drug Waste" bags must be thick, leakproof, and of a different color than other trash bags.
- Hazardous drug waste bags should be kept in a covered waste container that identifies it as "Hazardous Drug Waste."
- A hazardous drug waste container should be in each area where hazardous drugs are prepared and administered.
- Bag should be sealed when filled, and the covered waste container should be tightly taped.
- Sharps containers should be used for disposing used needles and breakable items such as ampules, single, and multidose vials.
- Hazardous drug waste should be stored in a secure area until it is disposed of according to EPA regulations for hazardous waste.

PROCEDURES FOR THE TREATMENT OF EXPOSURE TO HAZARDOUS SUBSTANCES

- Chemotherapy spill kits should be used for the cleanup of accidental spills of antineoplastic agents. These kits include waste disposal bags, a respirator, latex gloves, heavy utility gloves, eyeglasses, gowns, shoe covers, toweling, and sealable bags.
- The technician should know the location of the SDSs and should follow the directions on them for a particular item. After completion of the cleanup, an incident report should be filed with the supervisor.
- If a hazardous substance comes in contact with the skin, it must be washed immediately with soap and water for at least 5 minutes. If a substance comes in contact with the eyes, they should be rinsed for 15 minutes. This can be done at the eyewash station.

STORAGE AND HANDLING REQUIREMENTS FOR HAZARDOUS SUBSTANCES

- **Chemotherapeutic agents** and cytotoxic materials must be prepared in a biologic safety cabinet or vertical flow hood and placed in bags identifying them as such. The preparer should wear a gown, goggles, and two pairs of gloves to protect him or her from possible contamination. A 4- × 4-inch piece of gauze should be kept inside the hood in case of a spill. A preparer should know the location of the cleanup kit. Refer to OSHA guidelines regarding the storage and handling of chemotherapeutic agents.
- **Hazardous substances** include syringes, needles, and toxic medications. Used needles and syringes should be placed in a red plastic sharps container to be autoclaved and disposed of. Toxic substances (e.g., chemotherapeutic agents) should be placed in a red biohazard bag to be picked up by the appropriate authorities for destruction. Refer to OSHA guidelines regarding the storage and handling of hazardous substances.

NATIONAL REGULATORY COMMISSION REGULATIONS AND STANDARDS

Nuclear pharmacy is a specialized pharmaceutical care service that has been defined as a patient-oriented service that embodies the scientific knowledge and professional judgment required to improve and promote health through assurance of the safe and efficacious use of radioactive drugs for diagnosis and therapy.

A nuclear pharmacy has designated rooms to perform the following specific functions:

- **Breakdown room:** Area where empty or used radiopharmaceuticals are returned and dismantled for reuse
- **Order entry area:** Area where prescription orders for radiopharmaceuticals are entered
- **Compounding area:** Compounding or dispensing area
- **Quality-control area:** Quality assurance tests are performed before delivery.
- **Packaging area:** Finished product is packaged for delivery.
- **Storage and disposal area:** Storage area for radioactive waste
- **Requires special equipment:** Fume box, glove box, dose calibrator, Geiger-Müller counter, dosimeter, lead-lined refrigerator and freezer, lead-lined storage boxes, autoclave, heating equipment, testing equipment, centrifuge, lead barrier shield, stainless steel sink, shower, and respirator

Standards have been established in the following areas:

- Procurement
- Compounding
- Quality assurance
- Dispensing
- Distribution
- Health and safety

- Provision of information and consultation
- Monitoring patient outcome
- Research and development

The Nuclear Regulatory Commission (NRC) controls the use and disposal of radioactive materials and the safety of the employees and the public. Any pharmacy that deals with radioactive compounds must possess the following:

- A license from the NRC
- A traditional pharmacy license issued by the state BOP
- A nuclear pharmacist in charge
- A list of personnel who have met specialized requirements for training and experience to handle radioactive materials
- Detailed floor plans that have been approved by the NRC
- A separate area for radiation storage and decay
- Maintenance of strict records for the receipt, storage, compounding, disposal, and transport for radioactive material
- Compounding records
- Radiopharmaceutical unit-dose dispensing
- Regularly monitored for external radiation exposure and contamination
- Compounding areas surveyed daily
- Storage areas surveyed weekly
- Exposure limits for personnel
- Radiopharmaceutical labeling
- Posting of radiation caution signs
- Radioactive spills
- Radiopharmaceutical errors

FACILITY, EQUIPMENT, AND SUPPLY REQUIREMENTS

FACILITIES

State BOPs require a minimum amount of counter space in a pharmacy, an alarm system to be activated when the pharmacy is not open, separate refrigerators for refrigerated medications and controlled substances (must be lockable), a safe for Schedule II medications, and a sink with hot and cold water. Areas designated for compounding have adequate space for the orderly placement of equipment and materials to prevent mix-ups between ingredients, labels, in-process materials, and finished materials. The compounding area is designed, arranged, used, and maintained to prevent cross-contamination. Areas used for sterile preparation are to be separated and distinct from nonsterile compounding. The area is to be well lighted. Heating, ventilation, and air conditioning systems must be controlled to avoid decomposition. The pharmacy must be kept clean and uncluttered.

EQUIPMENT

Equipment is to be of appropriate design and size for compounding and suitable for the intended purposes. The types and sizes of equipment depend on the dosage forms and quantities compounded. Prescription balances may be class A, micro-, semimicro-, or single-pan balances. Pharmacy weights include both metric and apothecary weights. Other pharmacy equipment includes graduated cylinders for reconstitution, various mortars and pestles for mixing, spatulas, and stirring rods. Laminar airflow hoods are required for preparing IV preparations and chemotherapy agents.

DRUG STORAGE

All Schedule II forms must be stored in a locked safe (either combination or key lock). Schedule III to V medications may be dispersed throughout the pharmacy with the other medications. Refrigerated medication must be stored in a refrigerator.

PRESCRIPTION STORAGE

Prescriptions, biennial inventories, invoices, and Forms 222 and 41 must be readily retrievable (able to be produced within 72 hours of the request). Prescriptions may be filed either by separating the Schedule II, Schedule III to V, and noncontrolled prescriptions or by filing the Schedule II to V prescriptions separately from prescriptions for nonscheduled drugs.

PHARMACY RESOURCES

PRINTED REFERENCE MATERIALS

Required resources include the Federal Controlled Substances Act, USP and National Formulary, and other texts (statutes) required by the state BOP. Examples of reference books that may be found in a pharmacy library include the following:

- *American Drug Index,* St. Louis: Facts and Comparisons. This standard reference work contains more than 20,000 entries on drugs and drug products, including alphabetically listed drug names, cross-indexing, phonetic pronunciations, brand names, manufacturers, generic or chemical names, composition and strength, pharmaceutical forms available, package size, use, and common abbreviations. It also contains a listing of orphan drugs. The work is available in hardbound and CD-ROM editions. www.factsandcomparisons.com
- *American Hospital Formulary Service Drug Information,* Bethesda, MD: American Society of Health-System Pharmacists. The complete text of roughly 1400 monographs covering about 50,000 commercially

available and experimental drugs, including information on uses, interactions, pharmacokinetics, dosage, and administration. www.ashp.org

- Ansel HC, Allen LV, Popovich NG. *Pharmaceutical Dosage Forms and Drug Delivery Systems,* Baltimore: Williams & Wilkins. A superb survey of contemporary dosage forms and delivery systems. www.lww.com
- *Drug Facts and Comparisons,* St. Louis: Facts and Comparisons. This comprehensive source of information about 16,000 prescription and 6000 OTC drugs contains monographs about individual drugs and groups of related drugs; product listings in table format providing information on dosage forms and strength, distributor names, costs, package sizes, product identification codes, flavors, colors, and distribution status; and information on therapeutic uses, interactions, and adverse reactions. The publication includes an index of manufacturers and distributors and controlled substance regulations. This reference work is available in hardbound form, on CD-ROM, or in a loose-leaf form that is updated monthly. www.factsandcomparisons.com
- *Drug Information Fulltext,* Norwood, MA: Silverplatter. A searchable computer database combining two publications, the *American Hospital Formulary Service Drug Information* and the *Handbook on Injectable Drugs.* This database is available on hard disk, on CD-ROM, or the Internet. www.silverplatter.com
- *Drug Interaction Facts,* St. Louis: Facts and Comparisons. This reference, available as a hardbound book, CD-ROM, or loose-leaf book that is updated quarterly, provides comprehensive information on potential interactions that can be reviewed by drug class, generic drug name, or trade name. Provides information on drug–drug and drug–food interactions. www.factsandcomparisons.com
- FDA: *Approved Drug Products with Therapeutic Equivalence Evaluations,* Washington, DC: U.S. Government Printing Office. Revised annually, with monthly updates, this source lists drug products approved for use in the United States. Also known as the *Orange Book* because of its orange-colored cover, it is available online at www.fda.gov/cder/ob/default.htm.
- *Goodman and Gilman's the Pharmacological Basis of Therapeutics,* New York: McGraw-Hill. An authoritative text on pharmacology and therapeutics containing 67 articles by leading experts in the field. This text provides information for pharmacists to help them answer clinical questions about how drugs work under different conditions in the body. www.pbg.mcgraw-hill.com
- *Index Nominum,* Geneva: Swiss Pharmaceutical Society. A compilation of synonyms, formulas, and therapeutic classes of more than 7000 drugs and 28,000 proprietary preparations from 27 countries. Available in text and CD-ROM formats.
- *The International Pharmacopeia,* New York: World Health Organization. Recommended production methods and specifications for drugs, in four volumes. www.who.ch
- Koda-Kimble M, Young LY. *Applied Therapeutics: The Clinical Use of Drugs*. Vancouver, WA: Applied Therapeutics.
- *Patient Drug Facts: Professionals Guide to Patient Drug Facts,* St. Louis: Facts and Comparisons. Comprehensive guide to patient counseling about drugs, available in loose-leaf format for verbal patient counseling and in PC format (on disk) for creation of patient handouts. www. factsandcomparisons.com
- *Physicians' Desk Reference*. Oradell, NJ: Medical Economics. Available in hardbound and CD-ROM form with two supplements published twice a year, this standard reference work contains information from package inserts for more than 4000 prescription drugs, as well as information on 250 drug manufacturers. www.medec.com
- Stringer JL. *Basic Concepts in Pharmacology: A Student's Survival Guide.* New York: McGraw-Hill. Survey of basic pharmacologic concepts for students. www.pbg.mcgraw-hill.com
- USP and the National Formulary, Rockville, MD, *United States Pharmacopeial Convention.* Combined compendium of monographs setting official national standards for drug substances and dosage forms (USP) and standards for pharmaceutical ingredients (National Formulary). Available in book or CD-ROM form and in English- and Spanish-language editions. www.usp.org
- *USP Dictionary of USAN and International Drug Names,* Rockville: MD, United States Pharmacopeial Convention. An authoritative guide to drug names, including chemical names, brand names, manufacturers, molecular formulas, therapeutic uses, and chemical structures. www.usp.org
- Benitz WE, Tatro DS. *The Pediatric Drug Handbook.* St. Louis: Mosby. Information on drugs, dosage forms, and administration for pediatric patients. www.mosby.com
- Davies DM. *Textbook of Adverse Drug Reactions,* New York: Oxford University Press. A standard textbook on the subject. www.oup-usa.org
- *Goldfrank's Toxicologic Emergencies,* New York: Appleton & Lange. Information on treating toxicologic emergencies. The medical titles of Appleton & Lange are distributed by McGraw-Hill and may be found at that website. www.pbg.mcgraw-hill.com

- *Handbook of Nonprescription Drugs,* Washington, DC: American Pharmaceutical Association. A reference work on OTC medications. www.aphanet.org
- Hunt ML Jr. *Training Manual for Intravenous Admixture Personnel.* Chicago: Bonus Books. A manual for training people to create parenteral preparations. www.bonus-books.com
- *The King Guide to Parenteral Admixtures,* Napa, CA: King Guide Publications. Available in four loose-leaf volumes, on microfiche, and on CD-ROM, the *King Guide* provides 350 monographs on compatibility and stability information critical to determining the advisability of preparing admixtures of drugs for parenteral administration. The guide is updated quarterly. www.kingguide.com
- Nahata MC, Hipple TF. *Pediatric Drug Formulations.* Cincinnati: Harvey Whitney. Information on formulation and compounding of drugs for pediatric patients. *hwb@eos.net*
- *Poisindex System,* Englewood, CO: Micromedex. A computerized poison information system. www.mdx.com
- *Remington The Science and Practice of Pharmacology.* Philadelphia: Lippincott. The compounding "bible" of the pharmacy profession.
- Stoklosa MJ, Ansel HC. *Pharmaceutical Calculations,* Baltimore: Williams & Wilkins. A clear, concise, thorough introduction to pharmaceutical mathematics. www.lww.com
- Trissel LA. *Handbook on Injectable Drugs, with Supplement.* Bethesda, MD: American Society of Health-System Pharmacists. Provides information on stability and compatibility of injectable drug products, including formulations, concentrations, and pH values. www.ashp.org
- *Understanding and Preventing Errors in Medication Orders and Prescription Writing,* Bethesda, MD: United States Pharmacopeial Convention. An education resource consisting of lecture materials, videotapes, and 35-mm slides describing medication errors that arise from poorly written orders and prescriptions, using examples of actual reports received through the USP Medication Errors Reporting Program. Contains recommendations for preventing errors. www.usp.org (search within USP Educational Programs)

ELECTRONIC PHARMACY REFERENCES

- DEA.gov
- FDA.gov
  - Drug Recalls
  - Orange Book-Approved Drug Products with Therapeutic Equivalence
  - MEDWATCH
- OSHA.gov
- USP.org
- ISMP.org
- Pharmacist.com
- ASHP.org
- Facts and Comparisons.com
- PDR.net

PHARMACY JOURNALS OF SPECIFIC PHARMACY ORGANIZATIONS

- *AACP: American Journal of Pharmaceutical Education*
- *AAPS: Pharmaceutical Research*
- *AMCP: Journal of Managed Care Pharmacy*
- *AJHP: American Journal of Health System Pharmacists*
- *APhA: Journal of American Pharmacists Association; Pharmacy Today*
- *ASCP: The Consultant Pharmacist*
- *CRS: Journal of Controlled Release*
- *ISMP: ISMP Medication Safety Alerts Newsletter*
- *NCPA: America's Pharmacist*
- *NPTA: Today's Technician*

PHARMACY MAGAZINES

- *Chain Drug Store News*
- *Drug Topics*
- *Hospital Pharmacy*
- *Journal of Managed Care Pharmacy*
- *Pharmacy Times*
- *The Script*
- *U.S. Pharmacist*

REGULATORY AGENCIES

CENTERS FOR MEDICARE AND MEDICAID SERVICES

- Oversees Medicare and Medicaid
- Establishes conditions for a facility to be reimbursed for services rendered

DEPARTMENT OF TRANSPORTATION

- Regulates the shipment of hazardous materials that includes radioactive materials
- Controls the packaging, labeling, and transportation of radioactive materials

DRUG ENFORCEMENT AGENCY

- Enforces compliance with the Controlled Substances Act
- Places medications into the appropriate schedule
- Monitors records and reports of controlled substances
- Registers pharmacies
- Issues DEA Forms 222 and 41
- Monitors the destruction of controlled substances

ENVIRONMENTAL PROTECTION AGENCY

- Sets guidelines for the disposal of hazardous waste (includes disposal of controlled substances)

FOOD AND DRUG ADMINISTRATION

- Ensures that all pharmaceutical products are pure, safe, and effective
- Reviews information supplied on MedWatch Forms
- Issues drug recalls if product is adulterated or misbranded and has not been removed by the drug manufacturer
  - **Class I recall:** A situation in which there is a reasonable probability that the use of or exposure to a violative product will cause serious adverse health consequences or death
  - **Class II recall:** A situation in which use of or exposure to a violative product may cause temporary or medically reversible adverse health consequences or in which the probability of serious adverse health consequences is remote
  - **Class III recall:** A situation in which use of or exposure to a violative product is not likely to cause adverse health consequences

The FDA performs postrecall audits to verify that manufacturers, wholesalers, pharmacists, and customers have been notified and appropriate action has occurred.

- Regulates the distribution of patient package inserts and the repackaging of medications
- Reviews new drug applications and investigational new drug applications
- Establishes "Medicine Take Back Programs" in communities

INSTITUTIONAL REVIEW BOARD

- A board, committee, or other group designated by an institution to approve biomedical research in accordance with the FDA

THE JOINT COMMISSION

- The Joint Commission (TJC), formerly known as the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), addresses quality of patient care and patient safety
- Establishes standards and accredits the following health care providers: hospitals, home health care agencies, home infusion providers, long-term care pharmacies, ambulatory infusion pharmacies, home medical equipment and home oxygen providers, ambulatory surgical centers, community health centers, college and prison health care centers, nursing homes and subacute facilities, assisted living facilities, clinical laboratories, behavioral health organizations, alcohol and chemical dependency centers, health care networks, and preferred provider organizations
- TJC has been granted "deemed status" for participation in Medicare. This status states that the institution has met the Medicare Conditions of Participation and can receive Medicare funding. The institution does not need to meet requirements for annual Medicare surveys by state inspectors.

NATIONAL ASSOCIATION OF THE BOARDS OF PHARMACY

- Composed of all state Boards of Pharmacy (BOPs)
- No regulatory authority but meets to discuss current trends and issues in pharmacy that affect the practice of pharmacy

STATE BOARDS OF PHARMACY

- Regulatory state agency that oversees the practice of pharmacy in a given state
- Define regulations affecting pharmacy and the roles, duties, and expectations of pharmacists and pharmacy technicians in that state
- Establish criteria for continuing education for both pharmacists and pharmacy technicians to remain credentialed for their profession
- Have the authority to discipline pharmacies, pharmacists, and possibly pharmacy technicians for improper behavior

UNITED STATES PHARMACOPEIA

- The USP is an official public standards-setting authority for all prescription and OTC medicines and other health care products manufactured or sold in the United States.
- Establishes standards for food ingredients and dietary supplements
- Creates standards for the quality, purity, strength, and consistency of these products; critical to public health. USP's standards are recognized and used in more than 130 countries around the globe.

EMPLOYEE PERFORMANCE EVALUATION TECHNIQUES

- **Performance appraisal:** A process of systematically evaluating performance and providing feedback on which performance adjustments can be made. Performance appraisals define specific job criteria against which performance will be measured, measure past job performance accurately, justify rewards given to individuals and groups, and define the developmental experiences employees need to enhance their performance in the current job and to prepare for future responsibilities.

- **Activity measures:** A rating system based on an evaluator's observation and rating
- **Ranking:** A comparative technique of performance appraisal that involves rank ordering of each individual from best to worst on each performance dimension
- **Paired comparison:** A comparative method of performance appraisal whereby each person is directly compared with every other person
- **Forced distribution:** A method of performance appraisal that uses a small number of performance categories, such as "very good," "good," "adequate," and "very poor," and forces a certain proportion of people into each
- **Graphic rating scales:** A scale that lists a variety of dimensions thought to be related to high performance outcomes in a given job and that the individual is expected to exhibit
- **Critical incident diary:** A method of performance appraisal that records incidents of unusual success or failure in a given performance aspect
- **Behaviorally anchored rating scales:** A performance appraisal approach that describes observable job behaviors, each of which is evaluated to determine good versus bad performance
- **Management by objective:** A process of joint goal setting between a supervisor and a subordinate
- **360 evaluations:** A comprehensive approach that uses self-ratings, customer ratings, and others outside the workforce

EMPLOYEE PERFORMANCE FEEDBACK TECHNIQUES

Feedback is the process through which the receiver communicates with the sender by returning another message. Suggestions for giving constructive feedback include the following:

- Give feedback directly and in a spirit of mutual trust.
- Be specific.
- Give feedback when receiver is most ready to accept it.
- Be accurate; check validity with others.
- Focus on things the receiver can control.
- Limit how much the receiver gets at one time.

CHAPTER 2 REVIEW QUESTIONS

1. What do the middle four numbers represent in an NDC number?
   a. Drug manufacturer
   b. Drug product
   c. Drug packaging
   d. None of the above

2. A pharmacist fails to place a prescription label on the medication container. Which law is being broken?
   a. Pure Food and Drug Act of 1906
   b. Food, Drug, and Cosmetic Act of 1938
   c. Durham-Humphrey Act of 1950
   d. Kefauver-Harris Act of 1962

3. An employee injures his back while lifting a carton of medication in the pharmacy. What law allows the employee to collect damages from the employer?
   a. Kefauver-Harris Act of 1962
   b. Occupational Safety and Health Act of 1970
   c. Omnibus Budget Reconciliation Act of 1987
   d. Poison Prevention Act of 1970

4. A patient requests that the pharmacist place his medication in an easy-open container. Which law allows the pharmacist to dispense the prescription in this manner?
   a. Kefauver-Harris Act of 1962
   b. Controlled Substances Act of 1970
   c. Occupational Safety and Health Act of 1970
   d. Poison Prevention Act of 1970

5. A pharmacist prepares a prescription with a mortar and pestle that have been contaminated by an antineoplastic agent and dispenses the prescription to a patient. Which law is he violating?
   a. Pure Food and Drug Act of 1906
   b. Food, Drug, and Cosmetic Act of 1938
   c. Durham-Humphrey Act of 1950
   d. Kefauver-Harris Act of 1962

6. Which law allows a pharmacist to accept a telephoned prescription from a physician's office?
   a. Pure Food and Drug Act of 1906
   b. Food, Drug, and Cosmetic Act of 1938
   c. Durham-Humphrey Act of 1950
   d. Kefauver-Harris Act of 1962

7. Which law allows a pharmacist to dispense nitroglycerin tablets in a non–child-resistant container?
   a. Durham-Humphrey Act of 1950
   b. Kefauver-Harris Act of 1962
   c. Controlled Substances Act
   d. Poison Control Act

8. Which law resulted in clearly distinguishing an over-the-counter medication from a prescription medication?
   a. Pure Food and Drug Act of 1906
   b. Food, Drug, and Cosmetic Act of 1938
   c. Durham-Humphrey Act of 1950
   d. Kefauver-Harris Act of 1962

9. Which law required that the federal legend appear on all prescriptions?
   a. Pure Food and Drug Act of 1906
   b. Food, Drug, and Cosmetic Act of 1938
   c. Durham-Humphrey Act of 1950
   d. Kefauver-Harris Act of 1962

10. For how long is a DEA Form 222 valid?
    a. 1 week
    b. 1 month
    c. 60 days
    d. 6 months

11. Which law requires that a manufacturer provide Safety Data Sheets (SDS—formerly known as MSDS) to a pharmacy for products that are combustible, are flammable or can cause injury to an individual if he or she comes in contact with the substance?
    a. Kefauver-Harris Act of 1962
    b. Controlled Substances Act of 1970
    c. Occupational Safety and Health Act of 1970
    d. Poison Prevention Act of 1970

12. A pharmacist receives a prescription for 40 Percocet tablets, but the pharmacy has only 15 tablets in stock. The patient accepts the 15 tablets. How much time does the pharmacist have to provide the remaining 25 tablets?
    a. 24 hours
    b. 72 hours
    c. 96 hours
    d. 6 months

13. If a patient requests a partial filling of her Tylenol with codeine #3 prescription, what can the pharmacist do for the patient?
    a. The pharmacist may provide the patient with the requested amount and places the remaining tablets in a bottle for the patient to pick up at a later date.
    b. The pharmacist may provide the patient with the requested amount and informs her that she must pick up the remaining quantity within 72 hours.
    c. The pharmacist may provide the patient with the requested amount and informs her that she must pick up the remaining quantity within 6 months of the date on which the prescription was filled.
    d. The pharmacist may provide the patient with the requested amount but can give her the balance only if there is a refill indicated on the prescription.

14. Which of the following is a correct DEA number for a Dr. Andrea J. Shedlock, who was Dr. Andrea Costello when she requested her DEA number before she was married?
    a. AC1234563
    b. AS1234563
    c. JC1234563
    d. JS1234563

15. You are working for a chain pharmacy, and another member of the chain has run out of DEA Form 222s. They ask to borrow one of your DEA Form 222s. What would you do?
    a. Because you are members of the same pharmacy chain, you are allowed to let them use yours because you have the same DEA number.
    b. Give them one of your DEA Form 222s with the agreement that they will replace it after they receive their new ones.
    c. DEA Form 222s are for a specific pharmacy and can be used only by the pharmacy to which they were issued.
    d. Tell them to place an emergency order with the wholesaler and that you will provide them with a properly completed DEA Form 222 in 72 hours.

16. You receive a request from another pharmacy for 100 Percocet tablets. What do you do?
    a. You may loan them the requested 100 tablets of Percocet.
    b. You may sell them the 100 tablets of Percocet at the AWP.
    c. You may transfer to them the 100 tablets of Percocet through the use of a DEA Form 222.
    d. None of the above can be done.

17. What form is used to report the theft of controlled substances?
    a. DEA Form 41
    b. DEA Form 106
    c. DEA Form 222
    d. DEA Form 224

18. Which of the following is part of HIPAA?
    a. Allows a member of a plan to select any pharmacy for his or her pharmacy benefit as long as the pharmacy agrees to the terms and conditions of the plan
    b. Allows Rx to appear on a prescription instead of the federal legend
    c. Insurance reform
    d. Prohibits a prescription drug plan from requiring mail order prescription drug coverage without providing non–mail order coverage

19. Which organization oversees Medicare and Medicaid service?
    a. BOP
    b. CMS
    c. DEA
    d. TJC

20. Who reviews INDs?
    a. BOP
    b. DEA
    c. EPA
    d. FDA

21. Which law required opium to have a prescription?
    a. Comprehensive Drug Abuse Prevention and Control Act of 1970
    b. Federal Food and Drug Act of 1906
    c. Food, Drug, and Cosmetic Act of 1938
    d. Harrison Narcotic Act of 1914

22. Which law required that all narcotics be labeled "Warning: May Be Habit Forming"?
    a. Anabolic Steroid Control Act of 2004
    b. Comprehensive Drug Abuse Prevention and Control Act of 1938
    c. Harrison Narcotic Act of 1914
    d. Prescription Drug Marketing Act of 1987

23. Which law requires drug utilization evaluation to be performed on all prescriptions?
    a. Dietary Supplement Health and Education Act of 1994
    b. Omnibus Reconciliation Act of 1987
    c. Omnibus Reconciliation Act of 1990
    d. Prescription Drug Equity Law

24. Which law allowed pharmacists to take prescriptions over the telephone from a physician's office?
    a. Durham-Humphrey Act of 1950
    b. Food, Drug, and Cosmetic Act of 1938
    c. Kefauver-Harris Act of 1962
    d. Comprehensive Drug Abuse Prevention and Control Act of 1970

25. Which law established tax-free savings accounts?
    a. Freedom of Choice Law
    b. HIPAA of 1996
    c. Medicare Drug Improvement and Modernization Act of 2003
    d. Omnibus Budget Reconciliation Act of 1990

26. Which law stated that a resident's drug regimen must be free of unnecessary medications?
    a. Freedom of Choice Law
    b. HIPAA of 1996
    c. Omnibus Reconciliation Act of 1987
    d. Omnibus Reconciliation Act of 1990

27. Which law allows nasal inhalers to be dispensed without a child-resistant container?
    a. Americans with Disabilities Act
    b. Freedom of Choice Law
    c. Occupational Health and Safety Act of 1970
    d. Poison Control Act of 1970

28. Which law lowers the reimbursement rate for durable medical equipment?
    a. Drug Price Competition and Patent Term Restoration Act
    b. FDA Safe Medical Devices Act of 1990
    c. HIPAA
    d. Medicare Drug Improvement and Modernization Act of 2003

29. Which law prevents reimportation of medication into the United States other than by a manufacturer?
    a. Drug Listing Act of 1972
    b. Drug Price Competition and Patent Term Restoration Act of 1984
    c. Food, Drug, and Cosmetic Act of 1938
    d. Prescription Drug Marketing Act of 1987

30. Which agency oversees the practice of pharmacy?
    a. APhA
    b. DEA
    c. FDA
    d. State BOP

31. What classification of drug recall will cause serious adverse health consequences or death?
    a. Class I
    b. Class II
    c. Class III
    d. Class IV

32. Which agency regulates the dispensing of radiopharmaceuticals?
    a. DEA
    b. FDA
    c. NABP
    d. NRC

33. Which of the following addresses nonsterile compounding?
    a. ISO 9000
    b. <USP 790>
    c. <USP 795>
    d. <USP 797>

34. Which organization determines the regulations affecting generic substitution in state?
    a. BOP
    b. DEA
    c. FDA
    d. NABP

35. What is the maximum amount of pseudoephedrine base that may be purchased in 1 day?
    a. 2.4 g
    b. 3.6 g
    c. 9 g
    d. 10 g

36. What is the first consideration of a pharmacy technician?
    a. Assist and support the pharmacist in the safe, efficacious, and cost effective distribution of health services.
    b. Ensure patients' health and safety.
    c. Maintain professional competency.
    d. Promote honesty and integrity within the profession.

37. Which of the following is required to be found on a manufacturer's drug label?
    a. Control number
    b. Expiration date
    c. NDC number
    d. All of the above

38. How long is a pharmacy's DEA permit valid?
    a. 1 year
    b. 2 years
    c. 3 years
    d. 4 years

39. Which of the following is not found on a OTC drug label?
    a. Beyond-use-date
    b. Do not use for the following contraindications
    c. Use(s)
    d. Warnings

40. Which of the following might indicate that you have received a forged prescription for a controlled substance?
    a. No abbreviations are found on the prescription
    b. Prescription appears photocopied
    c. Quantity, directions, or dosage differs from the usual medical usage
    d. All of the above

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Chapter 3

Sterile and Nonsterile Compounding

Chapter Objectives

Upon completion of Chapter 3, the pharmacy technician student will be able to

1. Perform the necessary calculations needed to compound sterile and nonsterile products.
2. List factors that can affect a drug's stability and differentiate between an expiration date and beyond-use date.
3. Identify the various pharmacy dosage forms, characteristics, and routes of administration.
4. Explain nonsterile compounding, including:
   - Identify and explain the uses of the various equipment in nonsterile compounding.
   - Define the techniques used in nonsterile compounding.
   - List the steps used in the preparation of nonsterile compounds.
5. Do the following regarding sterile compounding:
   - Identify standard operating procedures under United States Pharmacopeia <797>.
   - Identify and explain the uses of the various equipment used in sterile compounding.
   - Identify the various types and uses of laminar airflow workbenches in sterile compounding.
   - List the steps used in the preparation of sterile compounds.
6. Describe infection control measures and processes.
7. Explain the handling and disposal of hazardous materials.

PTCB Knowledge Domains	
1.0	Pharmacology for technicians
3.0	Sterile and nonsterile compounding
3.1	Infection control (e.g., hand washing, PPE)
3.2	Handling and disposal requirements (e.g., receptacles, waste streams)
3.4	Determine product stability (e.g., beyond-use dating, signs of incompatibility)
3.5	Selection and use of equipment and supplies
3.6	Sterile compounding processes
3.7	Nonsterile compounding processes
6.0	Medication order entry and fill process

ExCPT Knowledge Domains	
3.3.1	Conversions/Systems of measurement used in pharmacy
3.3.2	Calculating the amounts of prescription ingredients
3.3.3	Calculating quantity or days supplied to be dispensed
3.3.4	Calculating individual and daily doses
3.3.5	Calculations used in compounding
3.3.6	Calculating dosages and administration rates
3.4.4	Aseptic technique and the use of laminar flow hoods

PHARMACY CALCULATIONS

ROMAN NUMERALS

Many doctors continue to use Roman numerals when writing quantities in a prescription or directions to the pharmacist. It is imperative that the pharmacy technician be able to correctly interpret these numerals in a prescription. Listed below are the more commonly used Roman numerals.

SS or $\overline{ss}$ = 1/2

I or i = 1

V or v = 5
X or x = 10
L or l = 50
C or c = 100
D or d = 500
M or m = 1000

Rules for Interpreting Roman Numerals

1. When a smaller numeral is repeated or follows a larger numeral, the numbers are added. For example:

$$iii = 1 + 1 + 1 = 3$$
$$vii = 5 + 1 + 1 = 7$$
$$xvi = 10 + 5 + 1 = 16$$

2. If a smaller numeral precedes a larger numeral, the smaller numeral is subtracted from the larger numeral. The smaller numeral in front of the larger number must not be smaller than one tenth of the larger numeral. For example:

$$iv = 5 - 1 = 4$$
$$ix = 10 - 1 = 9$$

3. Numerals are never repeated more than three times (e.g., iii = 3, XXX = 30); 4 should be written iv, not iiii; 40 should be written XL instead of XXXX.
4. If a smaller numeral is between two larger numerals, the smaller numeral is subtracted from the numeral following it. For example:

$$XIV = 10 + (5 - 1) = 14$$
$$XXIX = 10 + 10 + (10 - 1) = 29$$

RATIOS AND PROPORTIONS

A ratio is a relationship between two parts of a whole or between one part and the whole. An example of a ratio a pharmacy technician will encounter is 5 mg/mL or 5 mg/tsp. A ratio can be written either as 1/2 or 1:2. A proportion is a relationship between two ratios. A proportion may be written as 1/2 = 2/4 or 1:2::2:4. An example of a pharmacy proportion is 10 mg/1 mL = 50 mg/5 mL. A ratio can be converted to either a fraction or decimal. The majority of all pharmaceutical calculations performed in either retail or institutional settings can be accomplished by using proportions.

There are two ways to solve proportion problems. The first involves cross-multiplying and dividing. The second method is described as the mean and extremes. Both methods will yield the same answer if set up correctly. Solve the following problem using both methods, where X is the value we are seeking.

$$\frac{4}{7} = \frac{X}{28}$$

Method 1: Cross-multiply and divide

$$\frac{4}{7} = \frac{X}{28}$$

Multiply the numerator on the left side of the equation by the denominator on the right side ($4 \times 28 = 112$).

Multiply the denominator on the left side of the equation by the numerator on the right side of the equation ($7 \times X = 7X$).

Divide both sides of the equation by the side where a number is represented by a number multiplied by X. For example:

$$\frac{112}{7} = \frac{7X}{7}$$
$$16 = X$$

Always make sure that units in the numerator correspond and the units in the denominator are the same. If they are not, the likelihood of an incorrect answer increases.

Method 2: Means and extremes

4:7::X:28, where the first and last numbers in the series are considered the extremes and the two numbers in the middle are considered the means. In this situation, the 4 and the 28 represent the extremes and the 7 and X represent the means. Multiply the extremes (4×28) and then multiply the means ($7 \times X$).

$$4 \times 28 = 7X$$
$$112 = 7X$$

Divide both sides of the equation by the side where a number is represented by a number multiplied by X.

$$\frac{112}{7} = \frac{7X}{7}$$
$$16 = X$$

Always make sure the units in the first and third positions are the same and the units in the second and fourth position are the same. If they are not, the answer may be wrong.

DIMENSIONAL ANALYSIS

This is a mathematical method of manipulating units or the dimension given to numbers to cancel out unwanted units in conversion of unit equivalency. When using dimensional analysis, keep in mind the following:

- It is used when working with two quantities that are proportional to each other or that can be converted to find the proportional amounts.
- Use common equivalencies or conversion factors to find the proportional amounts.
- Express the equation as a fractional amounts.

- Cross out unwanted units before finding the products of the numerator and denominator.

METRIC–HOUSEHOLD–APOTHECARY CONVERSION

The practice of pharmacy uses the metric system, the household system, and the apothecary system. The metric system is the official system of measurement both in the United States and internationally. Pharmacy technicians must be able to calculate doses of medication in any of these systems and to convert them from one system to another system. It is essential that technicians memorize the basic conversions.

Metric

Prefixes Used in the Metric System

Nano-: One billionth of the basic unit (meter, gram, or liter)
Micro-: One millionth of the basic unit
Milli-: One thousandth of the basic unit
Centi-: One hundredth of the basic unit
Deci-: One tenth of the basic unit
Deka-: 10 times the basic unit
Hecto-: 100 times the basic unit
Kilo-: 1000 times the basic unit

Metric

Length (meter): The meter is the basic unit of measurement of length in the metric system. Other commonly used measurements in the practice of pharmacy are the millimeter (mm), centimeter (cm), and meter (m).

1000 millimeters (mm) = 100 centimeters (cm)
100 centimeters (cm) = 1 meter (m)

Weight (gram): The gram is the basic unit of measurement of weight in the metric system. Other commonly used measurements in the practice of pharmacy are microgram (mcg), milligram (mg), gram (g), and kilogram (kg).

1000 micrograms (mcg) = 1 milligram (mg)
1000 milligrams (mg) = 1 gram (g)
1000 grams (g) = 1 kilogram (kg)

Volume (liter): The liter is the basic unit of measurement of volume in the metric system. In addition to the liter, the milliliter is commonly used in the practice of pharmacy.

1000 milliliters (mL) = 1 liter (L)

Household System

Weight

2.2 lb = 1 kg

Volume

5 mL = 1 teaspoon (tsp)
15 mL = 3 tsp = 1 tablespoon (tbsp)
2 tbsp = 1 fluid ounce (fl oz)
8 fl oz = 1 cup
2 cups = 1 pint (pt)
2 pt = 1 quart (qt)
4 qt = 1 gallon (gal)

Apothecary System

Weight

20 grains (gr) = 1 scruple (℈)
3 scruples = 1 dram (ʒ)
8 drams = 1 ounce
12 ounces = 1 pound

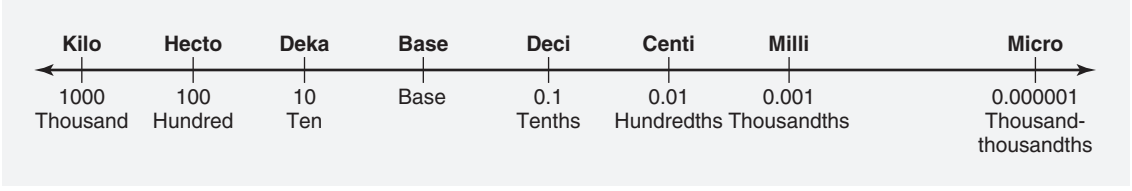
Volume

60 minims (♏) = 1 fluid dram (fl ʒ)
8 fluid drams (fl ʒ) = 1 fl oz (ȝ)
16 fl oz = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon

Apothecary-Metric System

16.23 minims (♏) = 1 mL
1 fl dram = 5 mL
1 fl oz = 29.57 mL (30 mL)*
1 pt = 473 mL (480 mL)*
1 gal = 3784 mL (3840 mL)*
1 g = 15.432 gr
1 gr = 60 or 65 mg†
1 lb (avoirdupois) = 454 g
1 oz (apothecary) = 31.1 g
1 oz (avoirdupois) = 28.35 g

*Approximate value.
†A grain may be either 60 or 65 mg.



UNITS AND MILLIEQUIVALENTS

Several pharmaceutical products made from biologic products are expressed as "units" or International Units. Examples include insulin, heparin, and vitamin E. Units represent an amount of activity within a particular system. Units represent a concentration and may be expressed as units/tablet or units/mL.

A milliequivalent (mEq) is the amount of active ingredients of a chemical element (compound) equal to 1/1000 of a gram equivalent weight of an element (compound). The equivalent weight of an element or compound is equal to the sum of the molecular weight of each element of the compound. Milliequivalents are used in the measurement of electrolytes. Common electrolytes are sodium (Na), calcium (Ca), potassium (K), magnesium (Mg), and chloride (Cl).

CALCULATION OF DOSES

A dose is the amount of medication to be administered to a patient. A dose may be measured in terms of milligrams, milliliters, units, or milliequivalents. Sometimes a dose maybe expressed in the number of dosage units to be given to a patient such as tablets, capsules, or inhalations.

$$\frac{\text{DD (desired dose)}}{\text{DH (dose on hand)}} \times \text{QTY (quantity)} = \text{Dose to be given}$$

REDUCING OR ENLARGING A FORMULA

When a formula specifies a specific total quantity, determine how much of each ingredient is needed to prepare a different total quantity by using this equation:

$$\frac{\text{Tot qty of form (specified)}}{\text{Qty of ingred (specified)}} = \frac{\text{Tot Des qty}}{\text{Qty Des qty}}$$

Key for Abbreviations

Tot = Total
Qty = Quantity
Des = Desired

PERCENTAGES AND STRENGTH OF MEDICATION

Percentages are another method of showing a relationship between parts and the whole. Percent means "parts per 100." A percent can be calculated using ratios, fractions, or decimals.

Rules

- To convert a decimal to a percent, multiply the number by 100 and add a percent (%) sign (e.g., 0.45 × 100 = 45%; 1.00 × 100 = 100%; 1.25 × 100 = 125%).
- To convert a percent to a decimal, remove the % sign and divide by 100 (e.g., 95%/100 = 0.95; 50%/100 = 0.50; 100%/100 = 1.0).
- To convert a fraction to a percent, divide the numerator by the denominator, multiply by 100, and add a % sign (e.g., 95/100 = 0.95; then multiply by 100 = 95%).
- To convert a percent to a fraction, drop the % sign and write the value of the number as the numerator. Place it over a denominator of 100 and reduce it to its lowest terms (e.g., 75% = 75/100; reduce to lowest terms where both 75 and 100 are divisible by 25, resulting in an answer of 3/4).
- To convert a ratio to a percent, divide the first number by the second number, multiply by 100, and add a % sign (e.g., 1:10 is the same as 1/10 = 0.1; then multiply 0.1 by 100 = 10%).
- To convert a fraction to a ratio, place the numerator first followed by a colon and then place the denominator next (e.g., ½ is the same as 1:2).

Percents can be calculated by setting up a proportion. The numerator represents parts and the denominators wholes. The left side of the equation can be expressed as follows:

$$\frac{\textit{Parts of the whole}}{\textit{Whole}} = \frac{\%}{100}$$

To solve this type of problem, two of the three variables need to be present: parts of the whole, the whole, or the percent. Identify each term as a part of the whole, the whole, or a percent. After identifying the values and placing them in the equation, cross-multiply and divide to find the missing term.

CONCENTRATION AND DILUTION

A concentration is a strength that shows the quantity of drug dissolved in either a solid or a liquid. It can be expressed as a fraction (e.g., mg/mL, mEq/mL, or units/mL), as a ratio (e.g., 1:100, 1:1000, or 1:10,000), or as a percentage (e.g., 10%, 25%, or 50%). Percents are found in solids (%w/w) and in solutions (%w/v or %v/v); %w/w is the number of grams per 100 g, %w/v is the number of grams per 100 mL, and %v/v is the number of milliliters per 100 mL.

The majority of all problems involving concentrations result in a dilution of a substance. In a daily application, a pharmacist receives an order to prepare a product of a given strength and volume (weight). These are known as the *final strength* (FS) and *final volume* (FV). The pharmacist must go to the shelf, choose the product at a given strength (initial strength [IS]), and determine the amount (initial volume [IV]) needed to prepare the compound. The same process

would be done in preparing solids except an initial weight (IW) and final weight (FW) would be substituted for initial and final volumes.

Use the following equation for this type of situation:

Initial volume (IV) × Initial strength (IS)
= Final volume (FV) × Final strength (FS)

Hints to prevent errors in solving dilution problems:

- Initial strength must be larger than final strength.
- Initial volume must be less than final volume.
- Final volume minus initial volume equals amount of diluent (inert substance) to be added to make the final volume.

ALLIGATION ALTERNATE

Alligations are used in pharmacy when a pharmacist or pharmacy technician is compounding either a solution or a solid. The strength being prepared is different from the strength of the substance on the shelf. In this situation, there are substances of at least two different concentrations on the shelf—one that is greater than the desired concentration and one that is less than the desired concentration.

For example, a pharmacist receives an order to prepare 4 oz of a 10% solution using a 25% and 5% solution. How much of each these should the pharmacist use?

Step 1: Draw a tic-tac-toe table.

Step 2: Place the highest concentration in the upper left corner, the lowest concentration in the lower left corner, and the desired concentration in the middle.

25%		
	10%	
5%		

Step 3: Subtract the desired concentration from the highest concentration and place that number in the lower right corner and express the answer as parts. Then subtract the lowest concentration from the desired concentration and place that number in the upper right corner and label it as parts.

25%		5 parts
	10%	
5%		15 parts

Step 4: Total the number of parts: 5 + 15 parts = 20 parts.

Step 5: Set up a proportion using the parts of the highest and lowest concentration and the total quantity to be prepared.

$$25\%: \frac{5 \text{ Parts}}{20 \text{ Parts}} \times 4 \text{ oz} = 1 \text{ oz of } 25\% \text{ needed}$$

$$5\%: \frac{15 \text{ Parts}}{20 \text{ Parts}} \times 4 \text{ oz} = 3 \text{ oz of } 5\% \text{ needed}$$

Step 6: Check your work by adding the amounts of each concentration to see if they equal the amount to be compounded.

ALLIGATION MEDIAL

Define as the weighted average percentage strength of two or more substances with known quantities and strengths. The percentage strength must be expressed as a whole number for each component. The quantities should be expressed in common measurements. If the percentage is not given, it is assumed to be 0. Example:

Amount desired (milliliters, etc.)
× Percent (in a decimal) = Grams

Prepare ½ L solution of 70% alcohol from 50% alcohol and 95% alcohol

500 mL × 0.7 = 350 g
278 mL × 0.5 = 139 g
222 mL × 0.95 = 211 g
139 g + 211 g = 350 g

SPECIFIC GRAVITY

Specific gravity is a ratio expressed as the weight of a substance to the weight of an equal volume of a substance as a standard. Water is the standard that is used and has a specific gravity of 1. Specific gravity can be expressed as follows:

Weight of substance/Weight of an equal volume of water

DRIP (FLOW) RATES

Pharmacy technicians must be aware of calculations associated with intravenous (IV) fluids. Pharmacy technicians must be able to determine the flow rates of IV infusions, calculate the volume of fluids administered over a period, and control the total volume of fluids administered to a patient over a period of time.

A variety of IV sets are available to pharmacists and are identified by the number of drops of a fluid

per milliliter. Common IV sets include 10 drops/mL, 15 drops/mL, and 60 drops/mL (mini-drip set).

Time of infusion = Volume of fluid (or amount of drug)/Rate of infusion
Rate of infusion = Volume of fluid (or amount of drug)/Time of infusion
Infusion rate = Drops/min = (Number of mL/hr) × (Number of drops/mL)/60 min/hr

The number of drops per milliliter may vary.

CALCULATION OF CHILDREN'S DOSES

Children require different amounts of medication than adults. These doses are affected by the individual's age, weight, body surface area (BSA), organ development, sex, and disease state. An individual's age is placed into one of several categories:

- **Neonates:** Birth to 1 month of age
- **Infants:** 1 month to 1 year of age
- **Early childhood:** 1 to 5 years of age
- **Late childhood:** 6 to 12 years of age
- **Adolescence:** 13 to 17 years of age

To calculate the appropriate dose for children, one of several methods may be used. Young's and Fried's rule uses age as a guide; Clark's rule uses weight (pounds) as the determining factor (Young's, Fried's, and Clark's rule calculations are not exact); mg/kg uses weight in kilograms for a patient; and BSA uses both height and weight as the basis for calculating the dose.

$$\text{Fried's rule} = \frac{\text{Age (in months)} \times \text{Adult dose}}{150}$$

Fried's rule is used for children under 1 year of age.

$$\text{Young's rule} = \frac{\text{Age (in years)} \times \text{Adult dose}}{\text{Age (in years)} + 12}$$

Young's rule is used for children between the ages of 1 and 12 years of age. Both Fried's and Young's rules are the least accurate means of determining a dose for a child.

$$\text{Clark's rule} = \frac{\text{Weight of child (expressed in pounds)}}{150} \times \text{Adult dose}$$

All of these methods require the adult dose and the given parameter to be provided to the practitioner for calculation of the appropriate dose. The adult dose may be measured in milligrams, milliliters, units, milliequivalents, or even tablets.

Using the mg/kg method, the drug manufacturer will provide the appropriate mg/kg dosage for a patient, and the patient's weight is provided. It may be calculated using a proportion:

$$\text{mg/kg} = \text{mg/kg}$$

A more accurate method of determining the appropriate dose is based on BSA. This method takes into account both the height and weight of the individual (Figure 3-1). If one knows both of these variables, a nomogram (a specialized graph) is referenced. BSA is measured in square meters (m^2). It is extremely important that the correct nomogram is used when using BSA. The dosage is calculated as follows:

BSA of child (in square meters)/1.73 m^2 (average adult BSA) × Adult dose = Approximate dose for child

TEMPERATURE CONVERSION

To solve math problems converting degrees Fahrenheit to Celsius or degrees Celsius to Fahrenheit, the following formula can be used:

$$9C = 5F - 160$$

where *C* represents the temperature in Celsius and *F* represents the Fahrenheit temperature. Only one of the two variables is required for this problem to be solved.

Another way to solve this problem is to use the following equations:

$$F = (C \times 1.8) + 32$$

$$C = \frac{F - 32}{1.8}$$

Either method will yield the same answer.

PRODUCT STABILITY

The following factors affect a drug's stability:

- Dosage form
- Humidity
- Ingredients used in a compound
- Light
- Material of the container
- Order and method of preparation
- Temperature

PRODUCT INCOMPATIBILITIES AND SIGNS OF PRODUCT INSTABILITY

- **Physical incompatibilities:** Occur from changes in solubility, which may result in changes in color or the formation of a precipitate. A change in the pH of a solution, the use of buffers, and the type of solvent used may create problems.

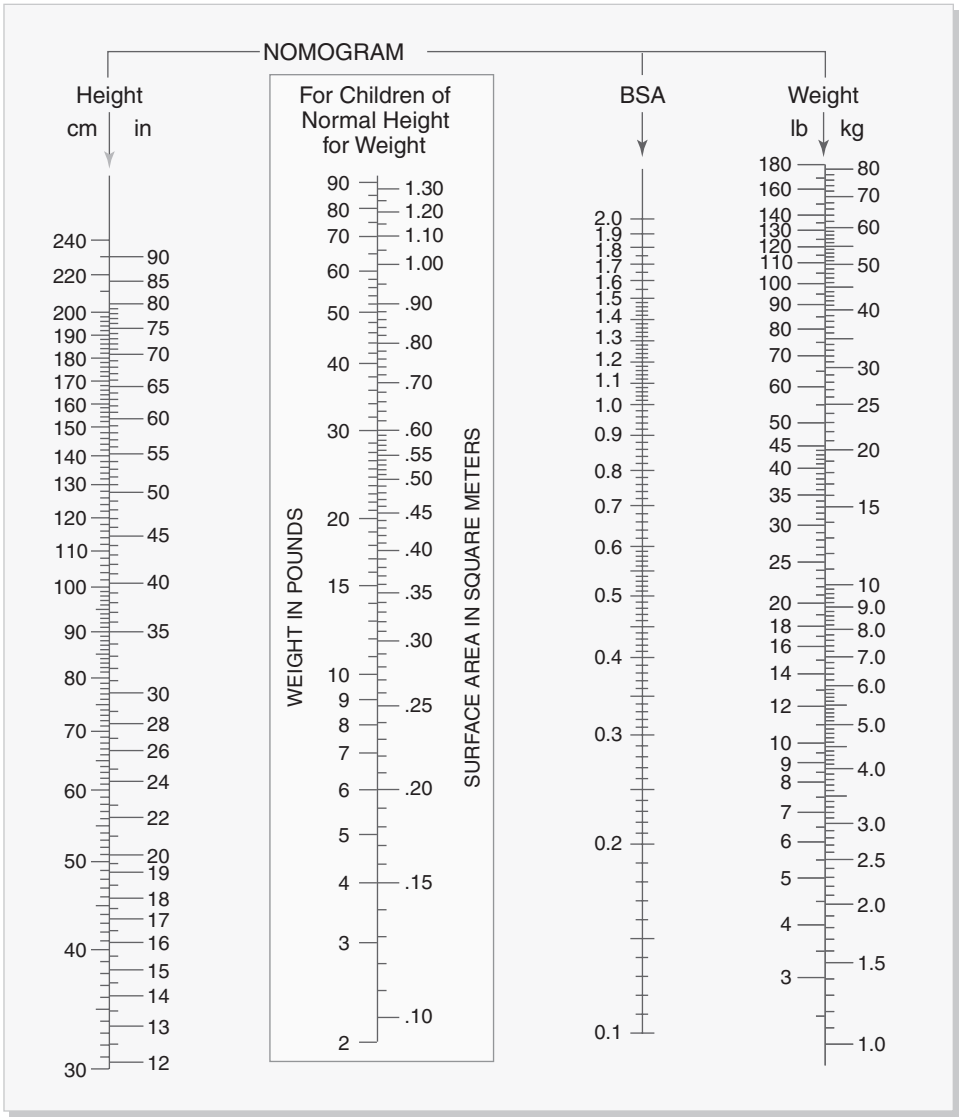


Figure 3-1 Body surface area chart.

- **Chemical incompatibilities:** Chemical reaction occurs between one or more of the ingredients. Incompatibilities may not be noticeable. Changes in pH or chemical decomposition may occur. The presence of light may cause deterioration of the ingredients.
- **Therapeutic incompatibilities:** The mixing together of two or more ingredients, resulting in a change in the therapeutic response of the drugs

STORAGE TEMPERATURES

The United States Pharmacopeia (USP) has defined terminology associated with temperature for the storage of medications:

- **Freezer:** A place in which the temperature is maintained thermostatically between -25° and -10° C (-13° and 14° F)
- **Cold:** Any temperature not exceeding 8° C (46° F). A refrigerator is a cold place in which the temperature is maintained thermostatically between 2° and 8° C (36° and 46° F).
- **Cool:** Any temperature between 8° and 15° C (46° and 59° F)
- **Controlled cold temperature**: This temperature is defined as the temperature maintained thermostatically between 2° and 8° C (36° and 46° F) that allows for excursions in temperature between 0° and 15° C (32° and 59° F) that may be experienced during storage, shipping, and distribution
- **Room temperature:** The temperature prevailing in a working area
- **Controlled room temperature**: A temperature maintained thermostatically that encompasses the usual

and customary working environment of 20° to 25° C (68° to 77 °F)
- **Warm:** Any temperature between 30° and 40° C (86° and 104° F)
- **Excessive heat:** Any temperature above 40° C (104° F)
- **Protection from freezing:** Where, in addition to the risk of breakage of the container, freezing medications can lose strength or potency, or to destructive alteration of its characteristics. The container label bears an appropriate instruction to protect the article from freezing.
- **Dry place**: The term "dry place" denotes a place that does not exceed 40% average relative humidity at controlled room temperature or the equivalent water vapor pressure at other temperatures.

BEYOND-USE DATING

Whereas expiration dates are determined by a drug manufacturer, beyond-use dating (BUD) is established by the repackager or the compounder. It is used when a pharmacy either repackages a medication or compounds a product. There are two possible methods, the 6-month and 1-year versions.
- **6-month version:** The date assigned will be a maximum of 6 months or one fourth of the time to the manufacturer's expiration date.
- **1-year version:** Maximum of 1 year of the drug life as long as it does not exceed the expiration date assigned by the drug manufacturer

State boards of pharmacy determine which method will be used.

DOSAGE FORMS

A dosage form is a system or device for delivering a drug to a biologic system.

SOLID DOSAGE FORMS

A dosage form that can be contained in various packages and when administered enterally can be given orally, rectally, or sublingually.

Advantages of Solid Dosage Forms

- Easy to package, transport, store, and dispense
- Convenient for self-dosing
- Lack smell or taste
- Extremely stable for products that are not stable in liquid form
- Predivided dosage form
- Suited for sustained- or delayed-release medications

Types of Solid Dosage Forms

- **Tablets:** Prepared either by compressing or by molding. The dosage form is accurate, compact, portable, and easy to administer. May come in various shapes and be scored (able to be broken in halves or quarters). The most common types of marketable tablets include standard compressed, enteric-coated, sugar-coated, film-coated, sublingual or buccal, multiple compressed, chewable, sustained-action, and delayed-action tablets.
- **Capsules:** A drug is contained in a shell of gelatin (either soft or hard) that dissolves in 10 to 20 minutes. The drug may be in either a solid or a liquid form with the shape being either spherical or ovoid. The capacity of capsule may vary up to 1 g and can be produced manually by using the punch method.
- **Effervescent salts:** Granules or powders; when dissolved in water, they effervesce and release carbon dioxide
- **Implants or pellets:** Dosage forms that are placed under the skin through injection and are effective for a long period of time
- **Lozenges, troches, or pastilles:** Solid dosage forms with flavoring that dissolve in the mouth
- **Pellets:** Small cylinders that are implanted subcutaneously for continuous absorption
- **Plasters:** Medicated or nonmedicated preparations that adhere to the skin by a backing material
- **Powders:** Finely ground substances that can be administered internally or externally. Their chief disadvantages are their taste and that they are not stable when exposed to the air. Powders may be dispensed in a bulk form, a multidose form, or as a divided dose such as a powder paper.
- **Suppositories:** Solid dosage forms to be inserted in body orifices, such as the rectum, vagina, or urethra. They may produce either a local or systemic effect. Their mechanism of action is either through melting or dissolving, and the medication is released over a period of time. The major disadvantages of a suppository are that it may be easily expelled from the body, and the medication's absorption into the body can be erratic.

Oral Extended-Release Dosage Forms Examples

- Controlled diffusion (CD)
- Continuous- or controlled-release (CR) tablet
- Controlled-release tablet (CRT)
- Long acting (LA)
- Sustained action (SA)
- Sustained or slow release (SR)
- Time delay (TD)
- Time release (TR)
- Extra long (XL)
- Extended release (XR)

LIQUID DOSAGE FORMS

A dosage form composed of various solutions whose term relates to the type of liquid with which the medication is mixed

Advantages of Liquids

- Effective more quickly than a solid dosage form because the drug is already dissolved
- Easier to swallow than a solid dosage form for many patients
- Drugs may be available only in liquid form owing to convenience of administration.
- Uniformity and flexibility of dosage form in dosing
- Certain medications may cause gastrointestinal distress if administered in a solid dosage form.

Disadvantages of Liquids

- Deterioration and loss of potency occur more quickly than in a solid dosage form.
- May require special sweetening or flavoring to be palatable
- Incompatibilities of dissolved substances
- May require preservatives to prevent bacteria or mold from developing
- Inaccurate measuring of a dose for a patient may occur
- Bulkier to carry than solid dosage forms
- Interactions may develop from changes in solubility.

Types of Solutions

Solutions: Contain a solute that is dissolved in a solvent, which may be aqueous, alcoholic, or hydroalcoholic

- **Aromatic waters:** Solutions of water-containing oils that have a smell and are volatile
- **Collodion:** Topical dosage form that contains pyroxylin and is dissolved in alcohol and ether
- **Elixir:** Clear, sweetened, flavored hydroalcoholic solution containing water and alcohol that may or may not be medicated
- **Enema:** Solution administered rectally for either cleansing or drug administration
- **Extract:** Process by which active ingredients are removed from their source through the application of solvents
- **Douche:** An irrigating or bathing solution
- **Isotonic (iso-osmotic):** A liquid having the same tone or osmolarity of another substance, where there is no loss or gain of water by the cell. The dilution of an isotonic solution may affect the composition of solution. Ophthalmic solutions are considered isotonic.
- **Liniments:** An emulsion or alcoholic or oleaginous solutions applied through rubbing
- **Spirits:** Alcoholic or hydroalcoholic solutions containing volatile aromatic ingredients
- **Syrups:** Aqueous solutions containing sucrose or sucrose substitutes
- **Tinctures:** Alcoholic or hydroalcoholic solutions of pure chemicals or extracts

Types of Dispersions

Dispersions: A solute dispersed through a dispersing vehicle

- **Suspension:** A two-phase system in which solid particles are dispersed in a liquid vehicle, which may be oral, topical, or injectable. The suspended material should not settle rapidly and should pour freely. A topical suspension should be fluid enough to spread over the affected area but should not run off the surface of application and dry quickly. Topical suspensions provide a protective film and have an acceptable color and odor.
- **Emulsion:** One liquid is dispersed in another liquid; may be water in oil (w/o) or oil in water (o/w). Emulsions are stabilized through the use of an emulsifying agent. Oral emulsions are o/w preparations; topical emulsions may be either o/w (washable and nonstaining) or w/o. An o/w emulsion will become diluted with water, but a w/o emulsion will not.
- **Lotion:** A liquid for topical application that contains insoluble solids or liquids
- **Gel:** A two-phase system containing an extremely fine solid particle that when mixed is difficult to distinguish between the two phases and is considered a semisolid form
- **Ointment:** A homogeneous, viscous, semisolid preparation, most commonly a greasy, thick oil (oil 80%, water 20%) with a high viscosity that is intended for external application to the skin or mucous membranes. They are used as emollients or for the application of active ingredients to the skin for protective, therapeutic, or prophylactic purposes and when a degree of occlusion is desired.
  - **Anhydrous ointments:** Absorb water but are insoluble in water and are not water washable
  - **Oleaginous ointments:** Insoluble in water, do not contain or absorb water, and are not water washable
- **Pastes:** Contain more solid materials than ointments
- **Creams:** An emulsion of oil and water in approximately equal proportions. Cream is thicker than a lotion and maintains its shape when removed from its container. It tends to be moderate in moisturizing tendency.

Types of Inhalants

Inhalants: Gases, vapors, solutions, or suspensions intended to be inhaled either orally or intranasally

- **Aerosol:** A spray in a pressurized container that contains a propellant, an inert liquid, or gas under

pressure meant to carry the active ingredient to its location of application. Particles may be either a fine solid or a liquid. Aerosols are used for administration into body cavities. Aerosols are convenient and easy to apply.
- **Spray:** A dosage form that consists of a container with a valve assembly that, when activated, will emit a dispersion of liquid, solid, or gaseous material.

Nebulizer: A device used to administer medication in the form of a mist inhaled into the lungs. Nebulizers use oxygen, compressed air, or ultrasonic power to break up medical solutions and suspensions into small aerosol droplets that can be directly inhaled from the mouthpiece of the device.

Transdermal Products

- Provide systemic therapy for acute or chronic conditions that do not involve the skin
- Deliver a controlled dose of medication through the skin and is absorbed directly into the bloodstream
- A convenient system that results in improved patient compliance, accurate drug dosage, and regulation of drug concentration

NONSTERILE COMPOUNDING

NONSTERILE PHARMACY EQUIPMENT AND SUPPLIES

- **Beakers:** May be either glass or plastic and are used to estimate and mix solutions
- **Class A (III) balance:** Required in all pharmacies and is used to weigh small quantities of ingredients; has a sensitivity requirement of 6 mg
- **Counter balance (bulk balance):** Two-pan balance used to weigh quantities up to 5 kg with a sensitivity of 100 mg
- **Digital balances:** Sensitive to a tenth of a milligram and are used to replace class A balances
- **Compounding slab (ointment slab):** Used for mixing compounds
- **Filter paper:** Paper used to filter a solution
- **Forceps:** Used to pick up prescription weights and are used to ensure that oil is not deposited on the weight, which would affect it
- **Funnels:** Used to filter or pour liquids
- **Glass stirring rods:** Used to stir solutions and suspensions
- **Glycine paper:** Placed under substances to be weighed
- **Graduates:** Used to measure liquids. There are two types of graduates, conical and cylindrical (most accurate method to measure a volume). Graduates will either be TD or TC. TD means the volume delivered is the exact amount desired, and the residual remaining solution is in addition to the volume measured. TC will hold the desired volume but, when transferred, a residual remains, making the amount measured inaccurate.
- **Master formula sheet** (pharmacy compounding log): Lists the ingredients and their quantities and the procedures to follow in the preparation (Figure 3-2)
- **Mortar and pestle:** Used to mix ingredients
- **Glass:** Used for mixing liquids and semisolid dosage forms
- **Wedgwood:** Used in the trituration of crystals, granules, and powders
- **Porcelain** is similar to Wedgwood and is more commonly used in the blending of powders (Figure 3-3)
- **Pharmaceutical weights:** Brass weights are available in both metric and apothecary systems. The weights should never be touched by the hand; they should be stored in a clean state and should be calibrated once per year.
- **Pipettes:** Used to measure volumes less than 1.5 mL
- **Sink with hot and cold running water:** Used to wash equipment and hands
- **Spatula:** May be rubber (used for corrosive ingredients), plastic, or steel
  - **Hard rubber spatula:** Used in the compounding of ingredients that react with metal
  - **Stainless steel spatula:** Most commonly used because of its flexibility and ability to remove materials from a mortar

TECHNIQUES USED IN COMPOUNDING NONSTERILE PRODUCTS

Pharmacists and pharmacy technicians use a variety of techniques in compounding nonsterile products; these techniques include:

- **Blending:** An act of combining two substances
- **Comminution:** An act of reducing a substance to small, fine particles
- **Geometric dilution:** A technique used in mixing two ingredients of unequal quantities, where one begins with the smallest quantity and adds an equal quantity of the ingredient having the larger amount; the process continues until all of the ingredients are used
- **Levigation:** Trituration of a powder drug with a solvent in which the drug is insoluble with the solvent
- **Pulverization by intervention:** Reducing the size of a particle in a solid with the aid of an additional material

Ranitidine suspension		
Formulation ingredients	15 mg/mL	
Ingredients	150 mg tablets	#6
Simple syrup		30 mL
Distilled water		qs to 60 mL
Compounding procedure	1. Pulverize tabs in mortar	
	2. Levigate with a small amount of distilled water to disintegrate the film-coating fragments	
	3. Add, by geometric proportion, the syrup and levigate until a uniform mixture is obtained	
	4. Transfer the contents of the mortar to a conical graduate	
	5. Qs ad to 60 mL with distilled water	
	6. Pour into an amber bottle and shake vigorously	
Auxiliary labels	**Shake well**	
	Protect from light	
Stability	1 week at 20 to 30 degrees Celsius	

Figure 3-2 A recipe book for formula cards. (Reprinted from Hopper T. *Mosby's pharmacy technician: principles and practice,* ed 3. St Louis, 2012, Saunders.)

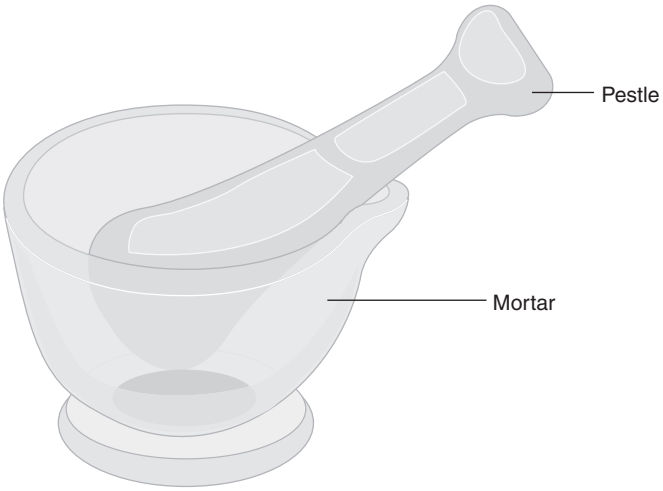


Figure 3-3 Mortar and pestle used to crush solids. (Reprinted from Hopper T. *Mosby's pharmacy technician: principles and practice,* ed 3. St Louis, 2012, Saunders.)

- **Sifting:** A technique to either blend or combine powders
- **Spatulation:** Mixing powders using a spatula in a mortar, an ointment slab, or a plastic bag; it is a process used when ingredients may liquefy on mixing; there is no reduction in particle size
- **Trituration:** A process of rubbing, grinding, or pulverizing a powder to create fine particles
- **Tumbling:** Combining powders in a bag and shaking it

Equipment Calibration

- **Calibration** is a comparison between measurements, one of known magnitude or correctness made or set with one device and another measurement made in as similar a way as possible with a second device.
- **Weighing:** Scales must be tared before being used for each weighing and be inspected once a year by the state department of taxation.

Torsion Balance Procedures

- Leave the balance in a draft-free area (Figure 3-4).
- If the balance has a level bubble, make sure the bubble is inside the bull's eye and make adjustments using the leveling feet.
- Place a weighing boat or a single piece of paper on the pan.
- When the balance has determined the final weight, press the tare bar to compensate for the weighing boat.
- As ingredients are added or removed, the digital display will show the weight.

Measuring Liquids Procedures

- Choose properly sized graduates such that quantity to be measured is not less than 20% of the total volume of graduate (Figure 3-5).
- Pour liquid down the center of the graduate slowly and watch the level of liquid rise to desired volume.

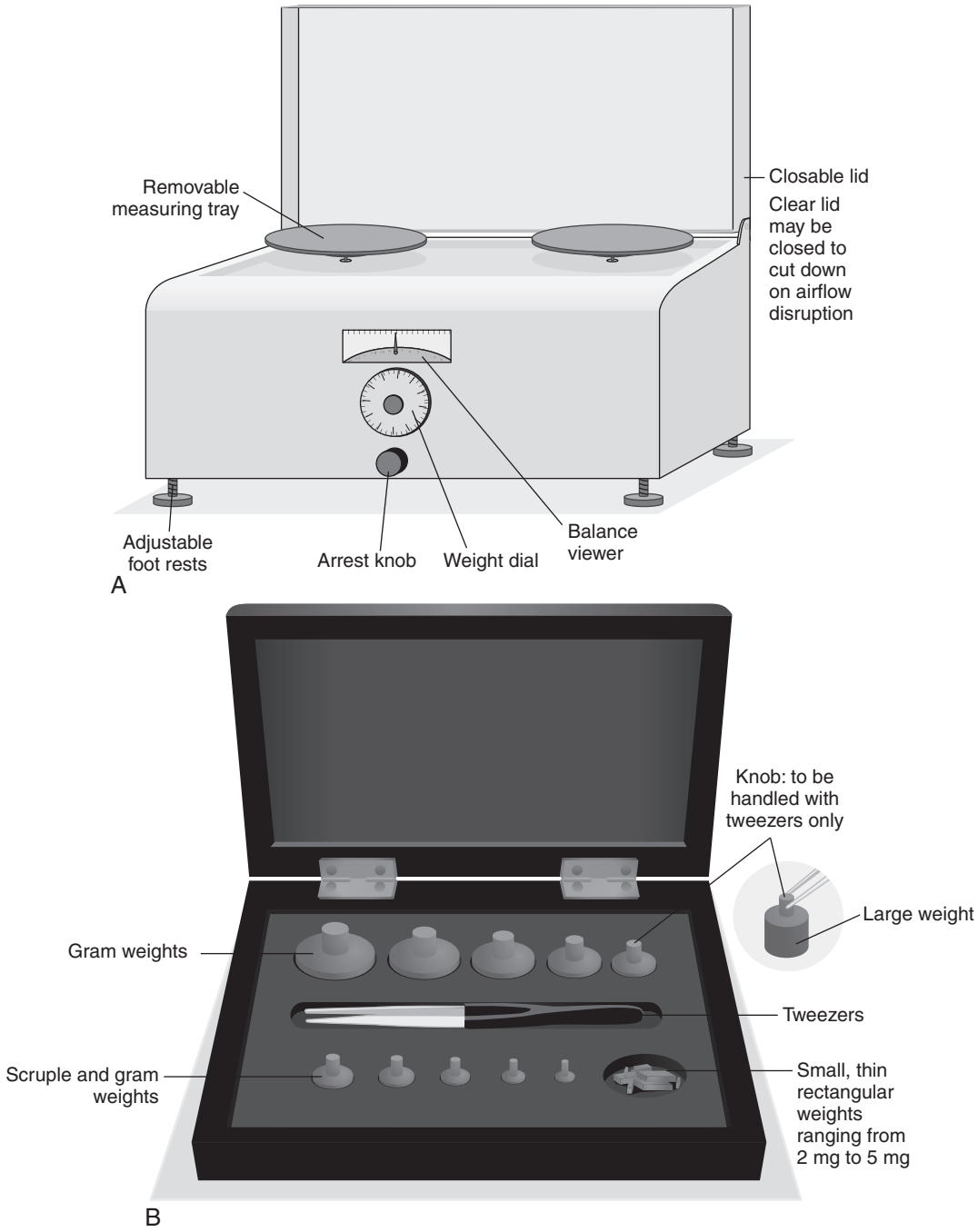


Figure 3-4 A, Class A balance. **B,** Pharmaceutical weights. (Reprinted from Hopper T. *Mosby's pharmacy technician: principles and practice,* ed 3. St Louis, 2012, Saunders.)

- Allow time for all liquid to fall in graduate before taking measurement.
- Measure level of liquid at eye level and make observation at the bottom of the meniscus.
- Pour liquid into the container and allow for liquid to be completely drained from the graduate.

Powders

- Powders are prepared through the use of trituration and geometric dilution.
- Particle size is determined through the use of a sieve.

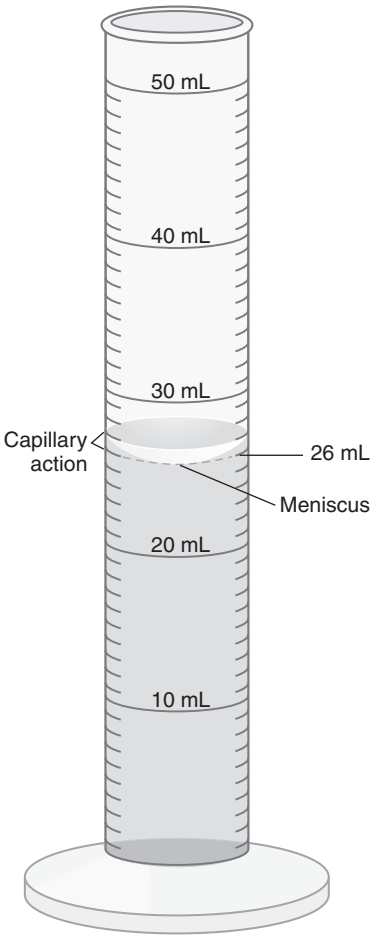


Figure 3-5 A 50-mL graduate showing the meniscus and proper measurement of solutions. (Reprinted from Hopper T. *Mosby's pharmacy technician: principles and practice*, ed 3. St Louis, 2012, Saunders.)

SIEVES

SIEVE NUMBER	SIEVE OPENING
2.0	9.5 mm
3.5	5.6 mm
4.0	4.75 mm
8.0	2.36 mm
10.0	2.0 mm
20.0	850 micrometer
30.0	600 micrometer
40.0	425 micrometer
50.0	300 micrometer
60.0	250 micrometer
70.0	212 micrometer
80.0	180 micrometer
100.0	150 micrometer
200.0	75 micrometer

Punch Method Procedure for Capsules

- Triturate ingredients to the same particle size.
- Mix using geometric dilution.
- Calculate enough ingredients for several extra capsules.
- Place powder on the ointment slab, where the depth of powder is approximately half the length of the capsule body.
- Hold the capsule vertically and punch the open end into the powder until capsule is filled.
- Place the cap on the capsule and weigh it using an empty capsule as a counterweight. Add or remove ingredient as needed.
- **Hints:** Remove the exact number of capsules from the box, wear finger cots to protect the fingers, and roll capsules on a clean towel to remove traces of the drug on the outside.
- Place completed capsules in either a glass or plastic vial and store in a dry place to prevent them from absorbing moisture or becoming dry (Figure 3-6).

CAPSULE SIZES AND CAPACITY

CAPSULE SIZE	CAPSULE CAPACITY (WEIGHT)	CAPSULE CAPACITY (VOLUME)
000	1000 mg	1.37 mL
00	750 mg	0.95 mL
0	500 mg	0.68 mL
1	400 mg	0.5 mL
2	300 mg	0.37 mL
3	200 mg	0.3 mL
4	150 mg	0.2 mL
5	100 mg	0.13 mL

Procedure for Preparing an Emulsion Using the Wet Gum Method

- Primary emulsion is formed by triturating one part gum and two parts water to form a mucilage.
- Add four parts oil and triturate slowly.
- Add additional ingredients.

Continental Method (Dry Gum) Method

- The primary emulsion is formed from four parts oil, two parts water, and one part gum (an emulsifier, acacia).
- Using a Wedgwood or porcelain mortar, the gum and oil are levigated.
- Water is added and the trituration continues.
- After the primary emulsion is formed, additional ingredients may be added and are added up to the initial volume with the external phase.

Procedure for Preparing Emulsions Using the Beaker Method

- Water-soluble and oil-solute ingredients are mixed in separate containers.

Number	Approximate amount contained	Example
000	1000 mg	
00	750 mg	
0	500 mg	
1	400 mg	
2	300 mg	
3	200 mg	
4	150 mg	
5	100 mg	

Figure 3-6 Capsule sizes. (Reprinted from Hopper T. *Mosby's pharmacy technician: principles and practice,* ed 3. St Louis, 2012, Saunders.)

- Heat both phases to 70° C and remove from heat.
- Add the internal phase to the external phase.
- The final product is cooled to room temperature but is continually stirred.

Procedure for Preparing a Liquid Drug in a Liquid Vehicle

- Measure quantities of each liquid in a graduated cylinder.
- Add drug to vehicle slowly; then shake and stir.

Procedure for Dissolving a Solid Drug in a Liquid Vehicle

- Weigh the solid and measure the solvent.
- Triturate drug if needed and dissolve in solvent.
- If needed, heat gently, stir, or shake gently.

Procedure for Preparing Nonaqueous Solution

- Prepare by dissolving alcohol-soluble ingredients in alcohol and water-soluble ingredients in water.
- Add the alcohol portion to the aqueous portion and stir.

Procedures for Preparing Syrups

- **Heat method:** Heat must be controlled; works fastest, but not all ingredients can be used with heat
- **Without heat method:** Must use a container that is twice the size of the final volume. The syrup needs to be shaken or stirred.

Procedure for Preparing Suspensions

- The solid drug to be suspended is weighed and levigated in mortar and pestle with either alcohol or glycerin.
- A portion of the vehicle is added to mortar and is mixed with the levigated drug until a uniform consistency occurs.
- This portion of the drug is placed in the final container.
- The mortar and pestle are rinsed with the balance of the vehicle, and the suspension is added up to the final volume with the vehicle being used.
- A "SHAKE WELL" label should be affixed to the container.
- **Note:** A flocculating and thickening agent may be used in the preparation of a suspension.

Fusion Mold Procedure for Preparing Suppositories

- Active ingredients are dispersed or dissolved in a melted base.
- Weigh quantities of base and active ingredient.
- Melt the suppository base at a low temperature and dissolve the drug in it.

- The base is poured and overfilled into a special suppository mold (metal, plastic, or rubber) and is left to harden.
- Excess material is removed from the top of the mold.

Compression Mold Procedure for Preparing Suppositories

- Weigh quantities of base and active ingredient.
- Mix the suppository base and drug ingredients.
- Force the mixture into a special compression mold.

Procedures for Preparing Ointments and Creams

Note: Ointment bases are chosen based on their characteristics to deliver a drug (Table 3-1).

- Weigh quantities of each ingredient and place them either on an ointment slab or parchment paper.
- Prepare by using geometric dilution and two spatulas to mix the ingredients.
- Transfer the final product into an ointment jar using a spatula.
- Remove air pockets from the ointment by using a spatula.
- Spread evenly in the container.

Factors to be Considered in Preparing Ophthalmic Products

- **Sterilization:** Can be accomplished by autoclave, filtration, gas, or radiation
- **Clarity:** Free from foreign particles, which can be accomplished through filtration
- **Stability:** Affected by chemical nature of the drug substance, pH, method of preparation, solution additives, and packaging
- **Buffer and pH:** Should be formulated at a pH of 7.4, but this rarely occurs. The pH chosen should be optimum for stability.
- **Tonicity:** Refers to the osmotic pressure exerted by the salts. An isotonic solution should have tonicity equal to that of sodium chloride 0.9%.
- **Viscosity:** Agents are used to prolong contact time in the eye and enhance drug absorption and activity.

REPACKAGING REQUIREMENTS FOR NONSTERILE PRODUCTS

Labeling: The labeling must contain the following information:

- Generic name of the drug
- Strength
- Dosage form
- Manufacturer's name and lot number
- Expiration date after repackaging

Repackaging log: The log contains documentation required for repackaging medication and must be signed by the pharmacist.

- Date of repackaging
- Name of drug
- Dosage form
- Drug manufacturer
- Manufacturer's expiration date and lot number
- Pharmacy lot number
- Expiration date assigned by the pharmacy
- Quantity of drug repackaged
- Pharmacy technician's initials (if a pharmacy technician participated in the repackaging)

STERILE COMPOUNDING

UNITED STATES PHARMACOPEIA <797> TERMINOLOGY

- **Ante area:** An area in which all preparations for IV admixtures are gathered, including labels, gowning, and drug materials
- **BUD:** The date or time a drug or material can no longer be used; the drug is ineffective after this date
- **Buffer area:** An area in which hoods are kept and IV preparations take place
- **Clean area:** A space where microbial containment is kept at a specific level of safety to ensure a certain level of cleanliness

TABLE **3-1 Property of Ointment Bases**

PROPERTY	OLEAGINOUS BASE	ABSORPTION BASE	WATER–OIL EMULSION BASE	OIL–WATER EMULSION BASE	WATER–MISCIBLE BASE
Greasiness	Greasy	Greasy	Greasy	Nongreasy	Nongreasy
Occlusiveness	Yes	Yes	Sometimes	No	No
Spreadability	Difficult	Difficult	Moderate to easy	Easy	Moderate to easy
Washability	Nonwashable	Nonwashable	Nonwashable or poorly washable	Washable	Washable
Water content	Anhydrous	Anhydrous	Hydrous	Hydrous	Hydrous
Examples	White petrolatum	Aquaphor	Hydrous lanolin, Eucerin	Hydrophilic ointment	Polyethylene glycol (PEG)

- **Compounded Sterile Product (CSP):** a sterile drug product (including a radiopharmaceutical) that was prepared by compounding or underwent other handling or manipulation prior to administration
- **Critical site:** An area exposed to air or touch, such as vial, needle, or ampule
- **Direct compounding area (DCA):** A critical area within an ISO class 5 area
- **Media-fill test:** A test performed on compounded products to ensure no contamination has occurred during the preparation phase
- **Negative-pressure room:** A room in which air flows into the room and away from adjacent rooms, which results in positive pressure in the room
- **Positive-pressure room:** A room in which air flows out of or toward adjacent rooms, which results in a lower pressure in the room
- **ISO Class 5 (**formerly known as a Class 100 Area): An area where there are no more than 100 particles 0.5 micron or larger per cubic foot of air
- **ISO Class 7** (formerly known as a Class 10,000 Area): An area where there are no more than 10,000 particles 0.5 micron or larger per cubic foot of air
- **ISO Class 9** (formerly known as a Class 100,000 Area): An area where there are no more than 100,000 particles 0.5 micron or larger per cubic foot of air

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Responsibility of Compounding Personnel

- Compounding personnel must be adequately skilled, educated, instructed, and trained.
- Ingredients must have their correct identity, quality, and purity.
- Opened or partially used packages must be properly stored under restricted access conditions.
- Water-containing CSP that are nonsterile during any phase of compounding must be sterilized within 6 hours after completing the preparation.
- Measuring, mixing, sterilizing and purifying devices are clean, appropriately accurate, and effective for their use.
- Packaging selected CSP is appropriate to preserve the sterility and strength until BUD.
- Compounding environment maintains sterility or presterilization purity.
- Labels on CSPs list the names and amounts or concentrations of active ingredients.
- Labeling of injections list the names and amounts of concentrations of all ingredients.
- Before dispensing or administering CSPs, the clearness of the solution is visually confirmed.
- BUDs are assigned based on testing and obtaining information from reliable literature sources.
- Procedures for measuring, mixing, diluting, sterilizing, packaging, and labeling conform to quality established for the CSP.

Compounded Sterile Product Microbial Contamination Risk Levels

- **Low risk:** Compounded within an ISO Class 5 or better air environment. The compounding involves the transfer, measuring, and mixing of not more than three packages of sterile products. There cannot be more than two ingredients entered into one sterile container. Sterile needles and syringes must be used to open disinfected ampules or vials. The time from compounding and administering the CSP cannot exceed 48 hours at controlled room temperature.
- **Medium risk:** Multiple individual or small doses of sterile products are combined to prepare a CSP that will be administered to multiple patients or to one patient on multiple occasions. The compounding process takes a long time to complete. The time period from the completion of the compounding and administration cannot exceed 30 hours at controlled room temperature.
- **High risk:** Uses nonsterile ingredients not intended for sterile routes of administration. If the air quality is less than International Organization for Standardization (ISO) Class 5 for 1 hour or longer:
  1. sterile contents of commercially manufactured products
  2. CSPs that lack effective antimicrobial preservatives
  3. sterile surfaces of devices and containers for the preparation, transfer, sterilization, and packaging of CSP
- Compounding personnel are not properly garbed. Nonsterile water–containing compounds are stored for more than 6 hours before being sterilized.

Personnel Training

- Must be trained using videos and professional publications
- Course work must include both didactic and clinical content
- Must pass written and media-fill tests

Immediate CSP

- Intended only for emergency or immediate patient administration of CSP

Single- and Multiple-Dose Containers

- Single-dose containers must be used within 1 hour of being opened.
- Multiple dose containers have a BUD of 28 days.

MINIMUM FREQUENCY OF CLEANING AND DISINFECTING COMPOUNDING AREAS

SITE	MINIMUM FREQUENCY
ISO Class 5	At beginning of each shift, before each batch, not longer than 30 minutes after the previous surface disinfection when ongoing compounding activities are occurring, after spills, and when surface contamination is known or suspected
Counters and easily cleanable work surfaces	Daily
Floors	Daily
Walls	Monthly
Ceilings	Monthly
Storage shelving	Monthly

Hazardous Drugs

- Should only be prepared for administration under conditions that protect the health care worker

Environmental Quality and Control

- Personnel requirements
- Cleaning and disinfecting the compounding area
- Personnel cleansing and garbing: Sequence of garbing is:
  - Donning of dedicated shoe covers
  - Head and facial covers
  - Face masks
  - Nonshedding gown
  - Sterile powder-free gloves
- Personnel training and competency
  - Training must be documented before the individual compounds a sterile preparation.
  - Personnel must complete didactic training, pass written competence assessments, and undergo skills assessment and a media-fill test.

Standard Operating Procedures

- Access to buffer area is restricted to qualified personnel.
- Cartoned supplies are decontaminated by using a spray disinfectant.
- Supplies that are not used frequently are stored in anteroom.
- Carts used in bringing supplies from the storeroom cannot be rolled past the anteroom.
- Supplies must be disinfected and brought into the buffer room.
- Nonessential supplies that shed particles should not be taken into the buffer area.
- Traffic in and out of the buffer area is minimized.
- Individuals entering the buffer area should not wear outer garments (coats), cosmetics, jewelry, or piercings.
- Proper attire should be worn into the anteroom.
- Hands and forearms should be washed with soap and water for at least 30 seconds.
- Antiseptic hand cleansing must be performed before sterile gloves are donned.
- No food, drink, or chewing gum is permitted in buffer or anteroom.
- At the beginning of the compounding session and whenever anything is spilled, the area is cleaned with USP-purified water followed by a disinfecting agent with a nonlint wipe.
- A blower must be on at least 30 minutes before working in the area.
- Supplies in the direct compounding area (DCA), an area within the ISO Class 5 where critical sites are exposed to unidirectional HEPA filtered air, are disinfected with 70% isopropyl alcohol.
- Supplies are arranged neatly in the DCA area.
- No objects should be between the first air from a HEPA filter and the critical site.
- Procedures are performed to reduce touch contamination; gloves are disinfected with 70% isopropyl alcohol.
- All rubber stoppers of vials, bottles, and ampule necks should be wiped with 70% isopropyl alcohol for at least 10 seconds before preparing CSP.

STERILE COMPOUNDING EQUIPMENT AND PROCEDURES

Sterile Compounding and Administration Equipment

- **70% isopropyl alcohol:** Used to clean laminar air hood surfaces
- **Administration sets:** Disposable sterile tubing that connects the IV solution to the injection site
- **Alcohol pads:** Used to clean the ports on an IV bag, the rubber stopper of a vial, or an area of the skin before an injection
- **Ambulatory pumps:** A small, lightweight, portable pump worn by a patient that may be either therapy specific or used for multiple therapies
- **Ampule breaker:** A device used to break the neck of an ampule
- **Ampules:** Elongated glass container in which the neck is broken off
- **Catheters:** Devices that are inserted into veins for direct access to the vascular system that may be either peripheral venous or central venous catheters

- **Clamps:** Adjusts the rate and shutting down of the flow of the IV; they include slide clamps, screw clamps, and roller clamps
- **Depth filter:** A filter that works by trapping particles as a solution moves through the channels
- **Drip chamber:** A hollow chamber where drops of an IV solution accumulate that prevent air bubbles from entering the tubing
- **Filters:** Used to remove particulate material and microorganisms from solution; they can be attached to the end of a syringe, the end of the administration kit, or the end of the needle
- **Filter needles:** Needles that include a filter that prevents glass from entering the final solution when one draws from an ampule
- **Filter straws:** Used for pulling medication from ampules
- **Final filters:** Filter used before a solution enters a patient's body
- **Flexible bag:** Plastic container that may hold volumes ranging from 50 to 3000 mL
- **Heparin lock:** A short piece of tubing attached to a needle or catheter when the tubing is filled with heparin to prevent potential clotting
- **Infusion pumps:** Regulate the flow of medication into a patient
- **Large-volume parenterals (LVPs):** Parenterals with a volume greater than 100 mL
- **Male and female adapters:** Fit a syringe on each end and are used in the mixing of the two contents
- **Membrane filters:** Consist of small pores that retain particles that are larger than the pores. Membrane filters may be placed between syringe and needle before a medication is introduced into an LVP or a small-volume parenteral (SVP).
- **Minibags:** Contain volumes between 50 and 100 mL
- **Multidose vial:** A vial or container that can be used for more than one admixture that normally contains preservatives and contains a maximum dating of 28 days unless otherwise specified by manufacturer
- **Needles:** Composed of a hub and a shaft and are designated by two numbers (gauge and length). The gauge measures the diameter of the needle bore; the larger the gauge, the smaller the bore. The length of the needle is measured in inches.
- **Needle adapter:** A needle or catheter may be attached to it.
- **Piggyback:** A small-volume solution added to an LVP
- **Roll clamp:** Allows for variable flow rates
- **Single-dose vial:** A vial or container that can only be used once and does not contain a preservative
- **Small-volume parenterals (SVPs):** Packaged products, containing a volume of 100 mL or less, that are either directly administered to the patient or added to another parenteral
- **Spike:** A rigid, sharpened plastic piece that is inserted into the IV bag
- **Syringe:** Components include a plunger, plunger flange, barrel, and tip (Figure 3-7).
- **Syringe caps:** A sterile cap used to prevent contamination of syringes during the transportation out of the pharmacy
- **Syringes needles:** Components include a hub, shaft, bevel, lumen, and point (Figure 3-8).
- **Transfer needles:** Specially designed needles that look like two needles attached together at the hub that are used to transfer sterile solutions from one vial directly into another without the use of a syringe
- **Vials:** Glass or plastic containers with rubber stoppers. Single-dose vials do not contain a preservative, but multidose vials do.

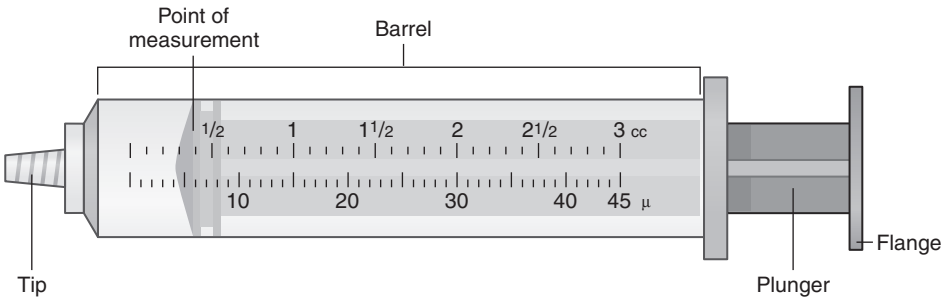

Figure 3-7 Parts of a syringe.

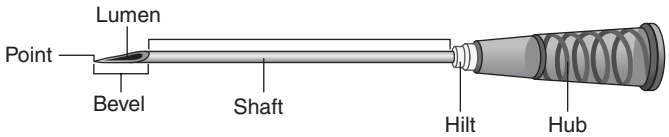

Figure 3-8 Parts of a needle.

Laminar Flow Hoods

- **Type A hoods:** Recirculate a portion of the air (after it first passes through a HEPA filter) within the hood and exhaust a portion of this air back into the parenteral room
- **Type B1 hoods:** Expel most of the contaminated air through a duct to the outside atmosphere and passes through a HEPA filter
- **Type B2 hoods:** Remove all of the contaminated air to the outside atmosphere after it passes through a HEPA filter. This air is not recirculated within the hood or returned to the parenteral room atmosphere.
- **Type B3 hoods:** Use recycled air within the hood. All exhaust air is discharged to the outside atmosphere. A type A hood may be converted to a type B3 hood.

Intravenous Solutions Used

- ¼ NS: One fourth normal saline (0.225% sodium chloride)
- ½ NS: One half normal saline (0.45% sodium chloride)
- D10W: 10% dextrose in water
- D5NS: 5% dextrose in normal saline (0.9% solution)
- D5W: 5% dextrose in water
- LRS: Lactated Ringer solution
- NS: Normal saline solution (0.9%)
- SW: Sterile water

Types of Injectable Water

- **Purified water USP:** Not intended for parenteral administration; used in the reconstitution of oral products
- **Water for injection USP:** Is not sterile and cannot be used in aseptic compounding of sterile products
- **Sterile water for injection USP:** Has been sterilized but has no antimicrobial agents; can be used in parenteral solutions
- **Bacteriostatic water for injection USP:** Sterile water with antimicrobial agents that can be used for injection
- **Sterile water for irrigation USP:** Has been sterilized but contains no antimicrobial agents; used as an irrigating solution

Aseptic Technique: Techniques used in the preparation of both hazardous and nonhazardous materials

- Used to prevent the introduction of microbes or unwanted debris that may cause a serious infection to occur
- Includes hand hygiene and wearing personal protective equipment (PPE)

United States Pharmacopeia <797> Risk Levels

- **Low risk level 1:** Uses a Class 100 laminar flow hood; sterile ingredients or devices; only syringe transfer used for measuring or mixing; no more than three products; batch doses have preservatives; ampule extraction requires filter needles; manually prepared total parenteral nutrition (TPN) with only three ingredients
- **Medium risk level 2:** All low risk plus no broad-spectrum antibiotic present even over a predetermined number of days; complex aseptic technique manipulations; multiple doses in one container for multiple patients or multiple doses for one patient
- **High risk level 3:** All low or medium risk plus sterile products compounded from nonsterile ingredients; use of nonsterile device before terminal sterilization; sterile ingredients, components, or devices exposed to air quality; Class 100 hood or partially used and not adequately preserved

Procedures to Prepare Intravenous Admixtures

- The flow hood should be on for at least 30 minutes.
- Wear PPE.
- Clean the laminar flow hood with 70% isopropyl alcohol or another suitable disinfectant. Then clean the pole to hang IV bags, the sides of the hood by moving from the back to the front, and finally the bottom of the hood by moving side to side from the back to the front.
- Collect supplies; check expiration dates and bags for leaks. Remove dust coverings before placing supplies in the hood. Use presterilized needles, syringes, and filters.
- Position supplies in the hood.

HEPA FILTERING SYSTEM STANDARDS

CLASS	RISK LEVELS	SAFETY LEVEL	FILTERING SYSTEM
Class I	Low- to moderate-risk biological	Biosafety level I	HEPA filters exhaust air
Class II	Low- to moderate-risk biological	Biosafety level II	HEPA filters exhaust air to room or to a facility exhaust system
Class III	High-risk biologicals	Biosafety level III	Containment of hazardous materials

- Sterilize puncture surfaces with an alcohol wipe.
- Prevent coring by placing the vial on a flat surface and insert the needle into the rubber closure at a 45- to 60-degree angle. Use downward pressure on the needle and move the needle to a 90-degree angle.
- **Using vials with solutions:** Draw into syringe a volume of air equal to amount of volume being replaced (Figure 3-9). Penetrate the vial without coring. Invert the vial upside down and pull back on the plunger to fill the syringe. Tap to bring air bubbles to the top of the syringe. Transfer the solution to the final container.
- **Vials with lyophilized powder:** Determine the correct volume of diluent and withdraw it. Transfer the diluent into a vial containing the powder. Remove more air from vial than amount of diluent injected. Whirl the vial until the powder is dissolved. Use a new syringe and needle and proceed as if using a vial with solution.

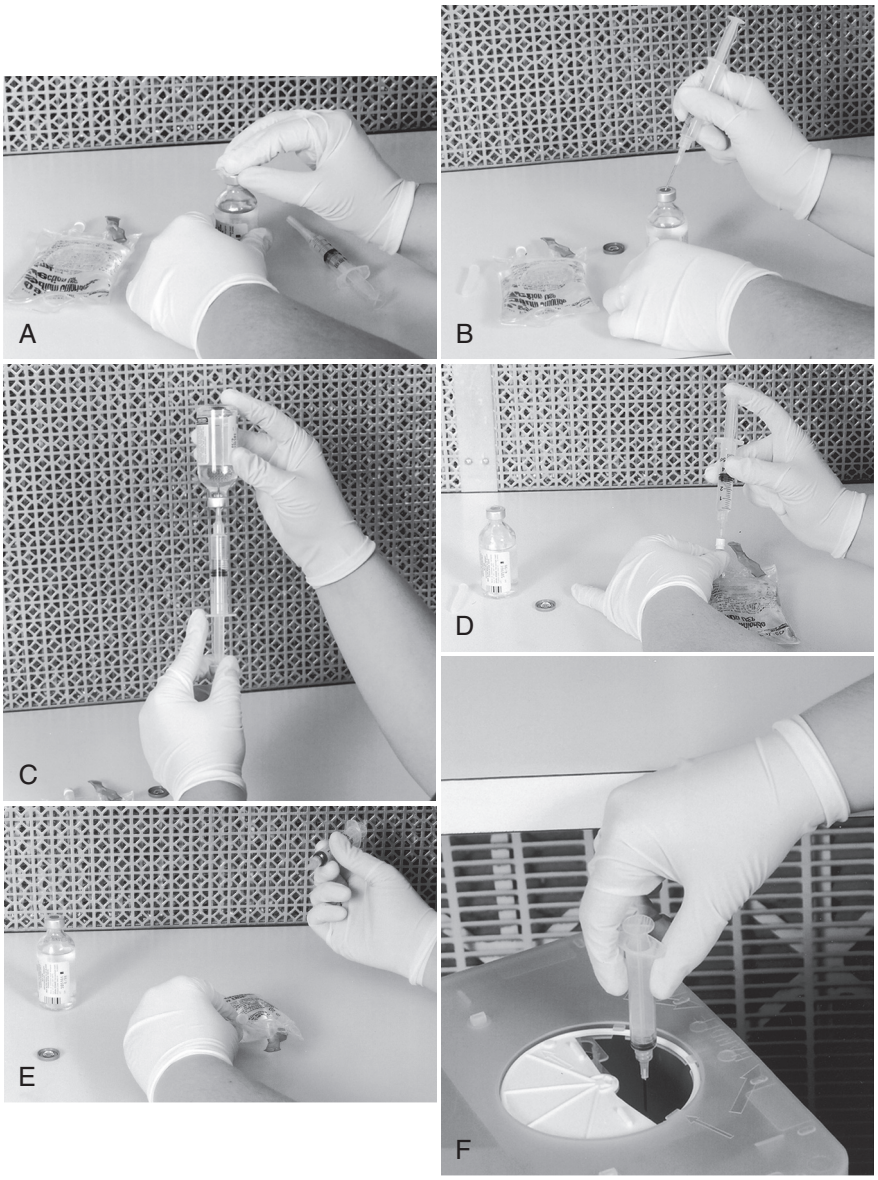

Figure 3-9 Six-step process of aseptic technique in the hood. (Reprinted from Hopper T. *Mosby's pharmacy technician: principles and practice,* ed 3. St Louis, 2012, Saunders.)

- **Using ampules:** Hold the ampule upright and tap it to ensure all liquid is in the bottom of the ampule. Wipe the neck of the ampule with an alcohol swab. Wrap gauze around the neck and gently snap the neck away from the individual. Inspect and use a filter needle or filter straw to withdraw. Hold the ampule downward at a 20-degree angle and withdraw the solution with a filter syringe.

Considerations in Preparing Chemotherapy Medications

Uses the same aseptic techniques used in preparing IV solutions except for the following:

- Chemotherapy requires a vertical laminar airflow hood, which is smaller than a horizontal laminar flow hood.
- Special chemotherapy clothing is worn.
- The hands in a vertical flow hood should not be over the top of any needle, vial, or IV bag.

Considerations in Preparing Parenteral Antineoplastics

- The safety cabinet work surface should be covered with a plastic-backed absorbent paper, which is disposed of in a hazardous container after use.
- Personnel should wear approved gloves for chemotherapy products that are double gloved and a closed-front surgical gown with knit cuffs that is specially designed for handling chemotherapeutic agents. Contaminated gloves or outer gloves should be removed and replaced. If the skin comes in contact with antineoplastics, the area should be washed with soap and water.
- Reconstituted vials should be vented to reduce the possibility of spraying and spillage.
- A sterile alcohol pledget should be wrapped around the needle and vial top during withdrawal of solution.
- External surfaces of syringes and IV bags (bottles) should be wiped clean of contamination.
- When using ampules, wrap the neck of the ampule with a sterile alcohol pledget to protect one's fingers from being cut by the glass.
- Syringes and IV bottles should be properly identified and dated. Cautionary labels should be affixed to the outer bag of the containers.
- The safety cabinet should be wiped down with 70% alcohol on completion of compounding.
- Contaminated needles, syringes, and hazardous waste should be placed in the sharps container. Disposable gowns, gloves, masks, and head and shoe covers should be placed in red hazardous bags.
- Wash hands.
- Dispose of remaining antineoplastic agents according to federal and state regulations.

Considerations in Preparing Total Parenteral Nutrition

- TPN normally contains 50% dextrose, 10% amino acids, and 20% fat.
- Aseptic technique is required because TPN is infused into the right atrium of the heart.
- TPN compounders have been developed that include a multichannel pump for the amino acids, dextrose, fats, and other additives that is connected to a personal computer. The computer assists in the calculations and drives the pump. Micro compounding pumps are used for the electrolytes and other additives (Figure 3-10).
- TPN and peripheral parenteral nutrition (PPN) are premixed from the manufacturer, but electrolytes, vitamins, and medications may be added to the nutrients at the pharmacy.

Compounding Techniques for Total Parenteral Nutrition Solution (Requires Aseptic Technique)

- **Method 1:** Amino acids and dextrose are mixed first. Fat emulsion is added next followed by the additives.
- **Method 2:** Amino acids are added to the fat emulsion. Dextrose is added next followed by the additives.
- **Method 3:** Dextrose, amino acids, and fat emulsion are added simultaneously while swirling and mixing. Additives are incorporated last.

Examples of TPN additives:

- Potassium chloride (KCl)
- Potassium phosphate (KPO_3)
- Calcium gluconate (Ca gluconate)
- Magnesium sulfate ($MgSO_4$)
- Sodium phosphate ($NaPO_4$)
- Sodium chloride (NaCl)
- Multivitamin (MVI)
- Multiple trace elements (MTE)
- Zinc (Zn)

Considerations in Preparing Radiopharmaceuticals

- Radiopharmaceuticals may be diagnostic or therapeutic; they may be oral, IV, or inhaled.
- The individual must wear a meter indicating the radioactive levels to which the individual is exposed.
- Quality-control tests are performed to ensure the radiopharmaceutical is sterile, pyrogen free, and pure.
- Proper handling of isotopes during preparation and disposal must be ensured.
- Radiopharmaceuticals are to be prepared in a vertical flow hood.
- Radiopharmaceuticals have strict packaging requirements, including the use of special shipping containers.
- Safety principles of time, distance, and shielding are observed.

TPN ORDER SHEET

HOME HEALTH | DATE

PATIENT | ADDRESS

TPN FORMULA:

AMINO ACIDS: ☐ 5.5% ☐ 8.5% ☑ 10% ☐ WITH STANDARD ELECTROLYTES	425 mL
DEXTROSE: ☐ 10% ☐ 20% ☐ 40% ☐ 50% ☑ 70% (check one)	357 mL
LIPIDS: ☐ 10% ☑ 20% FOR ALL-IN-ONE FORMULA	125 mL

FINAL VOLUME qsad STERILE WATER FOR INJECTION 400mL	1307 mL

Calcium Gluconate	0.465 mEq/mL	5 mEq
Magnesium Sulfate	4 mEq/mL	5 mEq
Potassium Acetate	2 mEq/mL	mEq
Potassium Chloride	2 mEq/mL	mEq
Potassium Phosphate	3 mM/mL	22 mM
Sodium Acetate	2 mEq/mL	mEq
Sodium Chloride	4 mEq/mL	35 mEq
Sodium Phosphate	3 mM/mL	mM
TRACE ELEMENTS CONCENTRATE	☐ 4 ☐ 5 ☐ 6	mL

Patient Additives:

- ☐ MVC 9 + 3 10 mL Daily
- ☐ HUMULIN-R 10 u Daily
- ☐ FOLIC ACID _____ mg _____ times weekly
- ☐ VITAMIN K _____ mg _____ times weekly
- ☐ OTHER: MVI 12 1.5mL/daily
- ☐ OTHER: _____

Directions:

INFUSE: ☑ DAILY

☐ ____ TIMES WEEKLY

OTHER DIRECTIONS:

Rate:

☐ CYCLIC INFUSION:	☐ CONTINUOUS INFUSION:	☑ STANDARD RATE:
OVER ____ HOURS	AT ____ mL PER HOUR	AT 110 mL PER HOUR
(TAPER UP AND DOWN)		FOR 12 HOURS

LAB ORDERS:

☐ STANDARD LAB ORDERS
SMAC-20, CO_2, Mg+2 TWICE WEEKLY
CBC WITH AUTO DIFF WEEKLY
UNTIL STABLE, THEN:
SMAC-20, CO_2, Mg+2 WEEKLY
CBC WITH AUTO DIFF MONTHLY

☐ OTHER: _____

VALIDATION:

_____

DOCTOR'S SIGNATURE

Print Name: _____

Office Address: _____

Phone: _____

Figure 3-10 Example of a total parenteral nutrition order. (Reprinted from Hopper T. *Mosby's pharmacy technician: principles and practice,* ed 3. St Louis, 2012, Saunders.)

- Special training must be completed if one is to work in a nuclear pharmacy.

Considerations in Preparing Reconstituted Injectable and Noninjectable Medications

- Reconstitution is the process of mixing a liquid and powder to form a suspension or solution.
- Solvent is the larger part of the solution.
- Solute is the agent or ingredient used with solvent.
- Solution is the solvent plus the solute.
- Measure the solute and solvent (distilled water) to be used.
- Add the solute to the solvent in small portions; mix thoroughly.
- Check precipitation for solutions or changes in color.
- Add a new expiration date and time of day to product bottle and affix a "SHAKE WELL" auxiliary label.

Components of a Label for Intravenous Medication

- Name of pharmacy
- Patient's name
- Date the medication was filled
- Ingredients with quantity of each in IV
- Total quantity of IV
- Directions for usage
- Infusion rate
- Any special notes
- Expiration date
- Must be initialed by the technician who prepared it
- Licensed pharmacist's initials
- **Expiration date of repackaged drugs:** Federal law mandates that the expiration date cannot exceed 6 months and cannot exceed 25% of the remaining time on the manufacturer's original expiration date on the bulk container (Figure 3-11).

INFECTION CONTROL

Infection control includes PPE, hand washing, and so on.

- Addresses the issues involving the transmission of germs that may cause infections within a health care setting
- Involves the education of health care providers dealing with the prevention, monitoring, management and investigation of suspected spread of an infection

Item	Description
Date	The date that the drug is made, which includes day, month, and year
Drug	Drug name, usually by generic name then brand name if indicated on log sheet
Dosage form	Tablet, capsule, spansule, troche, liquid, etc.
Manufacturer	Manufacturer of the drug, usually abbreviated
Manufacturer's lot number	Control number located on the side of the label or on the bottom of the bottle
Manufacturer's expiration date	Located with the lot number; remember that if the date indicates only the month, the drug is good through the end of the month
Pharmacy lot number	Each item repackaged in the pharmacy is given a number consecutive to the previously made batch
Pharmacy expiration date	Calculate the new expiration date, which is 6 months or 1/4 of the time of the manufacturer's expiration date, whichever is less
Technician	Must initial the logbook entry
Pharmacist	Each item made must be checked off by a pharmacist

The information on the label of the unit dose item is much less than what is required in the logbook, but it is just as important. The following sample lists the components necessary on a typical unit dose label:

Name of drug
  Generic name
  Trade name (trade name commonly given for the easy identification of the proper medication)

Strength
Dosage form
Pharmacy lot number
Pharmacy expiration date

Figure 3-11 Example of a record log sheet used for documentation.

- Infection transmission includes airborne, droplet, and contact.
- Each health care institution must establish policies and procedures addressing infection control.

EXAMPLES OF INFECTION CONTROL PROCESSES

- Universal precautions (standard precautions) apply to all individuals in an institution who may come in contact with blood, other body fluids, or body substances.
- Gloves must be worn when there is a possibility the individual may come in contact with these substances.
- Hands must be washed after removing the latex gloves.
- Specially trained individuals must be notified for cleanup or removal of contaminated waste.
- Contaminated materials such as syringes, needles, swabs, and catheters must be placed in red plastic containers labeled for disposal of biohazardous materials.
- A first-aid kit must be maintained and adequately stocked for use if an individual does come in contact with contaminated waste or body fluids. Items to be contained in the first-aid kit include adhesive bandages, alcohol, antiseptic or disinfectant, bleach, disposable latex gloves, disposable towels, medical tape, sterile gauze, and plastic bags for contaminated waste disposal.
- Employees should not use patient restrooms; they should only use employee restrooms.
- Medication refrigerators and freezers may only hold medications; they should not be used in the storage of food or drinks.
- Eating is prohibited in any drug preparation or patient care areas.

SPECIFIC PHARMACY INFECTION CONTROL PROCESSES

- All injectable drugs and other sterile products must be compounded under laminar flow hoods.
- Laminar flow hoods must be recertified every 6 months by an independent contractor.
- Routine maintenance of the laminar flow hoods includes cleaning all work surfaces and prefilters.
- Inspection records must be kept on file within the pharmacy department.

HANDLING AND DISPOSAL REQUIREMENTS

These requirements include receptacles, waste streams, and so on.

TYPES OF WASTE

- **Solid waste:** A term used to define all solid, liquid, and gaseous waste
- **Hazardous material:** Any substance or mixture of substances capable of producing adverse effects on the health and safety or the environment of a human being. The Occupational Safety and Health Act requires that all employees be aware of the hazards of chemicals to which they are exposed. The Hazard Communication Standard is based on the belief that all employees have both a need and a right to be informed of the hazards and identities of the chemicals to which they will be exposed. Every institution handling hazardous chemicals must have a written hazard communication program, and it must receive a Safety Data Sheet (formerly Material Safety Data Sheet) from the manufacturer, importer, or distributor for each hazardous chemical in the workplace.
- **Infectious waste:** Includes blood, blood products and bodily fluids, infectious sharps waste, and laboratory waste (contaminated or noncontaminated)

Hazardous Waste Characteristics

- **Ignitability:** Has a flash point less than 60° C. Examples include potassium permanganate, silver nitrate, and collodion.
- **Corrosivity:** Has a pH less than 2 or greater than 12.5. Examples include glacial acetic acid and sodium hydroxide.
- **Reactivity:** Liable to explode, react violently, or release toxic gases when in contact with water. An example is nitroglycerin.
- **Toxicity:** Contains a regulated substance at a concentration above the limit. Examples include zinc and selenium.

Types of Hazardous Waste

- Classified into one of four lists based on their ignitability, corrosivity, reactivity, and toxicity
- The four lists are identified as F-list, K-list, P-list, and U-list.
- Items listed under the P-list and U-list may be found in a pharmacy.

P- AND U-LIST WASTE

- Discarded commercial chemical products
- Defined as a chemical substance that is the commercially pure grade, a technical grade, or a formulation in which the chemical is the sole active ingredient

P-List Waste Examples

- Warfarin >0.3%
- Arsenic trioxide

- Phentermine
- Nicotine
- Physostigmine
- Epinephrine
- Nitroglycerin

U-list Waste Examples

- Mitomycin
- Chloral hydrate
- Chlorambucil
- Cyclophosphamide
- Lindane
- Melphalan
- Mercury
- Phenol
- Reserpine
- Selenium sulfide
- Warfarin <0.3%

EXAMPLES OF HAZARDOUS DRUGS

- asparaginase
- azathioprine
- bicalutamide
- bleomycin
- carmustine
- chloramphenicol
- dacarbazine
- estradiol
- fluoxymesterone
- oxytocin
- progesterone
- raloxifene
- tacrolimus
- tretinonin
- zidovudine

Storage of Hazardous Drugs and Materials

- Only authorized personnel should have access.
- Warnings should be applied to all hazardous drug containers to include the shelves and bins where they are stored.
- Hazardous drugs requiring refrigeration should be stored in a separate refrigerator from nonhazardous drugs.

Handling of Hazardous Drugs and Materials

- PPE that includes laboratory coats, masks, and gloves should be worn at all times.
- Hands should be washed before and after removal of gloves.
- Powder-free gloves should be doubled when handling hazardous drugs; hypoallergenic gloves should be available for those employees allergic to latex.
- The inner glove should be under the cuff and the outer glove should be above the cuff of a disposable lab jacket with a solid front.
- Gloves should be changed hourly or after contamination.
- Glove removal should be such that there is no skin contact with the outside of the gloves.
- Facial masks should be worn to prevent the splashing or spraying of hazardous drugs into the eyes, nose, or mouth.

Preparing Hazardous Drugs

- Should only be prepared in areas designated for preparation.
- Use syringes with Leur-Lok for preparing hazardous drugs.
- Drug-contaminated syringes and needles should be placed in a chemotherapy sharps container.
- Hazardous waste and contaminated materials should be placed in separate trash receptacles from nonhazardous trash.
- The work area should be cleaned and decontaminated before and after each compounding and at the end of each shift.

Disposal of Hazardous Drugs

- Hazardous waste bags should be labeled as "Hazardous Drug Waste"; they should be thick, leakproof, and a different color than other trash bags.
- Hazardous waste bags should be placed in trash receptacles labeled "Hazardous Drug Waste."
- One receptacle should in each area where hazardous drugs are prepared.
- Bags should be sealed when they are full.
- Sharps containers should be used for the disposal of needles and other breakable items; sharps containers should be labeled "Hazardous Drug Waste Only."
- Hazardous waste should be stored in a secure area while waiting for transfer.

CONTROLLED SUBSTANCES

- Controlled substances are classified under P-waste.
- A request for the destruction of controlled substance must be done using a Drug Enforcement Agency (DEA) Form 41 and must be submitted to the DEA 2 weeks before the scheduled destruction.
- Retail pharmacies are permitted one destruction per year; hospital pharmacies may be awarded a "blanket destruction" for controlled substances.

RADIOACTIVE MATERIALS

- The U.S. Department of Transportation (DOT) regulates the shipment of hazardous materials under the Hazardous Materials Transportation

Act of 1994. Radioactive materials are considered hazardous materials. The DOT has set regulations regarding packaging, labeling, and transporting of radioactive materials.

- The shipping container (metal) for transporting radioactive material must be able to maintain the integrity of the product during shipping. The container must be specifically labeled based on the activity of the radioactive material: Radioactive White I, Radioactive Yellow II, and Radioactive Yellow III (which contains the highest concentration of radiation).
- The container must have a "Caution: Radioactive" label with the name of the nucleotide, the quantity, the date, and the time.
- Shipping papers must be inside the shipping container and include the following information: name of nucleotide, quantity, form, label category, emergency response telephone number, information regarding emergency personnel, and pharmacy name. The driver carries a copy of the shipping papers.
- A placard must be on the vehicle if it is carrying Radioactive Yellow III material. Shipped material must be braced inside the transportation vehicle.

CHAPTER 3 REVIEW QUESTIONS

PHARMACY CALCULATIONS

1. How many colchicine tablets each containing 600 mcg may be prepared from 30 g of colchicine?

2. The prescriber ordered atropine sulfate 0.2 mg SC q6h prn. What is the equivalent dose in micrograms?

3. The physician has ordered Coumadin 5 mg to be taken on Monday, Wednesday, and Friday. On Tuesday, Thursday, Saturday, and Sunday, the patient is to receive 2½ mg. How many milligrams will the patient take in 1 week?

4. The prescriber ordered 0.05 mg of Sandostatin PO, a hormone. How many micrograms are in this dose?

5. You have a 2-mL ampule of caffeine Na benzonatate containing gr viiss. If the physician orders gr v, how many milliliters will you dispense?

6. How many grams of reserpine would be required to make 25,000 tablets, each containing 250 mcg of reserpine?

7. How many milligrams are in one tablet of Nitrostat 1/150 gr?

8. How many grams of antipyrine should be used in preparing the following prescription?

Rx	Antipyrine 5%
Glycerin ad	60

9. A pediatric patient is to be given a 70-mg dose of Dilantin by administration of an oral suspension containing 50 mg of Dilantin per 5 mL. How many milliliters of the suspension must be administered?

10. A prefilled syringe of furosemide contains 20 mg of drug in 2 mL of solution. How many micrograms of drug would be administered by an injection of 0.5 mL of the solution?

11. The usual dose range of dimercaprol is 2.5 mg to 5 mg/kg of body weight. What would be the dose range for a person weighing 165 lb?

12. How many chloramphenicol capsules each containing 250 mg of chloramphenicol are needed to provide 25 mg/kg/day of body weight for 1 week for a person weighing 154 lb?

13. Cyclosporine is an immunosuppressive agent administered before and after organ transplantation at a single dose of 15 mg/kg. How many milliliters of a 50-mL bottle containing 100 mg of cyclosporine per milliliter would be administered to a 140-lb kidney transplant patient?

14. How many milliliters of aminophylline injection containing 250 mg in each 10 mL should be used in filling a medication order calling for 15 mg of aminophylline?

15. The dose of a drug is 500 mcg/kg of body weight. How many milligrams should be given to a child weighing 55 lb?

16. The antiviral ophthalmic drug fomivirsen sodium (Vitravene) has been ordered by the physician, 330 mcg. The vial is labeled 6.6 mg/mL. How many milliliters contain the prescribed dose?

17. The physician ordered 0.725 mg of droperidol (Inapsine) IV stat. The vial reads 2.5 mg in 2 mL. Calculate the amount of drug you will administer to this patient in milliliters.

18. A patient is to receive a 100-mg dose of gentamicin. The medication is available in an 80-mg/mL vial. How many milliliters should the patient receive?

19. A drug has a concentration of 20 mg/mL. How many grams of the drug are in ½ L of the solution?

20. A dose of antacid is 1 tbsp. How many doses can be prepared from a pint bottle?

21. You are to prepare a dose of 300 mg and the tablets are available in 75-mg strength. How many tablets will the pharmacist need to dispense if the patient is to take 300 mg bid for 1 week?

22. What is the percent of a 1:25 (w/v) solution?

23. What is the percent of a 1:200 (w/w) ointment?

24. Convert 25° C to F.

25. Convert 65° F to C.

26. Convert 40° C to F.

27. Convert 45° F to C.

28. The drug vial contains 1,000,000 units of penicillin G. The label directions state: Add 2.3 mL of sterile water to the vial, 1.2 mL = 500,000 units. How many milliliters equal 200,000 units?

29. A patient is to receive 25 units of the hormonal drug vasopressin (Pitressin) IM. If the label reads 50 units per 2 mL, how many milliliters will you administer to the patient?

30. The prescriber ordered 175,000 units of urokinase IVPB. The vial directions read: "Add 4.2 mL to vial and each mL will contain 50,000 units." How many milliliters will you prepare?

31. The order is for K-Lor 60 mEq PO stat. Each packet contains 20 mEq. How many packets of K-Lor will you need?

32. A 20% KCl solution has a strength of 40 mEq/tbsp. How many milliliters need to be dispensed for the patient to receive 20 mEq?

33. If the dose of a drug is 150 mcg, how many doses are contained in 0.120 g?

34. If a physician prescribed cephalexin 250 mg qid for 10 days, how many milliliters of cephalexin oral suspension containing 250 mg/tsp should be dispensed?

35. A 25-lb child is to receive 4 mg of phenytoin per kg of body weight as an anticonvulsant. How many milliliters of pediatric phenytoin suspension containing 30 mg/5 mL should the child receive?

36. If a 3-year-old child weighing 33 lb accidentally ingested 20 81-mg aspirin tablets, how much aspirin did the child ingest on a milligram per kilogram basis?

37. The usual pediatric dose of cefazolin sodium is 25 mg/kg/day divided equally into three doses. What would be the single dose in milligrams for a child weighing 44 lb?

38. If a child is 4 years old and the adult dose of medication is 100 mg, how much medication should the child receive?

39. If a child is 36 months old and the adult dose is 250 mg, how much medication should the child receive?

40. If a child is 2½ years old and the adult dose is 100 mg, how many milligrams should the child receive?

41. If a child weighs 45 lb and the adult dose is 50 mg, how much medication should the child receive?

42. If a child weighs 50 lb and the adult dose is 1 tbsp, how many milliliters should the child receive?

43. If a child weighs 60 lb and the adult dose is 500 mg, how many milligrams should the child receive?

44. If a child weighs 15 kg and the adult dose is 75 mg, how many milligrams should the child receive?

45. If 125 mL of liquid weighs 95 g, what is its specific gravity?

46. A volume of fluid weighs 80 g and has a specific gravity of 1.05. What is its volume?

47. How many grams are in 100 mL of a liquid if its specific gravity is 1.25?

48. What is the specific gravity of a substance that weighs 60 g and occupies a volume of 75 mL?

49. How many grams of silver nitrate are needed to make 1 L of a 0.25% solution?

50. A pharmacist has received an order to prepare 1 lb of 5% (w/w) salicylic acid ointment. How much salicylic acid is needed to prepare this ointment?

51. How many grams of NaCl are in 250 mL of ½ NS (0.45%)?

52. How many grams are in 1 L of a 1:200 solution?

53. How many micrograms are in 1.0 mL of a 1:100 solution?

54. If a pharmacist adds 3 g of hydrocortisone to 120 g of a 5% hydrocortisone cream, what is the final percentage strength of hydrocortisone in the product?

55. How many 600-mg ibuprofen tablets will be needed to make 8 oz of a 15% ointment?

56. How many milliliters of a 3% (w/v) solution will be necessary to make 6 oz of a 1:200 solution?

57. A stock bottle of Lugol solution contains 2 oz from the original pint bottle. The pharmacy technician is able to prepare four 8-oz bottles of a more dilute 4% solution. What was the original percentage strength of the Lugol solution?

58. You receive an order for 125 mL of 4% acetic acid solution and you have in stock 75% acetic acid solution. How many milliliters of the 75% solution will you need?

59. If 100 mL of 25% (w/v) solution is diluted to 1 L, what will be the percentage strength (w/v)?

60. You are asked to prepare 80 mL of a 72% lidocaine solution, and you have in stock a 75% solution. How many milliliters of the 75% solution will you use?

61. The formula for a buffer solution contains 1.24% (w/v) of boric acid. How many milliliters of a 10% (w/v) boric acid solution should be used to obtain the boric acid needed in preparing 1 gal of buffer solution?

62. How many grams of Eucerin should be added to 4 oz of a 10% ointment to make a 7% ointment?

63. You are asked to prepare 50 mL of a 1:100 rifampin suspension, and you have in stock a 1:20 rifampin suspension. How many milliliters of the 1:20 suspension will you need?

64. You are asked to prepare 125 mL of a 1:8 nystatin suspension, and you have in stock a 1:6 solution. How many milliliters of the 1:6 nystatin solution will you need?

65. You are asked to prepare 50 mL of a 1:3 folic acid solution, and you have in stock a 1:2 solution. How many milliliters of the 1:2 solution will you use?

66. How many milliliters of a 1:50 (w/v) stock solution of a chemical should be used to prepare 2 L of a 1:4000 (w/v) solution?

67. How many milliliters of water should be added to 500 mL of a 1:2000 (w/v) solution to make a 1:5000 (w/v) solution?

68. How much water should be added to 1 quart of 70% isopropyl alcohol to prepare a 20% solution for soaking sponges?

69. How much metoclopramide 5 mg/mL is used to make 10 mL of 0.5 mg/mL solution?

70. Prepare 15 mL of cefazolin dilution 50 mg/ mL from a stock of 1 g/5 mL. How many milliliters of the diluent and cefazolin will be needed?

71. Make 30 mL of a vitamin B_{12} dilution with a concentration of 100 mcg/mL from a stock solution of 1 mg/mL. How much vitamin B_{12} and diluent are needed?

72. You are asked to prepare 36 mL of a 1:4 Bactrim solution, and you have in stock 30% solution. How many milliliters of the 30% solution will you use?

73. You are asked to prepare 52 mL of a 28% Flagyl solution, and you have in stock 42 g/mL solution. How many milliliters of the 42 g/mL will you use?

74. How many milliliters of a ½% solution of gentian violet should be used in preparing 500 mL of a 1:100,000 solution?

75. How many milliliters of a 5% stock solution are needed to prepare 1 pint of a solution containing 100 mg of the chemical per liter?

76. How many milliliters of a 95% (v/v) alcohol should be used in preparing 1 pint of a 75% (v/v) solution?

77. In what proportions should alcohols of 95% and 50% strengths be mixed to prepare 250 mL of a 70% alcohol solution?

78. How many milliliters of a 1:2000 iodine solution and a 7.5% iodine solution are needed to make 120 mL of a 3.5% solution?

79. How many milliliters of a 2.5% (w/v) chlorpromazine hydrochloride injection and how many milliliters of a 0.9% (w/v) sodium chloride injection should be used to prepare 500 mL of a 1.25% (w/v) chlorpromazine hydrochloride injection?

80. How much 10% dextrose solution and 20% dextrose solution should be mixed to prepare 1 L of a 12.5% dextrose solution?

81. In what proportion should 5% and 1% hydrocortisone ointments be mixed to prepare a 2.5% ointment?

82. Prepare 300 mL of 7.5% dextrose using SWFI and D20W. How much of each is needed?

83. Prepare 500 mL of D12.5W. You have on hand D5W, D10W, and D20W. How much of which two solutions will you use?

84. How many grams of a 2.5% hydrocortisone cream should be mixed with 240 g of a 0.25% hydrocortisone cream to make a 1% cream?

85. What is the total volume that will be delivered if a patient receives normal saline solution at 25 mL/hr for 24 hr?

86. Calculate the flow rate to be used to infuse 1000 mL of NS over 8 hours if the set delivers 10 gtt/mL.

87. 1 L NS is to be administered over 24 hr. The administration set to be used has a DF of 15 gtt/mL. What is the rate of infusion in
    a. mL/hr?
    b. gtt/min?

88. 1500 mL TPN solution is given IV at 75 mL/hr using an administration set with a drop factor of 20 gtt/mL. If the infusion starts at 0900 hours, when will it end?

89. Medication: Solu-Cortef 250 mg
    a. Fluid volume: 250 mL
    b. Time of infusion: 4 hr
    c. How many mL/hr? How many mg/hr?

90. How many milliliters of IV fluid will a patient receive if infused at the rate of 120 mL/hr over 3½ hr?

91. What will be the rate in gtt/min if a patient receives 1 L of an IV fluid over an 8-hr period if the drop factor = 15 gtt/mL?

92. If 1000 mL at 20 drops/min is administered using a 15-drop set, what is the flow rate in milliliters per hour?

93. If 500 mL of an IV solution contains 0.1 g of a drug, at what flow rate in milliliters per minute should the solution be administered to provide 1 mg/min of the drug?

94. An initial heparin dose of not less than 150 units/kg of body weight has been recommended for open heart surgery. How many milliliters of an injection containing 5000 heparin units per milliliter should be administered to a 280-lb patient?

95. An IV piggyback of lincomycin containing 1 g of drug in 100 mL is to be infused over 1½ hours. The IV set is calibrated to deliver 15 gtt/mL. How many drops per minute will the patient receive?

96. An IV piggyback of pentamidine isethionate containing 300 mg of drug in 150 mL of D5W is to be infused over 2 hr. The IV set is calibrated to deliver 20 gtt/mL. How many drops per minute should be administered?

97. An IV piggyback of enalapril maleate containing 10 mg of drug in 50 mL of 0.9% sodium chloride injection is to be infused over 1 hour. The IV set is calibrated to deliver 15 gtt/mL. How many drops per minute should be administered?

98. A physician orders 3 L D5W to be administered over 24 hr. How many drops per minute will be delivered using an administration set calibrated to deliver 30 drops per milliliter?

99.

Rx:	
Hydrocodone bitartrate	0.2 g
Phenacetin	3.6 g
Aspirin	6.0 g
Caffeine	0.6 g
M ft	caps no 24
Sig	i cap tid prn pain

a. How many milligrams of hydrocodone bitartrate would be contained in each capsule?
b. What is the total weight, in milligrams, of the ingredients in each capsule?
c. How many milligrams of caffeine would be taken daily?

Carafate	400 mg/5 mL
Cherry syrup	40 mL
Sorbitol solution	40 mL
Flavor qs	
Purified water ad	125 mL
Sig: 5 mL tid	

100. How many 1-g Carafate tablets should be used in preparing the prescription?

101. From the following formula for iodine topical solution, USP, calculate the number of grams of iodine needed to prepare 12 dozen 15-mL containers of the solution.

Iodine	20 g
Sodium iodide	24 g
Purified water ad	1000 mL

102. From the following formula, calculate the quantities to make 120 mL of benzyl benzoate lotion.

Benzyl benzoate	125 mL
Triethanolamine	2.5 mL
Oleic acid	10 mL
Purified water, to make 500 mL	

103. Each 5 mL of a pediatric cough syrup is to contain the following amounts of medications. Calculate the amount of each ingredient to prepare a gallon of the syrup.

Dextromethorphan hydrobromide	7.5 mg
Guaifenesin	100 mg
Flavored syrup, to make 5.0 mL	

104. The following is a formula for psoriasis ointment (*International Journal of Pharmaceutical Compounding* 2:305, 1998). Calculate, in grams, the quantity of each ingredient needed to make 1 lb of the ointment.

Coal tar	2.0 g
Precipitated sulfur	3.0 g
Salicylic acid	1.0 g
Lidex ointment	24.0 g
Aquabase	70.0 g

105. The following is a formula for 100 triple-estrogen capsules (*International Journal of Pharmaceutical Compounding* 1:187, 1997). Calculate the quantities of the first three ingredients in grams and the last two ingredients in kilograms required to prepare 2500 capsules.

Estriol	200 mg
Estrone	25 mg
Estradiol	25 mg
Polyethylene glycol	145,020 g
Polyethylene glycol	335,020 g

CHAPTER 3 REVIEW QUESTIONS

MULTIPLE CHOICE

1. Where should one place used syringes?
   a. In a biohazard container
   b. In a cardboard box
   c. In a locked cabinet
   d. In a sharps container

2. Which of the following is not a universal precaution?
   a. Special handling of chemotherapy agents
   b. Using a sharps container to store used syringes and needles
   c. Wearing jewelry while preparing IV admixtures
   d. Wearing protective clothing while preparing IV admixtures

3. What is the process of mixing a liquid and powder to form a suspension or solution?
   a. Geometric dilution
   b. Levigation
   c. Reconstitution
   d. Trituration

4. Which of the following is not a characteristic of an absorption base?
   a. Anhydrous
   b. Difficult to spread
   c. Nongreasy
   d. Nonwashable

5. If a pharmacy technician is using the continental (dry gum) method, what would he or she be compounding?
   a. Capsules
   b. Emulsions
   c. Suppositories
   d. Syrups

6. What should be used to clean a laminar flow hood?
   a. 70% rubbing alcohol
   b. 70% isopropyl alcohol
   c. 95% isopropyl alcohol
   d. 95% ethyl alcohol

7. What technique is used in mixing two ingredients of unequal quantities?
   a. Blending
   b. Geometric dilution
   c. Levigation
   d. Spatulation

8. What type of agent increases the viscosity of a suspension?
   a. Emulsifier
   b. Flocculating agent
   c. Mucilage
   d. Thickening agent

9. What type of ointment base is Aquaphor?
   a. Absorption
   b. Oleaginous
   c. Oil–water emulsion base
   d. Water–oil emulsion base

10. Which of the following ointment bases is anhydrous?
    a. Oleaginous
    b. Water-oil emulsion base
    c. Oil-water base
    d. Water-miscible base

11. Which of the following containers is a single-unit container intended for parenteral administration only?
    a. Tight container
    b. Single-unit container
    c. Single-dose container
    d. Unit-dose container

12. What dosage form can be prepared by the dry gum method, wet gum method, or beaker method?
    a. Capsules
    b. Emulsions
    c. Spirits
    d. Suspensions

13. Which dosage form can be prepared by the heat method?
    a. Elixir
    b. Suppository
    c. Syrup
    d. Tincture

14. Which dosage form can be prepared with either the compression mold or the fusion mold?
    a. Pills
    b. Suppositories
    c. Tablets
    d. Timed-released dosage forms

15. What type of an ointment base is white petrolatum?
    a. Absorption base
    b. Oleaginous
    c. Water–oil emulsion base
    d. Water–miscible base

16. Which of the following does not need to be placed in biohazard bag?
    a. Gloves
    b. Gowns
    c. Masks
    d. Needles

17. What type of substance is composed of 50% dextrose, 20% fat, and 10% amino acid?
    a. Partial parenteral nutrition
    b. Peripheral parenteral nutrition
    c. Total parenteral nutrition
    d. Total peripheral nutrition

18. Which of the following is not an advantage of a solid dosage form?
    a. Convenient for self-medication
    b. Takes a longer time for the medication to take effect
    c. Easy to package and dispense
    d. Lacks taste or smell

19. Which dosage form is contained in a gelatin shell?
    a. Capsule
    b. Effervescent salts
    c. Pastilles
    d. Suppositories

20. Which dosage form may be prepared by either compressing or molding?
    a. Capsule
    b. Pellet
    c. Plaster
    d. Tablet

21. Which dosage form releases carbon dioxide when it is dissolved in water?
    a. Effervescent salts
    b. Plasters
    c. Powders
    d. Troches

22. Which of the following is not a disadvantage of liquid?
    a. Deterioration and loss of potency occur quickly
    b. Easier to swallow than solid dosage forms
    c. Interactions develop owing to changes in solubility
    d. Requires sweetening and flavoring to be palatable

23. Which type of solution is a clear, sweetened, flavored hydroalcoholic containing water and alcohol?
    a. An aromatic water
    b. An elixir
    c. A suspension
    d. A syrup

24. What type of dispersion is either water in oil or oil in water?
    a. An emulsion
    b. A gel
    c. A lotion
    d. An ointment

25. Which of the following dosage forms is an aqueous solution containing sucrose or sucrose substitute?
    a. Elixir
    b. Spirit
    c. Syrup
    d. Tincture

26. Which of the following dosage forms is not an example of dispersion?
    a. Gel
    b. Liniment
    c. Lotion
    d. Suspension

27. Which of the following dosage forms is not an example of a solution?
    a. Elixir
    b. Emulsion
    c. Enema
    d. Syrup

28. Which of the following dosage forms is not an example of a sustained-release dosage form?
    a. Controlled action
    b. Depot
    c. Pastille
    d. Repository

29. Which type of solution is a topical dosage form containing pyroxylin and is dissolved in alcohol and ether?
    a. Collodion
    b. Extract
    c. Liniment
    d. Spirit

30. How many phases are in a suspension?
    a. Two
    b. Three
    c. Four
    d. Five

31. Which type of dispersion is similar to an ointment but contains more solid materials?
    a. Cream
    b. Gel
    c. Lotion
    d. Paste

32. What type of products must be isotonic?
    a. External medications
    b. Ophthalmic products
    c. Oral inhalation products
    d. Otic preparations

33. Which of the following is not a dispersion?
    a. Cream
    b. Gel
    c. Solution
    d. Suspension

34. Which of the following is not a delayed-release dosage form?
    a. Controlled release
    b. Repository
    c. Sublingual tablet
    d. Time release

35. Which of the following is not a solid dosage form?
    a. Pill
    b. Suppository
    c. Tablet
    d. All are solid dosage forms

36. Which federal agency is responsible for hazardous waste and materials?
    a. DEA
    b. FDA
    c. ISMP
    d. OSHA

37. What is the maximum amount of time that can be assigned to a repackaged drug?
    a. 3 months
    b. 6 months
    c. 9 months
    d. 12 months

38. Which of the following is not required on the label of a repackaged medication?
    a. Date of repackaging
    b. Generic name of the medication
    c. Manufacturer's name and lot number
    d. Expiration date after repackaging

39. Which of the following information is not required on a repackaging log?
    a. Date of repackaging
    b. Expiration date after repackaging
    c. Pharmacist's initials
    d. Color

40. Where is the piggyback placed in comparison to the primary IV?
    a. At the same height
    b. Higher than
    c. Lower than
    d. Does not matter

41. In the preparation of a 3-1 solution, what is the order of adding the ingredients to eliminate the possibility of the emulsion of "oilingout"?
    a. Amino acids, fats, dextrose
    b. Fats, amino acids, dextrose
    c. Dextrose, amino acids, fats
    d. Dextrose, fats, amino acids

42. How often must HEPA filters be certified?
    a. Every 3 months
    b. Every 6 months
    c. Every year
    d. Every 2 years

43. How often must laminar flow hoods be certified?
    a. Every 3 months
    b. Every 6 months
    c. Every year
    d. Every 2 years

44. Which of the following is an example of an electrolyte that may be used in a TPN?
    a. Ca gluconate
    b. KCl
    c. $MgSO_4$
    d. All of the above

45. What is the sensitivity of a class A balance?
    a. 5 mg
    b. 6 mg
    c. 10 mg
    d. 20 mg

46. What type of spatula should be used in measuring corrosive ingredients?
    a. Plastic
    b. Rubber
    c. Steel
    d. All the above

47. What type of alcohol should be used to clean a laminar flow hood?
    a. 70% isopropyl alcohol
    b. 70% methyl alcohol
    c. 70% rubbing alcohol
    d. All the above

48. What is the name of the opening of a needle?
    a. Bevel
    b. Hilt
    c. Lumen
    d. Shaft

49. What type of environment should a laminar flow hood provide?
    a. ISO 5, formerly known as a Class 100 area
    b. ISO 6, formerly known as a Class 1000 area
    c. ISO 7, formerly known as a Class 10,000 area
    d. ISO 8, formerly known as a Class 100,000 area

50. What is used to measure volumes less than 1.5 mL?
    a. 5-mL conical graduate
    b. 5-mL cylindric graduate
    c. Pipette
    d. Syringe

51. What term refers to the space between the HEPA filter and the sterile product being prepared in a laminar flow workbench?
    a. Buffer area
    b. Critical area
    c. Critical site
    d. Direct Compounding Area (DCA)

52. Which of the following may be used in a parenteral solution?
    a. Purified water USP
    b. Water for injection USP
    c. Sterile water for injection USP
    d. Sterile water for irrigation USP

53. Which size capsule has the greatest capacity?
    a. 0
    b. 1
    c. 2
    d. 3

54. How long should the blower be on for a laminar airflow hood?
    a. 10 minutes
    b. 15 minutes
    c. 20 minutes
    d. 30 minutes

55. What type of laminar flow hood can be converted to a type B3 hood?
    a. Type A hood
    b. Type A1 hood
    c. Type B1 hood
    d. Type B2 hood

56. How often does a pharmacy balance need to be certified?
    a. Every 3 months
    b. Every 6 months
    c. Every 9 months
    d. Every 12 months

57. What type of balance must a pharmacy have?
    a. Class A
    b. Class B
    c. Electronic
    d. Triple beam

58. What is the air velocity of a laminar flow hood?
    a. 70 linear feet/min (±20%)
    b. 80 linear feet/min (±20%)
    c. 90 linear feet/min (±20%)
    d. 100 linear feet/min (±20%)

59. Which of the following is not required on IV admixture labeling?
    a. Beyond-use date
    b. Drip rate
    c. Ingredients and quantities
    d. Physician's name

60. Who is responsible for the transportation of hazardous materials?
    a. Department of Transportation (DOT)
    b. Environmental Protection Agency (EPA)
    c. Food and Drug Administration (FDA)
    d. The Joint Commission (TJC)

61. Which of the following symbols indicates the highest level of radiation?
    a. Radioactive White I
    b. Radioactive Yellow II
    c. Radioactive Yellow III
    d. Radioactive Orange IV

62. Which of the following auxiliary labels should be affixed to a reconstituted medication?
    a. For Ophthalmic Use
    b. For Otic Use
    c. Refrigerate
    d. Shake Well

63. Which types of substances require a SDS (formerly known as MSDS)?
    a. Hazardous drugs and chemicals
    b. Investigational drugs
    c. Intravenous admixtures
    d. OTC drugs

64. When must an SDS (formerly known as MSDS) be provided to the patient?
    a. When dispensing a controlled substance
    b. When dispensing a hazardous substance
    c. When dispensing an investigational drug
    d. On request from the patient

65. How do ampules differ from vials?
    a. Ampules can be used multiple times.
    b. Ampules remain a closed system upon breaking.
    c. Ampules require the use of a filter needle.
    d. Vials require the use of a filter needle.

66. An LVP contains a potent medication that requires a constant infusion of the medication into the patient. Which of the following should be used?
    a. Electronic infusion device
    b. Hand clamp
    c. IVP
    d. Roller clamp

67. Which of the following balances can be used to weigh up to 5 kg of a substance?
    a. Class A
    b. Counter balance
    c. Digital
    d. All of the above

68. Which of the following can be used to curb infections in a hospital pharmacy?
    a. Cleaning the laminar airflow workbench
    b. Using aseptic technique
    c. Wearing PPEs
    d. All of the above

69. Which standards apply to sterile compounding?
    a. OSHA standards
    b. State Board of Pharmacy standards
    c. USP <795>
    d. USP <797>

70. Which of the following dosage forms would be require sterile compound?
    a. Oral solution
    b. Suppository
    c. Topical suspension
    d. TPN

71. Which of the following represents intravenous feeding?
    a. Enteral nutrition
    b. Oral nutrition
    c. Total parenteral nutrition
    d. All of the above

72. Which of the following types of laminar airflow workbenches is used in preparing chemotherapeutic agents?
    a. Horizontal
    b. Open
    c. Vertical
    d. All of the above

73. How much time does the ASHP recommend an individual wash his or her hands before compounding?
    a. 15 seconds
    b. 30 seconds
    c. 45 seconds
    d. 60 seconds

74. According to USP <797>, which of the following should not be worn during compounding?
    a. Artificial nails
    b. Gloves
    c. Hair ties
    d. All of the above

75. Which of the following are ways by which infections can be transmitted in a health care setting?
    a. Airborne transmission
    b. Contact transmission
    c. Droplet transmission
    d. All of the above

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Chapter 4

Medication Safety

Chapter Objectives

Upon completion of Chapter 4, the pharmacy technician student will be able to

1. List the five patient rights.
2. Discuss medication errors, including:
   - Differentiate between the various types of medication errors and the characteristics of each.
   - Recall the various causes of medication errors.
   - Explain the Medication Error Reporting and Prevention classification of medication errors.
3. Discuss safety strategy resources, including:
   - Identify the various agencies that are involved in medication safety.
   - Name the goals of The Joint Commission to improve patient safety.
   - Discuss the various Institute of Safe Medication Practices' resources and tools available to pharmacies to reduce medication errors.
4. Describe the responsibilities of the pharmacist in medication error prevention, and list examples of drug classifications that should be avoided in elderly adults.
5. Describe the requirements of inventory maintenance in avoiding medication errors.
6. Identify the agencies that track medication errors and Medication Error Reporting and Prevention recommendations.
7. Explain the advantages of electronic prescribing and automation in prescription processing and provide examples.
8. Identify strategies that can be used by pharmacy technicians, pharmacists, and pharmacies to ensure medication errors are reduced.

PTCB Knowledge Domains

- **4.1** Error prevention strategies for data entry (e.g., prescription or medication order to correct patient)
- **4.2** Patient package insert and medication guide requirements (e.g., special directions and precautions)
- **4.3** Identify issues that require pharmacist intervention (e.g., DUR, ADE, OTC recommendation, therapeutic substitution, misuse, missed dose)
- **4.6** Common safety strategies (e.g., tall man lettering, separating inventory, leading and trailing zeros, limit use of error prone abbreviations)

ExCPT Knowledge Domains

- **3.2** Preparing/dispensing prescriptions
  - ***3.2.1*** Avoiding errors (such as sound-alike/look-alike names)
  - ***3.2.2*** Systems for checking prescriptions
  - ***3.2.3*** Automated dispensing systems
  - ***3.2.6*** Purpose and use of patient records

PATIENT RIGHTS OF MEDICATION SAFETY

Every patient is entitled to the following:

- The right drug
- The right dose
- The right dosage form
- The right route of administration
- The right time of administration

MEDICATION ERRORS

A medication error is a preventable mistake that involves medicine, whether prescription or over the counter. It does not matter whether it is intentional or unintentional. A medication does not need to produce harm to the patient. Often medication errors go undetected.

TYPES OF ERRORS

1. Prescribing errors
   a. Route of administration not specified
   b. Patient allergies
   c. Incorrect strength of medication
   d. Incomplete medication name
   e. Quantity and refills omitted
   f. Additional directions required
2. Dispensing errors
   a. Mechanical: Occurs during preparation and dispensing of a prescription by either a pharmacy technician or pharmacist. Examples of mechanical errors include errors in prescription interpretation, transcription, and performing pharmacy calculations.
   b. Judgment: Result of a pharmacist making an incorrect decision during the screening of a patient, during drug utilization evaluation or counseling the patient
3. Administration errors
   a. Oral medications given intravenously
   b. Enteral formulas administered parenterally
   c. Intravenous medications administered intrathecally
   d. Intramuscular preparations administered intravenously
   e. Intravenous syringes used to measure doses of oral medications
   f. Ear medications being placed in the eye
   g. Irrigation solutions being administered intravenously

TYPES OF MEDICATION ERRORS[a]

TYPE	DEFINITION
Prescribing error	Incorrect drug selection (based on indications, contraindications, known allergies, existing drug therapy, and other factors), dose, dosage form, quantity, route, concentration, rate of administration, or instructions for use of a drug product ordered or authorized by physician (or other legitimate prescriber); illegible prescriptions or medication orders that lead to errors that reach the patient
Omission error[b]	The failure to administer an ordered dose to a patient before the next scheduled dose, if any
Wrong time error	Administration of medication outside a predefined time interval from its scheduled administration time (this interval should be established by each individual health care facility)
Unauthorized drug error[c]	Administration to the patient of medication not authorized by a legitimate prescriber for the patient
Improper dose error[d]	Administration to the patient of a dose that is greater than or less than the amount ordered by the prescriber or administration of duplicate doses to the patient (i.e., one or more dosage units in addition to those that were ordered)
Wrong dosage-form error[e]	Administration to the patient of a drug product in a different dosage form than ordered by the prescriber
Wrong drug-preparation error[f]	Drug product incorrectly formulated or manipulated before administration
Wrong administration-technique error[g]	Inappropriate procedure or improper technique in the administration of a drug
Deteriorated drug error[h]	Administration of a drug that has expired or for which the physical or chemical dosage-form integrity has been compromised
Monitoring error	Failure to review a prescribed regimen for appropriateness and detection of problems, or failure to use appropriate clinical or laboratory data for adequate assessment of patient response to prescribed therapy
Compliance error	Inappropriate patient behavior regarding adherence to a prescribed medication regimen
Other medication error	Any medication error that does not fall into one of above predefined categories

[a]The categories may not be mutually exclusive because of the multidisciplinary and multifactorial nature of medication errors.
[b]Assumes no prescribing error. Excluded would be (1) a patient's refusal to take the medication or (2) a decision not to administer the dose because of recognized contraindications. If an explanation for the omission is apparent (e.g., patient was away from nursing unit for tests or medication was not available), that reason should be documented in the appropriate records.
[c]This would include, for example, a wrong drug, a dose given to the wrong patient, unordered drugs, and doses given outside a stated set of clinical guidelines or protocols.
[d]Excluded would be (1) allowable deviations based on preset ranges established by individual health care organizations in consideration of measuring devices routinely provided to those who administer drugs to patients (e.g., not administering a dose based on a patient's measured temperature or blood glucose level) or other factors such as conversion of doses expressed in the apothecary system to the metric system and (2) topical dosage forms for which medication orders are not expressed quantitatively.
[e]Excluded would be accepted protocols (established by the pharmacy and therapeutics committee or its equivalent) that authorize pharmacists to dispense alternate dosage forms for patients with special needs (e.g., liquid formulations for patients with nasogastric tubes or those who have difficulty swallowing), as allowed by state regulations.
[f]This would include, for example, incorrect dilution or reconstitution, mixing drugs that are physically or chemically incompatible, and inadequate product packaging.
[g]This would include doses administered (1) via the wrong route (different from the route prescribed), (2) via the correct route but at the wrong site (e.g., left eye instead of right), and (3) at the wrong rate of administration.
[h]This would include, for example, administration of expired drugs and improperly stored drugs.

MEDICATION ERROR REPORTING AND PREVENTION CATEGORIES

CATEGORY	DEFINITION	TYPE OF RESULTING ERROR
A	Circumstances that have potential for causing errors	No error
B	Error occurred but did not reach patient	Error, no harm
C	Error reached patient but did not cause harm	Error, no harm
D	Error reached patient, did not cause harm but needed monitoring or intervention to prove no harm resulted	Error, no harm
E	Error occurred that may have contributed to or resulted in temporary harm to patient and patient required intervention	Error, harm
F	Error occurred that may have contributed to or resulted in temporary harm to patient and resulted in hospitalization	Error, harm
G	Error occurred that may have contributed to or resulted in temporary or permanent harm to the patient	Error, harm
H	Error occurred that may have contributed to or resulted in harm to patient and required hospitalization to sustain life	Error, harm
I	Error occurred that may have contributed or resulted in patient's death	Error, death

CAUSES OF ERRORS (AS IDENTIFIED BY MEDMARX)

- Performance deficit
- Procedure or protocol not followed
- Transcription inaccurate or omitted
- Improper documentation
- Incorrect computer entry
- Knowledge deficit
- Communication (lack thereof or incorrect)
- Written order
- Incorrect drug distribution center
- Handwriting illegible or unclear

WORKPLACE ISSUES THAT MAY CONTRIBUTE TO MEDICATION ERRORS

- Noise
- Stress
- Multitasking
- Similar medication labels (font size and color of font)
- Medication labels that are difficult to read

MEDICATIONS ASSOCIATED WITH A HIGH INCIDENCE OF MEDICATION ERRORS

- Insulin
- Morphine
- Potassium chloride
- Albuterol
- Heparin
- Vancomycin
- Cefazolin
- Acetaminophen
- Warfarin
- Furosemide

SAFETY STRATEGY RESOURCES

THE JOINT COMMISSION'S GOALS TO IMPROVE PATIENT SAFETY

- Improve the accuracy of patient identification.
- Improve the effectiveness of communication among caregivers.
- Improve the safety of using high-alert medications.
- Improve the safety of using infusion pumps.

The Joint Commission's "Do Not Use" List

Any health care institution accredited by The Joint Commission (TJC) must include the TJC's "Do Not Use" list in their formulary and adhere to the list to reduce medication errors.

The items in the table below must be included on each accredited organization's "Do Not Use" list.

OFFICIAL "DO NOT USE" LIST*

DO NOT USE	POTENTIAL PROBLEM	USE INSTEAD
U, u (unit)	Mistaken for "0" (zero), the number "4" (four) or "cc"	Write "unit"
IU (International Unit)	Mistaken for IV (intravenous) or the number "10" (ten)	Write "International Unit"
Q.D., QD, q.d., qd (daily)	Mistaken for each other	Write "daily"
Q.O.D., QOD, q.o.d., qod (every other day)	Period after the "Q" mistaken for "I" and the "O" mistaken for "I"	Write "every other day"

Continued

OFFICIAL "DO NOT USE" LIST—cont'd

DO NOT USE	POTENTIAL PROBLEM	USE INSTEAD
Trailing zero (X.0 mg)†	Decimal point is missed	Write X mg
Lack of leading zero (.X mg)		Write 0.X mg
MS	Can mean morphine sulfate or magnesium sulfate	Write "morphine sulfate"
MSO_4 and $MgSO_4$	Confused for one another	Write "magnesium sulfate"

*Applies to all orders and all medication-related documentation that is handwritten (including free-text computer entry) or on preprinted forms.
†**Exception:** A "trailing zero" may be used only where required to demonstrate the level of precision of the value being reported, such as for laboratory results, imaging studies that report size of lesions, or catheter/tube sizes. It may not be used in medication orders or other medication-related documentation.

ERROR-PRONE ABBREVIATION LIST

Many pharmacy abbreviations have been misinterpreted and involved in medication errors that have resulted in harmful and sometimes deadly results to patients. These errors have been reported to the Institute of Safe Medication Practices (ISMP) through the ISMP National Medication Errors Reporting Program (ISMP-MERP). The ISMP strongly advocates that these abbreviations, symbols, and dose designations should **NEVER** be used in communicating medical information that includes telephone or verbal prescription, computer-generated labels, labels for drug storage bins, medication administration records, or pharmacy and prescriber computer order entry screens. Examples of these abbreviations, symbols, and dose designations are found in Table 4-1.

A complete listing of these error-prone abbreviations, symbols, and dose designations can be found in Appendix F of this text or at www.ismp.org/Tools/errorproneabbreviations.pdf.

CONFUSED DRUG NAMES

There have been many drug names that either look alike or sound alike that have resulted in medication errors (Table 4-2) and have been identified by reporting them through the ISMP-MERP.

A complete listing of the ISMP's List of Confused Drug Names can be accessed at www.ismp.org/tools/confuseddrug names.pdf.

FOOD AND DRUG ADMINISTRATION AND INSTITUTE OF SAFE MEDICATION PRACTICES LIST OF DRUG NAMES WITH "TALL MAN" LETTERS

The look-alike drug names in the tables that follow have been modified using "tall man" (mixed case) letters to help draw attention to the dissimilarities in their names. Several studies have shown that highlighting sections of drug names using tall man letters can help distinguish similar drug names, making them less prone to mix-ups. The ISMP, the Food and Drug Administration (FDA), TJC, and other safety-conscious organizations have promoted the use of tall man letters as one means of reducing confusion between similar drug names (Table 4-3).

A complete list can be accessed at www.ismp.org/Tools/tallmanletters.pdf.

INSTITUTE OF SAFE MEDICATION PRACTICES LIST OF ADDITIONAL DRUG NAMES WITH RECOMMENDED "TALL MAN" LETTERS

Although this list is not sanctioned by the FDA, the ISMP has recommended that the medications listed in Table 4-4 be incorporated using tall man letters.

A complete list can be accessed at www.ismp.org/Tools/tallmanletters.pdf.

TABLE **4-1** Examples of the Institute of Safe Medication Practices' List of Error-Prone Abbreviations, Symbols, and Dose Designations

ABBREVIATION	INTENDED MEANING	MISINTERPRETATION	CORRECTION
AD, AS, AU	Right ear, left ear, each ear	Mistaken as OD, OS, OU (right eye, left eye, each eye)	Use "right ear," "left ear," or "each ear."
OD, OS, OU	Left eye, left eye, each eye	Mistaken as AD, AS, AU (right ear, left ear, each ear)	Use "right eye," "left eye," or "each eye."
D/C	Discharge or discontinue	Premature discontinuation of medications if D/C (intended to mean "discharge") has been misinterpreted as "discontinue" when followed by a list of discharge medications	Use "discharge" and "discontinue."

TABLE **4-1** **Examples of the Institute of Safe Medication Practices' List of Error-Prone Abbreviations, Symbols, and Dose Designations—cont'd**

ABBREVIATION	INTENDED MEANING	MISINTERPRETATION	CORRECTION
HS	Half-strength	Mistaken as bedtime	Use "half-strength" or "bedtime."
hs	At bedtime, hour of sleep	Mistaken as half strength	Use "half-strength" or "bedtime."
q.d. or QD	Every day	Mistaken as q.i.d, especially if the period after the "q" or the tail of the "q" is misunderstood as an "I"	Use "daily."
per os	By mouth, orally	"Os" can be mistaken as "left eye"	Use "PO," "by mouth," or "orally."
q.o.d. or QOD	Every other day	Mistaken as "qd" (daily), or "qid" (four times daily), if the "o" is poorly written	Use "every other day."
SC, SQ, or sub q	Subcutaneous	SC mistaken as SL (sublingual)	Use "subcut" or "subcutaneously."
UD	As directed	Mistaken as unit dose	Use "as directed."

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TABLE **4-2** **Examples of Confused Drug Names**

Accupril-Aciphex	Clozaril-Cozaril	NexIUM-NexAVAR	SINEquan-Singulair
Actonel-Actos	Cozzar-Zocor	NovoLIN-HumuLIN	sotalol-Sudafed
Adderall-Inderal	Denavir-indinavir	NovoLOG-NovoLIN	SUMAtriptan-ZOLMitriptan
Advair-Advicor	Depakote-Depakote ER	Paxil-Plavix	TEGretol XR-TEGretol
Allegra-Viagra	Diabeta-Zebeta	Paxil-Taxol	Tobrex-Tobradex
ALPRAZolam-LORazepam	Dilacor XR-Pilocar	Precose-Precare	traZODone-traMADol
Axert-Antivert	metroNIDAZOLE-metFORMIN	PriLOSEC-PROzac	tretinoin-ISOtretinoin
buPROPion-busPirone	Miralax-Mirapex	Provera-Proscar	
carvedilol-captopril	Myleran-Alkeran	Retrovir-ritonavir	
CeleBREX-CeleXA	Myleran-Leukeran	RisperDAL-Restoril	
CeleBREX-Cerebyx	Neurontin-Motin	SEROquel-SEROquel XR	
CeleXA-ZyPREXA	Neurontin-Noroxin	SINEquan-SEROquel	

TABLE **4-3** **Examples from the Food and Drug Administration–Approved List of Generic Drug Names with "Tall Man" Letters**

DRUG NAMES WITH "TALL MAN" LETTERS	CONFUSED WITH
buPROPion	busPIRone
clomiPHENE	clomiPRAMINE
cycloSERINE	cycloSPORINE
DAUNOrubicin	DOXOrubicin
glyBURIDE	glipiZIDE
hydrALAZINE	hydrOXYzine
medroxyPROGESTERone	methylPREDNISolone, methylTESTERone
methylTESTOSTERone	medroxyPROGESTerone, methylPREDNISolone
NIFEdipine	niCARdipine
prednisoLONE	predniSONE
sulfADIAZINE	sulfiSOXAZOLE

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TABLE **4-4** **Institute of Safe Medication Practices' List of Additional Drug Names with Recommended "Tall Man" Letters**

DRUG NAME WITH TALL MAN LETTERS	CONFUSED WITH
ALPRAZolam	LORazepam
carBAMazepine	OXcarbamazepine
ceFAZolin	cefoTEtan, cefOXitin, cefTAZidime, cefTRIAXone
CeleBREX	CeleXA
ePHEDrine	EPINEPHrine
FLUoxetine	DULoxetine, PARoxetine
HumaLOG	HumuLIN
ISOtretinoin	tretinoin
KlonoPIN	cloNIDine
metFORMIN	metroNIDAZOLE
NexAVAR	NexIUM
NovoLIN	NovoLOG
OxyCONTIN	oxyCODONE
PriLOSEC	PROzac
QuiNIDine	quiNINE
RisperDAL	rOPINIRole
SandIMMUNE	SandoSTATIN
TEGretol	TRENtal
traMADol	traZODone

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HIGH-ALERT MEDICATIONS

The ISMP has identified specific categories of medications and specific medications that may cause patients significant harm if they are used in error. The pharmacy should make every attempt to separate or identify these medications from other medications to prevent medication errors.

Classes and Categories of High-Alert Medications

- Adrenergic agonists, intravenous (IV) (e.g., EPINEPHrine, phenylephrine, norepinephrine)
- Adrenergic antagonists, IV (e.g., propranolol, metoprolol, labetolol)
- Anesthetic agents, general, inhaled and IV (e.g., propofol, ketamine)
- Antiarrhythmics, IV (e.g., lidocaine, amiodarone)
- Antithrombotic agents, including
  - Anticoagulants (e.g., warfarin, low-molecular-weight heparin, IV unfractionated heparin)
  - Factor Xa inhibitors
  - Direct thrombin inhibitors (e.g., argatroban, bivalirudin, dabigatran, lepirudin)
  - Thrombolytics (e.g., alteplase, reteplase, tenecteplase)
  - Glycoprotein IIb/IIIa inhibitors (e.g., eptifibatide)
- Cardioplegic solutions
- Chemotherapeutic agents, parenteral and oral
- Dextrose, hypertonic, 20% or greater
- Dialysis solutions, peritoneal and hemodialysis
- Epidural or intrathecal medications
- Hypoglycemics, oral
- Inotropic agents, IV (e.g., digoxin, milrinone)
- Insulin, subcutaneous and IV
- Liposomal forms of drugs (e.g., liposomal amphotericin B) and conventional counterparts (e.g., amphotericin B desoxycholate)
- Moderate sedation agents, IV (e.g., dexmedetomidine, midazolam)
- Moderate sedation agents, oral for children (e.g., chloral hydrate)
- Narcotics/opioids
  - IV
  - Transdermal
  - Oral (including lipid concentrates, immediate and sustained-release formulations)
- Neuromuscular blocking agents (e.g., succinylcholine, rocuronium, vecuronium)
- Parenteral nutritional agents
- Radiocontrast agents, IV
- Sterile water for injection, inhalation, and irrigation (excluding pour bottles) or containers of 100 mL or more
- Sodium chloride for injection, hypertonic, greater than 0.9% concentration

Specific High-Alert Medications

- Epoprostenol (Flolan), IV
- Magnesium sulfate injection
- Methotrexate, oral, non oncologic use
- Opium tincture
- Oxytocin, IV
- Nitroprusside sodium for injection
- Potassium chloride for injection concentrate
- Potassium phosphates injection
- Promethazine, IV
- Vasopressin, IV or intravenous

DO NOT CRUSH LIST

The ISMP has established a list of medications that should never be crushed before administration because of a variety of reasons, which include:

- Slow-release dosage form
- Extended-release dosage form
- Enteric-coated dosage form
- May irritate the mucous membrane
- Rate of absorption may be increased
- Coating of tablet may release the drug over a period of time
- Taste
- Skin irritant
- Liquid filled

- Sublingual dosage form
- Film-coated dosage form
- Effervescent tablet
- Teratogenic effect (women who are or may become pregnant should not handle crushed or broken tablets because the medication can be absorbed into the body and produce birth defects to the fetus)
- Local anesthesia of the oral mucosa

Examples of Medications That Should Not Be Crushed

- Accutane
- Actonel
- Adalat CC
- Allegra D
- Ambien CR
- Augmentin XR
- Avodart
- Calan SR
- Cardizem (CD, LA, XL)
- Cymbalta
- Depakote
- Detrol LA
- Ecotrin
- EES 400
- Effexor XR
- Evista
- Flomax
- Glucophage XR
- Indera LA
- Isotretinoin
- Janumet XR
- K-Dur
- Lithobid
- MS Contin
- Nexium
- Nitrostat
- Paxil CR
- Prilosec
- Ritalin (LA, SR)
- Seroquel XR
- Tessalon Perles
- Wellbutrin (SR, XL)

A complete listing of medications that should not be crushed can be accessed at www.ismp.org/Tools/DoNotCrush.pdf.

STANDARD CONCENTRATIONS OF NEONATAL DRUG INFUSIONS

The ISMP and the Vermont Oxford Network (VON) are working to standardize the concentrations for typical neonatal infusions (Table 4-5). The goals of this standardization are to:

- Reduce medication error risk when critically ill neonates are transferred from one facility to another

TABLE **4-5** Standard Concentrations of Neonatal Drug Infusions

DRUG	TYPE(S) OF INFUSION	RECOMMENDED CONCENTRATIONS
acyclovir	Intermittent infusion	7 mg/mL
alprostadil	Continuous infusion	10 mcg/mL
amphotericin B	Intermittent infusion	0.1 mg/mL
amphotericin B liposomal	Intermittent infusion	1 mg/mL
ceFAZolin	Intermittent infusion	100 mg/mL
cefotaxime	Intermittent infusion	100 mg/mL
clindamycin	Intermittent infusion	6 mg/mL
digoxin	Intermittent infusion	20 mcg/mL and 100 mcg/mL
DOBUTamine	Continuous infusion	2000 mcg/mL
DOPamine	Continuous infusion	1600 mcg/mL
EPINEPHrine	Continuous infusion	10 mcg/mL
fentaNYL	Continuous or intermittent infusion	10 mcg/mL
fluconazole	Intermittent infusion	2 mg/mL
furosemide	Continuous or intermittent infusion	2 mg/mL and 10 mg/mL
gentamicin	Intermittent infusion	2 mg/mL and 10 mg/mL
heparin (0.45% NaCl)	Continuous or intermittent infusion	0.5 unit/mL
insulin (regular)	Continuous infusion	0.1 unit/mL 0.5 unit/mL
metroNIDAZOLE	Intermittent infusion	5 mg/mL
midazolam	Continuous or intermittent infusion	0.5 mg/mL (continuous infusion); 1 mg/mL (intermittent infusion)
morphine	Continuous or intermittent infusion	0.1 mg/mL (continuous or intermittent infusion); 0.5 mg/mL (intermittent infusion)
norepinephrine	Continuous infusion	16 mcg/mL
PHENobarbital	Intermittent infusion	10 mg/mL or 65 mg/mL
vancomycin	Intermittent infusion	5 mg/mL

- Stimulate development of standardized infusion device drug libraries
- Provide the demand necessary for all manufacturers to offer commercially prepared standard solutions

GUIDELINES FOR TIMELY ADMINISTRATION OF MEDICATIONS

The ISMP developed guidelines for the administration of medications in an acute care facility where medications are to be administered to the patient either 30 minutes before or 30 minutes after the scheduled time. The guidelines apply only to scheduled medications that are all maintenance doses that are administered in a standard, repeated cycle of frequency, such as q4h, QID, TID, BID, daily, and so on. Scheduled medications do not include:

- STAT and NOW doses
- First doses and loading doses
- One-time doses
- Specifically timed doses
- On-call medications
- Time-sequenced or concomitant medications
- Medications administered at specific times to ensure accurate drug levels
- PRN (as-needed) medications
- Investigational drugs

Time-critical scheduled medications are those for which early or delayed administration of maintenance doses of greater than 30 minutes before or after the scheduled time may cause harm or result in suboptimal therapy or pharmacologic effect. A hospital will determine which medications in its formulary will be placed on this list.

Nontime critical scheduled medications are medications where early or delayed administration within a specific range of either 1 or 2 hours should not cause harm or result in suboptimal therapy or pharmacological effect.

It is the responsibility of both pharmacists and pharmacy technicians to ensure that a patient's medication is present when it is to be administered to the patient by a member of the nursing staff.

PHARMACIST INTERVENTION

Drug Utilization Evaluation (Formerly Known as Drug Utilization Review)

Drug utilization evaluation is mandated by the Omnibus Budget Reconciliation Act of 1990 (OBRA-90). Every patient who has filled a prescription in a particular pharmacy has a patient profile. During the prescription filling process, a new prescription is checked against all of the medications in the patient's profile to determine if a possible interaction may occur, the drug is contraindicated, or the patient may be allergic to the medication. If the computer system detects a possible interaction, a warning (e.g., changing the color of the computer screen) will appear on the screen to alert the pharmacist or pharmacy technician. The pharmacy technician must stop the filling process and alert the pharmacist. The pharmacist will examine the patient's profile and make a decision whether to continue with the filling process. Some factors that may affect the pharmacist's decision include:

- The date the prescription was filled
- Whether the medication is still being taken by the patient
- Whether the physician was aware of the other medication being prescribed
- The severity of the interaction, such as filling a prescription for amoxicillin and patient is taking an oral contraceptive

ADVERSE DRUG EVENTS

Any injury caused by a drug (at normal dosage or caused by an overdose) and any harm associated with the use of drug (e.g., discontinuation of drug therapy) may result in an adverse drug event. If a patient informs the pharmacy technician of an adverse drug event he or she experienced, the pharmacist should be informed immediately. The pharmacist will collect information regarding the adverse drug event, notify the prescriber to determine if the current therapy should be continued, and if necessary file an FDA Adverse Event Reporting System (FAERS, formally known as AERS) report to the FDA.

POTENTIAL INAPPROPRIATE MEDICATION USAGE IN ELDERLY PATIENTS

There are many drug classifications and medications elderly patients should use cautiously because of their adverse drug effects. These include:

- **Anticholinergic:** First-generation antihistamines such as chlorpheniramine, hydroxyzine, diphenhydramine and cyproheptadine should be avoided because they may cause confusion, constipation, and dry mouth.
- **Benzodiazepines** such as lorazepam cause drowsiness.
- **Nonbenzodiazepine sedatives** such as zolpidem cause drowsiness.
- **Androgens** such as methyltestosterone may cause cardiac problems.
- **Estrogens with or without progestins** may cause carcinogenic effects.

- **Insulin:** A higher risk of hypoglycemia may occur.
- **Sulfonylureas** such as glyburide may cause hypoglycemia.
- **Nonsteroidal antiinflammatory drugs (NSAIDS)** such as ibuprofen and naproxen increase the possibility of gastrointestinal (GI) bleeding.
- **Aspirin** may increase the risk of GI bleeding.
- **Skeletal muscle relaxants** such as carisoprodol and cyclobenzaprine have anticholinergic effects.
- **Oral decongestants** such as pseudoephedrine lead to central nervous system stimulation.

The pharmacist should be notified when warnings appear for elderly patients who may be prescribed these medications. The pharmacist will contact the prescriber to determine whether an alternative treatment might be more appropriate for the patient.

A complete listing of the medications that may be potentially inappropriate older adults can be found at www.americangeriatrics.org/files/documents/beers/PrintableBeersPocketCard.pdf.

THERAPEUTIC SUBSTITUTION

This is substitution of a new drug product with another that differs in composition but is considered to have the same or very similar pharmacologic and therapeutic activity. State regulations and institutional policies will determine if therapeutic substitution is permissible.

PATIENT COUNSELING

A pharmacy technician may ask patients if they have any questions about their medications, but it is the pharmacist's responsibility, not a pharmacy technician's, to counsel a patient. The following information can be given to either the patient or the patient's representative. This information is not considered to be counseling.

- Name of medication
- Dosage form
- Dosage
- Route of administration

However, providing the information below is considered counseling because these decisions must be made by the pharmacist.

- Duration of therapy
- Action to be taken if a dose is missed
- Common or severe side effects
- Interactions and contraindications of the medication (to include food)
- Self-monitoring of medication
- Proper storage of medication
- Special directions for use

OVER-THE-COUNTER RECOMMENDATIONS

Only a pharmacist may recommend an over-the-counter (OTC) medication to a patient after evaluating the patient's symptoms and the other medications a patient may be taking. When a pharmacist recommends an OTC medication to a patient, he or she is making a professional judgment that is in the realm of pharmacists' practice. Pharmacy technicians are not permitted to make professional judgments.

DRUG ADHERENCE

- Calculate how many days the prescriptions should last (i.e., day's supply = quantity dispensed/quantity taken each day).
- If the patient is seeking a refill early or the prescription is lasting longer than it should, the pharmacy technician should bring this to the attention of the pharmacist. If the directions have changed, a new prescription should be issued from the physician.
- The pharmacist should empathetically determine the reason for noncompliance.

MISSED DOSE

Patients should ask the pharmacist what to do if they forget a dose. Situations vary depending on the medication and frequency of dosing. Providing this information is part of counseling and can be done only by a pharmacist.

INVENTORY MAINTENANCE

The ISMP has identified specific high-alert drug classifications and medications that may cause potential harm to patients if taken inappropriately. These drug classifications and medications should be either identified in some manner or stored away from the other medications to eliminate possible errors. The pharmacy should have a method in place to identify short-dated medications. In addition, the pharmacy should allocate a specific area of the pharmacy for outdated, damaged, and returned medications to be stored. These medications should not be left in their original home in the pharmacy because of the possibility of being dispensed accidentally to the patient. Finally, the pharmacy should identify a place to store recalled medications until they are returned to the drug manufacturer.

PATIENT PACKAGE INSERT REQUIREMENTS

A patient package insert is an informational leaflet written for the lay public describing the benefits and

risks of medications. Information found on a package insert includes the following:

- Description
- Clinical pharmacology
- Indications and usage
- Contraindications
- Warnings
- Precautions
- Adverse reactions
- Drug abuse and dependence
- Overdosage
- Dosage and administration
- How supplied
- Date of the most recent revision of the labeling

A pharmacy is required to provide patient package inserts to all patients receiving metered-dose inhalers, oral contraceptives, estrogen, and progesterone. Package inserts should be given to any patient receiving a new medication.

As a result of OBRA-90, patients receive documentation from the pharmacy for every prescription they receive.

MEDICATION ERROR REPORTING

TRACKING MEDICATION ERRORS

The following agencies track medication errors:

- FDA MedWatch is a voluntary program that allows the reporting adverse health events and medical problems.
- The ISMP oversees the MERP.
- The FAERS is a database that contains information regarding both adverse events and medication error reports submitted to the FDA.
- Institute of Medicine (IOM)
- TJC
- National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP)
- United States Pharmacopoeia (USP): MedMarx is a national, Internet-accessible database used by hospitals and health care systems to track and trend adverse drug reactions and medication errors.
- The FDA and Centers for Disease Control and Prevention (CDC) Vaccine Adverse Event Reporting System is a postmarketing safety surveillance program that collects information about adverse events that occur after the administration of U.S.-licensed vaccines.

ERROR PREVENTION STRATEGIES

TJC assists organizations implement safety standards to reduce medication errors in five distinct areas:

- Leadership process and accountability
- Competent and capable workforce
- Safe environment for staff and patients
- Clinical care of patients
- Improving quality and safety

MEDICATION ERROR REPORTING AND PREVENTION RECOMMENDATIONS

- Develop written policies and procedures for persons who administer medications.
- Provide training to personnel who are responsible for medication management.
- Ensure that controlled medications are stored properly to prevent theft and diversion.
- Encourage personnel to report medication errors to appropriate drug error reporting programs.
- When a medication error occurs, evaluate possible causes to improve the facility's system for drug management and to prevent future errors.

MEDICATION ERROR REPORTING AND PREVENTION RECOMMENDATIONS FOR VERBAL ORDERS

Initiate institutional policies that:

- Describe limitations or prohibitions on use of verbal orders.
- Provide a mechanism to ensure validity/authenticity of the prescriber.
- List the elements required for inclusion in a complete verbal order.
- Describe situations in which verbal orders may be used.
- List and define the individuals who may send and receive verbal orders.

AMERICAN SOCIETY OF HEALTH SYSTEM PHARMACISTS, INSTITUTE OF SAFE MEDICATION PRACTICES , THE JOINT COMMISSION, INFUSION NURSES SOCIETY, AND NATIONAL PATIENT SAFETY FOUNDATION RECOMMENDATIONS FOR PARENTERAL MEDICATION ERROR PREVENTION

- Standardize product concentrations, patient care procedures, and equipment.
- Develop toolkits and other resource material to enhance adoption of recommendations.
- Improve mechanisms for communicating in a timely manner specific information about medication errors that can reduce the likelihood of the event from occurring again.

ELECTRONIC PRESCRIBING

- Eliminates illegible prescriptions
- Uses clinical decision support to reduce preventable errors

- Improves communication between the clinician and patient
- Enhances communication throughout the prescribing chain
- Increases access to patient and reference information
- Improves work efficiency

Advantages of Automation

- Reduction in medication errors
- Increased speed in medication processing
- Manage and track inventory

Examples of Pharmacy Automation

- **Accusource monitoring system (Baxter, Deerfield, IL):** Automated total parenteral nutrition compounder with total nutrient admixture
- **Baker cells (McKesson Corp., San Francisco, CA):** An example of an automated counting and filling device. Each cell contains a particular medication. The desired quantity is entered, and the Baker cell counts the desired quantity for the pharmacist.
- **Bar code scanners:** The FDA requires that bar codes be placed on all human drugs and biological agents, which will result in an improvement in both patient and medication safety. The potential for errors will be greatly reduced because the right patient will be receiving the right drug and dose at the right time through the right route.
- **A physician order entry system** results in a reduction of medical errors by having complete and accurate information, accurate dose calculation, and appropriate clinical decision support.
- **Mobile robots** that travel through a hospital to the various nursing units deliver medication.
- **Pyxis** (Cardinal Health) is an automated point-of-use storage system for making floor stock items available to nursing staff. Servers are connected to a Pyxis server and link hospital billing and information systems together.

ERROR REDUCTION

WAYS PHARMACY TECHNICIANS CAN REDUCE ERRORS

- Always question illegible handwriting.
- Question ambiguous orders.
- Question the prescription order that uses abbreviations you are not familiar with or that are uncommon.
- Do a mental check on dosage appropriateness.
- Keep your work area free of clutter.
- Always keep the prescription and the label together during the filling process.
- Check the drug three times: when removing the medication bottle from the shelf, after placing the medication in the bottle, and before returning medication bottle to the shelf.
- Make sure the label is always compared with the original prescription by at least two people. If an error occurs at this stage, the refills may be filled incorrectly as well.
- Observe and report pertinent OTC purchases.
- Triple check your work.
- Verify your own data entry before processing.

WAYS PHARMACISTS CAN DECREASE ERRORS

- Avoid using abbreviations that have more than one meaning and verify the meaning of these abbreviations with the prescriber.
- Check prescriptions in a timely manner.
- Document all clarifications on orders.
- Encourage OTC and herbal remedy documentation.
- Initial checked prescriptions.
- Use the ISMP Medication Error Reporting Form to inform manufacturers of errors caused by commercial packaging and labeling.
- Visually check the product in the bottle.
- Educate patients to always verify their insulin purchases.

WAYS PHARMACIES CAN REDUCE ERRORS

- Use electronic prescribing.
- Automate and bar code all fill procedures.
- Encourage physicians to use common terminology and abbreviations.
- Maintain a safe work area.
- Provide adequate computer applications and hardware. Use the metric system. A leading zero should always be present in decimal values less than 1. Remember that an error of this nature will mean a dosage error of at least 10-fold.
- Provide adequate storage areas.
- Maintain accurate and up-to date patient profiles to include OTC, nutritional, and herbal supplements.
- Make sure prescriptions and orders include the correctly spelled drug name, strength, appropriate dosing, quantity or duration of therapy, dosage form, and route. Missing information should be obtained from the prescriber.
- Never used error-prone abbreviations in internal communications, telephone and verbal prescriptions, computer-generated labels, labels for drug storage bins, and medication administration records.
- Use both the brand and generic names on a drug label.
- Configure computer selection screens to prevent look-alike drug names from appearing consecutively.
- Scan the original prescription.

- Scan the prescription label and the UPC code found on the bulk medication bottle.
- Keep dangerous or high-alert medications in a separate storage area of the pharmacy.
- Know the common look-alike and sound-alike drugs and keep them stored in different areas of the pharmacy so that they will not be easily mistaken.
- Clearly separate insulin brands from one another.

CHAPTER 4 REVIEW QUESTIONS

1. Which of the following medications requires that a patient product insert be provided to the patient?
   a. Atenolol
   b. Erythromycin
   c. Medroxyprogesterone
   d. Naproxen

2. Which of the following is an Internet-accessible database to track medication errors in hospitals?
   a. FAERS
   b. Medmarx
   c. MedWatch
   d. VAERS

3. Which organization oversees MedWatch?
   a. CMS
   b. FDA
   c. ISMP
   d. TJC

4. Which organization is responsible for approving "tall man" letters?
   a. DEA
   b. FDA
   c. ISMP
   d. TJC

5. Which of the following organizations implemented the error-prone abbreviation list?
   a. FDA
   b. ISMP
   c. TJC
   d. USP

6. Which organization is responsible for overseeing Medmarx?
   a. ASHP
   b. ISMP
   c. TJC
   d. USP

7. What do "tall man" letters indicate?
   a. Tall man letters are used only to indicate differences in the spelling of brand name drugs.
   b. Tall man letters are used to indicate differences in the spelling of drug names.
   c. Tall man letters are used to indicate similarities in drug names of drug names.
   d. Tall man letters are used to designate different drug classifications.

8. Which of the following drug classifications is not listed on the ISMP List of High-Alert Drug Classes or Categories of medications?
   a. Antiarrhythmics
   b. Antibiotics
   c. Chemotherapeutic agents
   d. Hypoglycemics (oral)

9. Within how much time does a scheduled medication need to be administered to a patient?
   a. 30 minutes
   b. 60 minutes
   c. 90 minutes
   d. 120 minutes

10. Which of the following is a type of medication error?
    a. Administration
    b. Dispensing
    c. Prescribing
    d. All of the above

11. Which of the following prescribing methods will reduce the number of prescription errors?
    a. Electronic
    b. Fax
    c. Oral
    d. Written

12. For which of the following could the abbreviation "OS" be misinterpreted?
    a. Each ear
    b. Right ear
    c. Right eye
    d. All of the above

13. Which of the following strategies may result in a reduction in medication errors?
    a. Place a period after mg or mL.
    b. Spell out drug names.
    c. Use a naked decimal point.
    d. Use a trailing "0" after a decimal point.

14. What should a pharmacy technician do if he or she receives a warning during the drug utilization evaluation phase of prescription processing?
    a. Ask the patient about the situation.
    b. Call the prescriber immediately.
    c. Continue processing the prescription.
    d. Inform the pharmacist immediately.

15. Within what period of time must a time-critical scheduled medication be administered to a patient?
    a. 30 minutes
    b. 45 minutes
    c. 60 minutes
    d. 90 minutes

16. Which of the following medications is found on the ISMP's list of high-alert medications?
    a. Albuterol
    b. Amoxicillin
    c. Methotrexate
    d. Naproxen

17. Who may counsel a patient on their medication?
    a. Pharmacy cashier
    b. Pharmacist
    c. Pharmacy technician
    d. All of the above

18. A patient complains of experiencing an adverse drug effect, what should the pharmacy technician do?
    a. Inform the patient to stop taking the medication and tell the patient to inform his or her physician immediately.
    b. Listen carefully to the patient and look up the information for the patient in the pharmacy's library.
    c. Listen carefully to the patient and inform the pharmacist of the situation.
    d. Notify the physician immediately.

19. What should a pharmacy technician do if a patient presents a prescription and the patient's name is not on the prescription?
    a. Ask the patient for his or her name and write it on the prescription.
    b. Call the physician.
    c. Hand the prescription back to the patient and inform him or her that you cannot fill the prescription.
    d. Inform the pharmacist of the situation and contact the physician.

20. A patient asks to purchase a box of Sudafed from behind the counter. You know the patient has elevated blood pressure and that a warning appears on the back of the box that it should not be taken by an individual with hypertension. What should you do?
    a. Contact the physician on behalf of the patient.
    b. Inform the patient that you cannot sell the Sudafed to him or her.
    c. Inform the pharmacist of the situation.
    d. Sell the Sudafed to them because it is OTC and does not require a prescription.

21. What do "tall man" letters represent?
    a. Differences in spelling between two similarly spelled drug names
    b. Differences in spelling between two similarly spelled nonproprietary drug names
    c. Differences in spelling between two similarly spelled proprietary drug names
    d. Differences in spelling between two similarly drug classifications

22. Which MERP error category is defined as an error that may have contributed or resulted in a patient's death?
    a. Category A
    b. Category B
    c. Category I
    d. Category J

23. Which of the following medications has not been involved in a high incidence of medication errors?
    a. Amoxicillin
    b. Heparin
    c. Insulin
    d. Warfarin

24. Which organization has made recommendations regarding verbal prescriptions?
    a. ISMP
    b. MedMarx
    c. MedWatch
    d. MERP

25. Which of the following organizations have medication error systems?
    a. MERP
    b. MedMarx
    c. MedWatch
    d. All of the above

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Chapter 5

Pharmacy Quality Assurance

Chapter Objectives

Upon completion of Chapter 5, the pharmacy technician student will be able to

1. Differentiate between quality control and quality assurance.
2. Identify organizations and the role they play in providing quality assurance practices in the practice of pharmacy, including:
   - List The Joint Commission (TJC) Initiatives.
   - List the various resources the Institute of Safe Medication Practices makes available to pharmacies to reduce the occurrence of medication errors.
   - Identify the MERP Information Guidelines.
3. Discuss pharmacy staff guidelines for quality assurance practices, including:
   - Differentiate between policies and procedures.
   - State the areas that TJC's Pharmacy Infection Control Policies and Procedures address.
4. Explain medication dispensing process guidelines, including the American Society of Health-System Pharmacists' Guidelines on Quality Assurance for Pharmacy-Prepared Products.
5. Recall the various methods to prevent prescription errors, including:
   - Differentiate between MedWatch and the Medication Errors Reporting Program (MERP).
   - Differentiate between the various types of forms used in documentation.
6. Discuss quality assurance practices in the pharmacy environment.
7. Discuss various risk management guidelines used in pharmacies.
8. Explain the importance of communication in the pharmacy, the communication process, and the principles of customer service.

PTCB Knowledge Domains

5.1 Quality assurance practices for medication and inventory control systems (e.g., matching National Drug Code [NDC] number, bar code, data entry)

5.3 Risk management guidelines and regulations (e.g., error prevention strategies)

5.4 Communication channels necessary to ensure appropriate follow-up and problem resolution (e.g., product recalls, shortages)

5.5 Productivity, efficiency, and customer satisfaction measures

ExCPT Knowledge Domains

1.1.7 Identifying expired products

3.1.5 Interpreting prescribers' directions for prescription labels

3.1.6 Recognizing and using common prescription abbreviations

3.2.1 Avoiding errors (such as sound-alike/look-alike names)

QUALITY ASSURANCE AND QUALITY CONTROL

QUALITY ASSURANCE

- Establishes systems for ensuring the quality of the product
- Is established by the quality assurance department to ensure that quality procedures are developed for a company
- Guided by standard operating procedures
- Monitored through audits

QUALITY CONTROL

- Uses the application of total quality management (TQM) and quality improvement
- Follows standard operating procedures directed toward assuring the quality, purity, and effectiveness of the drug
- Uses good manufacturing practices (GMPs)
- Involves the day-to-day control of quality
- Control of packaging to include materials used
- Includes storage conditions of the product
- Labeling must be 100% correct before product is dispensed

ORGANIZATIONS PROMOTING QUALITY ASSURANCE

UNITED STATES PHARMACOPEIA

- Sets standards for the identity, strength, quality, and purity of medicines, food ingredients, and dietary supplements
- Publishes United States Pharmacopeia and National Formulary (USP-NF), which contains standards for chemical and biological drug substances, dosage forms, compounded preparations, excipient, medical devices, and dietary supplements
- Drugs marketed in the United States must conform to USP-NF standards.
- Establishes nonsterile compounding requirements under USP <795>
- Establishes sterile compounding requirements under USP <797> to include infection control
- Standards established limit adulterants and contaminants that may be found in dietary drug supplements
- Establishes requirements for labeling of medications, whether they are in a multidose vial or unit-dose container, an intravenous (IV) admixture, or a compound

FOOD AND DRUG ADMINISTRATION

- The Food and Drug Administration (FDA) oversees food, drugs, medical devices, vaccines, blood, biologics, veterinary, cosmetics, radiation-emitting products, and tobacco.
- The FDA has developed polices on biotechnology and provides information on dietary supplements. The FDA addresses bioterrorism, drug preparedness, and our natural disaster response during emergencies.
- Provides information on recent drug approvals and drug shortages and provides drug safety information
- Establishes clinical trials, submission of drug applications, and the required labeling of medications
- Issues warning letters to the public regarding specific medications and conducts postmarket surveillance programs for newly approved medications
- Evaluates the safety of drug products
- The FDA approves and clears all medical devices, surgical implants, prosthetics and in vitro diagnostics; issues alerts, notices, and medical device recalls; and provides postmarket surveillance on medical devices.
- The FDA oversees all allergenics to include patch tests and allergenic extracts; blood and blood product (e.g., blood, blood components, blood bank devices, and blood donor screening tests); gene- and cell-based treatments; vaccines for use in children and adults; and issues recalls and shortages of vaccines, blood, and biologics.
- Responsible for the approval process of veterinary drugs and for reporting adverse drug events of veterinary medicine animal drug recall and shortages
- Ensures the labeling for cosmetic adheres to strict labeling requirements of what can be said, what it must read, and what it means to the consumer
- Evaluates radiation-emitting products, medical imaging, and radiation safety
- Issues labeling requirements for tobacco products

THE JOINT COMMISSION

- The Joint Commission (TJC) accredits and certifies more than 19,000 health care organizations and programs in the United States. This accreditation reflects an institution's commitment to meeting specific performance standards.
- Accredits ambulatory health care, behavioral health care, critical access hospitals, home care, hospital, laboratory services, and long-term care facilities
- Provides certification for disease-specific care, advanced disease-specific care, palliative care, and home care staffing
- Establishes national patient safety goals and universal protocol for those accredited or certified
- Addresses health care–associated infections, infection control, and patient safety concerns to include medication errors

Joint Commission Initiatives

- **Leadership process and accountability:** Addresses the leadership structure of an organization, individual accountability, policies and procedures, and the management of daily operations
- **Competent and capable workforce:** Staff has documented credentials, accurate job descriptions, and training in their employee files.
- **Safe environment for staff and patients:** Includes a safe working environment, adherence to infection control practices, and handling of hazardous waste
- **Clinical care of patients:** Patients' identification is verified before the administration of medications, treatments, and specific procedures.
- **Improving quality and safety:** An adverse reporting system must be in place, and the system must be analyzed.

INSTITUTE OF SAFE MEDICATION PRACTICES

The organization provides impartial, timely, and accurate medication safety information. It has developed initiatives, built upon a nonpunitive approach and system-based solutions, which fall into five key areas: knowledge, analysis, education, cooperation, and communication.

The mission of the Institute of Safe Medication Practices (ISMP):

> *To advance patient safety worldwide by empowering the healthcare community, including consumers, to prevent medication errors.*
>
> *We accomplish this through our interdisciplinary efforts to:*
> - *Collect and analyze reports of medication-related hazardous conditions, near-misses, errors, and other adverse drug events.*
> - *Disseminate timely medication safety information, risk-reduction tools, and error-prevention strategies.*
> - *Educate the healthcare community and consumers about safe medication practices.*
> - *Collaborate with other patient safety organizations, educational institutions, governmental agencies and other healthcare stakeholders.*
> - *Advocate the adoption of safe medication standards by accrediting bodies, manufacturers, policy makers, regulatory agencies, and standards-setting organizations.*
> - *Conduct research to provide evidence-based safe medication practices.*
>
> **From the ISMP's mission statement.**

The ISMP provides pharmacy resources that include the following:

- "DO NOT CRUSH" List
- Black Box Warnings
- Community Pharmacy Medication Safety Tools and Resources
- Error-Prone Abbreviations List
- Guideline for Preventing Medication Errors in Pediatrics
- Improving Medication Safety with Anticoagulant Therapy
- ISMP Confused Drug Name List
- ISMP High Alert Medications
- ISMP List of High Alert Medications in Community/Ambulatory Healthcare
- ISMP List of Products with Drug Name Suffixes
- Patient Controlled Analgesia
- Standard Concentration of Neonatal Drug Infusion
- Tall Man Letters

Institute of Safe Medication Practices Reporting Programs

The ISMP operates two error-reporting programs, the National Medication Errors Reporting Program (ISMP-MERP) and the National Vaccine Errors Reporting Program (ISMP-VERP). Both are confidential national voluntary reporting programs that examine causes of medication and vaccine errors and provide suggestions for prevention of errors. Both regulatory agencies and drug manufacturers are notified of desired changes in products when patient safety is of concern. Medication and vaccine errors, preventable adverse drug reactions, close calls, and hazardous conditions may be reported. Types of errors that can be reported include:

- Errors in the prescribing, transcribing, dispensing, administering, and monitoring of medications and vaccines
- Wrong drug, wrong strength, or wrong dose errors
- Wrong patient errors
- Confusion over look-alike, sound-alike drugs or similar packaging
- Wrong route of administration errors
- Calculation or preparation errors
- Misuse of medical equipment

MERP Information Guidelines

Information that is obtained through MERP is used to:

- Report the medication error
- Understand the medication error
- Provide additional knowledge of the problem
- Evaluate data that have been collected
- Develop educational tools
  - Identify means to prevent the medication error from occurring
  - Provide confidential consulting services to health care systems

  - Educational programs include teleconferences on medications and issues and providing patient resources
  - Issue high drug alerts through newsletters
- Cooperate with
  - Legislative and regulatory bodies
  - Health care practitioners
  - Health care institutions
  - Regulatory and accrediting agencies
  - Pharmaceutical industry
- Communicate
  - Information to consumers, employers, and health care providers
  - Providing a voluntary reporting program

AMERICAN PHARMACISTS ASSOCIATION

- The goal of the American Pharmacists Association (APhA) is to improve medication use and advance patient care.
- Advocates for the practice of pharmacy regardless of the setting
- Provides informational resources for both pharmacists and pharmacy technicians
- Provides continuing education through home study, live activities, and certificate training

AMERICAN SOCIETY OF HEALTH-SYSTEM PHARMACISTS

- Advocate for the practice of pharmacy to various organizations to include TJC, federal and state regulatory agencies, and other health care organizations
- Provide continuing education through print media, e-learning, webinars, podcasts, and specialty certifications
- Develops official professional policies in the form of policy positions and guidance documents in order to establish best practices
- Establishes regulations and standards for pharmacy technician programs to include curriculum and clinical expectations
- Accredits pharmacy technician training programs
- Developed the Pharmacy Technician Initiative

ACCREDITING COUNCIL OF PHARMACY EDUCATION

- The Accrediting Council of Pharmacy Education (ACPE) accredits professional degree programs in pharmacy and providers of continuing pharmacy education.
- Ensures and advances the quality of continuing pharmacy education
- Provides continuing professional education through knowledge-based, application-based, and pharmacy-based activities
- Establishes standards for pharmacy continuing education

STATE BOARDS OF PHARMACY

- State boards of pharmacy (BOPs) ensure that specific standards are met for the licensing of pharmacists, permits are issued for pharmacies, and pharmacy technicians meet specific requirements.
- State BOPs discipline pharmacies, pharmacists, and pharmacy technicians for egregious conduct.
- Many state BOPs require prescription error reporting.

NATIONAL ASSOCIATION OF BOARDS OF PHARMACY

- The National Association of Boards of Pharmacy (NABP) assists state Boards of Pharmacy (BOPs) in developing, implementing, and enforcing uniform standards for protecting the public health.
- The NABP has addressed standards for electronic prescribing, overprescribing controlled substances, pharmacy technician education, and prescription monitoring programs.

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

- Occupational Safety and Health Administration (OSHA) ensures safe and healthful working conditions by establishing and enforcing standards and providing training, outreach, education, and assistance.
- Responsible for requiring safety data sheets (SDS; formerly known as material safety data sheets [MSDS]) to be maintained in pharmacy for medications and hazardous compounds

QUALITY ASSURANCE PRACTICES: PHARMACY STAFF GUIDELINES

POLICIES AND PROCEDURES

- Each organization maintains a policies and procedure manual, which is to be adhered to at all times.
- Policies are written rules of an organization that ensure all employees follow them.
- Procedures are processes that employees are to follow when performing a particular task to ensure consistency throughout the organization.

PERSONNEL

- Pharmacists
  - Must be high school graduates and have graduated from an accredited school of pharmacy with BS in pharmacy or a Pharm D

  - Meet state requirements for licensure, including externship requirements, passing a pharmacy board examination, and continuing education
  - Pharmacists may reciprocate their pharmacy licenses to another state without taking that state board of pharmacy examination; however, they may be required to take a pharmacy law examination.
  - Pharmacists from countries outside of the United States may become licensed in the United States by meeting certain qualifications, which include various tests.
- Pharmacy technicians
  - Possess either a high school diploma or GED
  - Presently 43 states require a pharmacy technician to be either Pharmacy Technician Certification Board (PTCB) certified or National Healthcareer Association (NHA) certified.
  - Certification must be maintained by taking 20 hours of continuing education every 2 years with 1 hour being on topics of law.
  - Several states require pharmacy technicians to register with the state BOP or to become licensed by the state.

Note: Several proposals are currently being considered that may affect pharmacy technicians in all states; they include the following: passing a background examination, graduating from an accredited ASHP Pharmacy Technician program that has a minimum of 600 hours of class work, and completing an externship upon completion of the pharmacy technician program and satisfactorily pass the PTCB examination.

PHARMACY TRAINING

- Continuing education is required of both pharmacists and pharmacy technicians to remain licensed or certified.
- Many pharmacies require the pharmacy staff are certified in cardiopulmonary resuscitation and first aid. In addition, the staff must know the location of the automated external defibrillator kit in the facility and how to use it properly.
- Pharmacists and pharmacy technicians must be trained properly for repackaging medications and compounding both sterile and nonsterile products.
- Pharmacy training should include preparing the staff on the proper handling of hazardous drugs and all equipment that is used in the pharmacy.

DRESS CODE

- Institutional dress codes require that pharmacy technicians wear a white laboratory jacket. Hair should be pulled back.
- Fingernails should be kept clean and short; nail polish should be nonacrylic to prevent fungal infections from occurring.
- Jewelry should not be worn during aseptic technique because of the possibility of contamination.
- Makeup should not be worn because of the particulate nature of the substance. Clean, particulate-free clothing should be worn.

INFECTION CONTROL

- Proper hand-washing techniques include washing the hands and arms with hot water and Betadine, scrubbing both the top and bottom of the hands, scrubbing between the fingers up to the elbow, and rinsing the arms and hands thoroughly.
- Microorganisms can be introduced into the laminar flow hood by jewelry, cosmetics, coughing or sneezing (if a mask is not worn), or loose facial hair.

The Joint Commission states that pharmacy infection control policies and procedures must address the following:

- Containment and disposal of waste
- Hand-washing technique and personal hygiene requirements
- Infection surveillance, prevention, and control for the pharmacy
- Irrigation solution preparation
- Microbial monitoring of laminar flow hoods
- Preparation of sterile parenteral nutrition products
- Proper use of laminar flow hoods
- Reporting of unsanitary conditions and practices
- Requirements for assessing sterile technique of personnel and frequency assessed
- Routine cleaning of pharmacy facilities
- Shelf life of all sterile items in storage
- Storage of sterile medication products
- Testing for microbial contamination of hospital-prepared sterile products
- Traffic control of sterile medication preparation areas
- Use of single-dose and multidose containers

Hand Hygiene

- Using gloves does not eliminate the need for hand washing.
- Liquid soap is preferred over bar soap.
- Hands should be washed:
  - After using the restroom
  - Before and after contact with a patient
  - Before donning gloves for working in the laminar flow hood
  - Before eating
  - When they are visibly soiled or dirty
- Alcohol preparations (hand rubs) are effective if hands are not visibly dirty and soap and water are not available.

- Alcohol-based antiseptics should be applied to all surfaces of the hands and fingers, which should then be allowed to dry.
- Persons involved in the preparation of sterile products should scrub their hands with an appropriate antibacterial agent for a predetermined time and dry them with paper towels. The procedure should be repeated if possible contamination occurs.

Personal Protective Equipment

- Personal protective equipment (PPE) is used to place a barrier between the employee and specific substances; they include latex gloves, masks, goggles, face shields, gowns, laboratory coats, shoe coverings, and head coverings.
- A face shield should be worn when splashes to the eyes, nose, or mouth may occur.
- Gloves should be changed hourly or immediately after contamination.
- Removal of gloves should be performed in such a way as to avoid direct skin contact with the outside of the glove.
- Employees must know the proper sequence for donning and removing gowns, gloves, protective glasses or goggles, shoe covers, hair covers, and face shields before compounding sterile compounding.
- The employer must provide hypoallergenic (nonlatex) gloves and liners to employees who are allergic to latex.

QUALITY ASSURANCE PRACTICES: MEDICATION DISPENSING PROCESS GUIDELINES

PRESCRIPTIONS AND MEDICATION ORDERS

- Prescriptions and medication orders must contain specific information from the prescriber to be valid.
- Prescriptions and medication orders are valid only for a given period of time depending federal and state regulations. In some situations, the institutional Pharmacy and Therapeutics (P&T) Committee may establish time limits on the filling of a medication order.
- E-prescribing is encouraged in lieu of writing, telephoning, or faxing prescriptions to the pharmacy.

HOSPITAL AUTOMATIC PROCESSING OF MEDICATION ORDERS

- The physician or physician's representative enters the medication order directly into the hospital computer service, which communicates the order to the pharmacy.
- A pharmacist reviews and verifies the order.
- A registered nurse retrieves medication from the point-of-use automated medication station.
- A pharmacy technician fills inventory as medication supplies fall below PAR (periodic automatic replacement) levels.

AMERICAN SOCIETY OF HEALTH-SYSTEM PHARMACISTS GUIDELINES ON QUALITY ASSURANCE FOR PHARMACY-PREPARED PRODUCTS

- **Level 1:** Products to be stored at room temperatures and administered completely within 28 hours after being prepared; unpreserved products that are prepared for more than one patient that contain preservatives; and products prepared by closed system aseptic transfer of nonpyrogenic, sterile finished products (in sterile containers) from licensed manufacturers. Examples of these products include:
  - Single patient admixtures
  - Sterile ophthalmic
  - Syringes without preservatives
  - Batch-prefilled syringes with preservatives
- **Level 2:** Products administered more than 28 hours after preparation and stored at room temperature, products that are batch prepared with no preservatives for more than one patient, and products compounded by various manipulations of sterile ingredients using close-system aseptic transfer from licensed manufacturers. Examples include:
  - Batch-reconstituted antibiotics without preservatives
  - Batch-prefilled syringes without preservatives
  - Total parenteral nutrition (TPN) solutions mixed with automatic compounding devices
- **Level 3:** Products compounded from nonsterile components, containers, or equipment before they are terminally sterilized and products prepared with sterile or nonsterile products prepared from sterile or nonsterile ingredients using open-system transfer before they are terminally sterilized. Examples include:
  - Autoclaved IV solutions
  - TPN solutions made from dry amino acids or sterilized by final filtration
  - Morphine injections made from powders or tablets

Medication Distribution

- Automation is being used to regulate and track controlled substances.
- Bar-coded labels are used as part of automation to reduce errors and to streamline the medication process. This will improve the quality of patient care.
- Computerized dispensing systems are used to provide round-the-clock medication availability.

TJC requires unit-dose dispensing and pharmacy-based IV additive programs.
- Robotics is being used to scan unit-dose medication and fill patients' medication cassettes.
- Scanning patient identification bracelets ensures patients are receiving the proper medication.
- A "code blue" in a hospital signifies that a patient is in a life-threatening situation such as the stopping of a patient's heart or a cessation of breathing. Crash carts are located on the floors of a hospital, are stocked with the necessary medications and equipment for a code blue situation, and are used to stabilize patients.
- Unit-dose systems are preferred over floor stock inventories in hospitals and long-term care facilities.
- Internal and external products must be kept in separate locations in a pharmacy to prevent an error from occurring.
- Medications must be checked periodically according to an institution's policies and procedures manual to ensure they are in date. Medications that are out of date must be separated from other medications to ensure patient safety.
- Recalled medications must be separated from all usable medications.

DRUG UTILIZATION EVALUATION

- The Omnibus Budget Reconciliation Act of 1990 (OBRA-90) requires that all pharmacists perform a drug utilization evaluation (DUE) during the processing of prescriptions. The DUE will alert the pharmacist of any potential drug interactions or contraindication a patient may experience while taking a prescribed medication.

DRUG RECONCILIATION

- This is the process of verifying with patients the medications they are currently taking.

QUALITY ASSURANCE PRACTICES: PREVENTING MEDICATION ERRORS

TIPS TO PREVENT MEDICATION ERRORS

- Accuracy is important during the entire prescription filling process.
- Many medication errors occur because of system errors.
- Ensuring that patient information is accurate and up to date can help reduce allergic drug reactions and drug–drug interactions.
- Be familiar with the various resources available on the Internet that can assist in preventing medication errors.
- Pharmacies are required to maintain a professional library relevant to the practice of the pharmacy.
- The prescription label should be compared with the original prescription to ensure the information entered is correct.
- The National Drug Code (NDC) numbers from the prescription label should be matched with the bulk medication label.
- Scan the prescription label and the bar code on the bulk medication container.
- The use of automatic dispensing equipment will reduce medication errors.
- Always keep the prescription and the label together during the fill process.
- Know the common look-alike and sound-alike drugs and keep them stored in different areas of the pharmacy so that they will not be easily mistaken.
- Always question illegible handwriting.
- Be aware of insulin mistakes. Insulin brands should be clearly separated from one another. Educate patients to always verify their insulin purchases.
- Clear stock bottles no longer needed from the work area in a timely fashion. Keep only what is needed for immediate use in the work area.
- Keep dangerous or high-alert medications in a separate storage area of the pharmacy.
- Make sure prescriptions and orders include the correctly spelled drug name, strength, appropriate dosing, quantity or duration of therapy, dosage form, and route. Missing information should be obtained from the prescriber.
- Question ambiguous orders.
- Question the prescription order that uses abbreviations you are not familiar with or that are uncommon. Avoid using abbreviations that have more than one meaning and verify the meaning of these abbreviations with the prescriber.
- The label should always be compared with the original prescription by at least two people. If an error occurs at this stage, the refills may be filled incorrectly as well.
- Use the metric system. A leading zero should always be present in decimal values less than 1. A trailing zero to the right of the decimal point should never be used. Both leading and trailing zeros will result in a dosage error of at least 10-fold or tenthfold.
- Prescription and medication orders should be reviewed a minimum of three times.

DOUBLE COUNTING NARCOTICS

- It is a good practice to double count narcotic prescriptions before they are dispensed and to have the count verified by the pharmacist or another pharmacy technician.

MEDICATION REPORTING AND DOCUMENTATION

Medical Error Documentation (Incident Reports)

- Incident reports are used to report accidents and events involving employees, individuals, visitor injury, property damage, or occupational illness.
- Filled out by the individual observing the incident or initially being informed of the incident and filed with the supervisor on duty
- Incident reports contain the following information:
  - Information about the person involved in the incident (name, contact information, whether the person is an employee or visitor, patient and identification information)
  - Information about the incident (date, time, and location of the incident; description of what occurred; the type of injury; whether treatment was provided)
  - Individual or supervisor information (printed name, signature of the individual or supervisor taking the report, title, and date)
- Encourage pharmacies to report errors and find causes for the error without fear of punishment.

MedWatch Program

- The FDA's Safety Information and Adverse Event Reporting Program
- Provides an Online Voluntary Reporting Form (3500) to report serious adverse events for human medical products, including potential and actual product use errors and product quality problems associated with the use of FDA-regulated drugs, biologics (including human cells, tissues and cellular and tissue-based products), medical devices (including in vitro diagnostics), and special nutritional products and cosmetics.
- MedWatch is not used to report vaccine events.
- MedWatch provides safety alerts for human medical products that include drugs, biologics, medical devices, special nutritionals, and cosmetics.

Food and Drug Administration Adverse Event Reporting System

- The FDA Adverse Event Reporting System (FAERS) is a database that contains information on adverse event and medication error reports that have been submitted to the FDA.
- Supports the FDA's postmarketing safety surveillance program for drug and therapeutic biologic products
- Information received is used to identify possible safety concerns for a marketed product.
- Health care professionals and consumers may voluntarily report adverse events and medication errors to the FDA or the drug manufacturers.
- Drug manufacturers who receive an adverse drug event report must submit the information to the FDA.

Vaccine Adverse Reporting System

- The Vaccine Adverse Reporting System (VAERS) is a national vaccine safety and surveillance administered by the FDA.
- Collects and analyzes data from adverse events after vaccination; information collected is used to identify any new safety concerns that otherwise may not come to light before licensing
- Reports may be generated by health care providers, vaccine manufacturers, vaccine recipients, and state immunization programs.
- Health care providers are required to report the following:
  - Any event listed by the vaccine manufacturer as a contraindication to subsequent doses of the vaccine
  - Any event listed in the Reportable Events Table that occurs within the specified time period after vaccination

FOOD AND DRUG ADMINISTRATION PRODUCT RECALLS

- The pharmacy is notified by the FDA, drug manufacturer, or wholesaler. This notification may occur either by mail or fax.
- A complete listing of all medication recalls is found on the FDA's website.
- The pharmacy determines if the recalled medication is currently in stock.
- The pharmacy contacts patients who may have received the medication. If a customer has the recalled product, the medication should be returned to the pharmacy for refund or substitution.
- Recalled medication is returned to the manufacturer for credit.
- The pharmacy technician should reorder medication that has been recalled; notify the physician of the recalled medication; and inquire if the physician wishes to change the medication order, especially if product may not be available for a long period.

DRUG SHORTAGES

- The FDA attempts to reduce the number of medication shortages from occurring because of manufacturing, supply issues, and medications being discontinued by drug manufacturers.

- The FDA attempts to find alternative sources for a specific product from other drug manufacturers.
- Drug manufacturers are not required to provide information regarding drug shortages, but many do so.

INSTITUTIONAL DOCUMENTATION

- **Controlled-substance form:** Allows a nursing staff to verify controlled substances at each change of shift. Monitors the receipt, administration, and disposal of a controlled substance.
- **Medication administration record (MAR):** Documents medication administered to a patient. It includes the drug, dose, route of administration, frequency of administration, and administration times. The MAR lists the patient's allergies and diagnoses. It is used every time a medication is administered.
- **Medication delivery record:** Provides accountability for medication distribution between the pharmacy and hospital or long-term care facility. It lists the medication found in a particular delivery for a patient.
- **Patient profile:** OBRA-90 requires that a patient profile be maintained for every patient regardless of the pharmacy setting. A patient profile may be either a hard copy or a computerized list of a patient's prescriptions (medications) and other information. A patient profile identifies the patient by name, Social Security number, birth date, and gender. It provides billing information, such as insurance (group number, patient's identification, patient's relationship to the cardholder [spouse, dependent]). A patient profile contains a patient's medical history, which includes current conditions, known allergies, and adverse reactions. It provides a listing of medications, whether legend or over the counter, that have been filled for the patient, including dates, quantities, directions for use, and physician's name. It may list whether the patient requests easy-open containers or use of generic medications if authorized by the physician.
- **Physician order sheet (POS):** List of all of the physician's orders for a patient, including both drug and nondrug orders. Nondrug orders may include allergies, diagnoses, diet orders, directives, laboratory orders, and orders for ancillary services (e.g., physical therapy, occupational therapy, respiratory therapy, speech therapy).
- **Resident monitoring form:** Documents behavior of a patient and any precipitating factors, drug and nondrug intervention, outcomes, and adverse reactions
- **Treatment administration record (TAR):** Documents external treatments given to a patient in a hospital or long-term care facility

QUALITY ASSURANCE PRACTICES: PHARMACY ENVIRONMENT

PHYSICAL ENVIRONMENT

- Every pharmacy must have running hot and cold water. A mild detergent may be used to clean instruments used in extemporaneous compounding; 70% isopropyl alcohol should be used to clean all countertops in the pharmacy. All pharmacy equipment should be kept clean and in good condition.
- Traffic must be controlled in the pharmacy.
- A buffer room must be at least a class 100,000 clean room but may be a class 10,000 clean room.
- Fire extinguishers must be certified on a yearly basis. Personnel should know the location of fire extinguishers in the facility.
- First-aid kits need to be periodically checked to ensure contents have not expired.

EQUIPMENT

- Pharmacy balances require certification by the Department of Taxation on a yearly basis.
- Pharmacy weights need to be calibrated once a year.
- Counting trays should be cleaned with alcohol after every use to prevent cross-contamination from occurring, which might result in an allergic reaction in another patient. A separate counting tray should be used for chemotherapeutic agents only.
- Laminar flow hoods must be turned on for a minimum of 30 minutes before being used. The velocity of air from the HEPA filter is measured using a volumeter. Average air velocity is 90 linear feet per minute $\pm 20\%$.
- The laminar flow hood should provide an ISO class 5 clean environment, and the work surface should be cleaned with 70% isopropyl alcohol. The prefilter and the HEPA filter need to be maintained such that particles greater than 3 microns cannot enter the sterile area.
- Laminar flow hoods need to be certified every 6 months unless the HEPA filter becomes damaged, which requires certification.
- Microorganisms can be introduced into the laminar flow hood by jewelry, cosmetics, coughing or sneezing (if a mask is not worn), or loose facial hair.
- A HEPA filter is monitored by introducing aerosolized Emery 3004 into the plenum of the laminar flow hood while monitoring the penetration of the

Emery 3004 on the downstream side of the HEPA filter. No more than 0.01% of the upstream concentration may be detected downstream from the HEPA filter.
- Automated compounding and repackaging equipment must be calibrated before each use.

WORKING CONDITIONS
- Improving work flow in a pharmacy
- Improving lighting in a pharmacy
- Establishing the maximum number of prescriptions a pharmacist may fill during a shift
- Limiting the number of hours a pharmacist or technician may work in a given pay period has been addressed by the state BOP.
- Many states have established the a maximum number of pharmacy technicians (four) a pharmacist may supervise during a shift.

RISK MANAGEMENT GUIDELINES

HAZARDOUS DRUGS
- Be familiar with and be able to recognize sources of exposure to hazardous drugs, which include all procedures involving hazardous drugs and all materials that come into contact with hazardous materials.
- Prepare hazardous drugs in an area that is intended for that purpose and is restricted to authorized individuals only.
- Hazardous drugs are to be prepared inside a ventilated cabinet that is designed to protect the employee and others from exposure.
- Wear two pairs of powder-free disposable chemotherapy gloves with the outer glove covering the cuff.
- Avoid skin contact by using a disposable gown made of polyethylene-coated polypropylene material (which is lint free and nonabsorbent); the gown should have a closed front, long sleeves, and elastic or knit cuffs. Gowns should only be worn once.
- Use syringes and IV sets with Luer-Lok fittings for preparing and administering hazardous drugs.
- Handle hazardous waste and contaminated materials separately from other trash.
- Clean and decontaminate work areas before and after each activity involving hazardous drugs and at the end of each shift.
- Clean up small spills of hazardous drugs immediately, using proper safety precautions and PPE.

NEEDLE RECAPPING
- Never recap used needles using both hands or perform any other technique that involves directing the point of the needle toward the body.
- Use a one-handed "scoop" technique or a mechanical device designed for holding the needle sheath.
- Do not remove used needles from disposable syringes by hand, and do not bend, break, or manipulate the needles by hand.

SAFETY DATA SHEETS
- Read all information found on SDS of hazardous materials found in your pharmacy.

USE OF SHARPS CONTAINERS
- Used disposable syringes are to be placed in the sharp containers (a thick red plastic container) in an area close to where sharps are being used.

COMMUNICATION CHANNELS

Communication between the pharmacist, pharmacy technician, and patient is essential in the practice of pharmacy. The pharmacy technician plays a vital role in obtaining patient information when a prescription is dropped off at the pharmacy. In addition, the pharmacy technician relays information to the pharmacist during the filling process. Communication is critical in the pharmacy to reduce the number of medication errors from occurring.

PHARMACY PRACTICE COMMUNICATION
- Importance of communication
  - Establishes the ongoing relationship between members of the pharmacy team and the patient
  - Provides an exchange of information necessary to evaluate the patient's health condition and his or her treatment
- Components of interpersonal communication
  - Sender
  - Message
  - Receiver
  - Feedback
  - Barriers
- Meanings in a message
  - Avoid using words with more than one meaning.
  - Avoid using professional jargon.
  - Build clarity.
  - Recognize differences in cross-cultural styles of speaking.

ORGANIZATIONAL COMMUNICATION

Process by which information is exchanged in an organizational setting

Lines of Communication Throughout an Organization
- Face-to-face meetings
- Telephone

- Voice mail
- E-mail
- Memorandums (written letters)
- **Channel richness:** The capacity of a channel to convey information effectively. In the following list, the channels are shown in decreasing order of channel richness:
  - Face-to-face (most effective)
  - Telephone
  - E-mail
  - Written memos
  - Letters
  - Posted notices
  - Bulletins: Least effective
- **Formal channels:** Follow the chain of command or hierarchy in an organization.
- **Informal channels:** Do not follow chain of command; allow for the transfer of information through networks and acquaintances.

RESOURCE ALLOCATION

- **Cross-training (cross-functional):** Bringing together persons with different expertise to work on a common task; designed to help improve lateral communication. They have the ability to solve problems based on "total systems thinking." They have the ability to work well based on better information and speed of transmitting the information.
- **Multiskilling:** Team members are trained in skills to perform more than one job.
- **Scheduling:** Productivity reports can be used to show the peak times of the day when prescription processing is heaviest and when prescriptions are being picked up by customers. The staff should be scheduled based on these times.
- **Self-managing teams:** Teams that are empowered to make decisions about planning, doing, and evaluating their daily work
- **Virtual groups:** Convene and operate with members linked together electronically by computers
- **Workflow:** An organized way of performing a task. It is efficient and a repeatable, defined set of activities.

PRODUCTIVITY, EFFICIENCY, AND CUSTOMER SERVICE

MEASUREMENT METHODS

- **Customer service:** Follow-up survey with customers. Use of focus groups to gauge opinions of customers, comparing customer service in one location or organization with that in another.
- **Efficiency:** Inventory turnover rates, reduction in prescription errors per shift, compliance reports from vendors, average waiting time per prescription
- **Productivity:** Prescriptions filled per pharmacist per hour; absenteeism and tardiness reports through payroll

PHARMACY CUSTOMER SERVICE PRINCIPLES

- Maintain a positive attitude toward the customer.
- Be friendly toward the customer.
- Obtain as much information as possible from the customer.
- Do not interrupt the customer.
- Provide accurate information to the customer.
- Understand the customer's condition.
- Develop a professional relationship with the customer.
- Preserve patient confidentiality.
- Demonstrate compassion toward the customer.
- Support the customer's decisions.
- Avoid conflict with the customer by avoiding passing judgment on the patient, jumping to conclusions, or gossiping about the patient.

CHAPTER 5 REVIEW QUESTIONS

1. Which of the following is not true regarding TJC's policies regarding the pharmacy in an institution?
   a. To avoid errors, external and internal products should not be stocked next to each other.
   b. IV admixtures are prepared in a pharmacy using aseptic technique and a laminar flow hood.
   c. Professional samples should be dispensed as soon as the pharmacy receives them to prevent them from going out of date.
   d. Unit doses are preferred over a traditional vial system.

2. Which of the following does TJC not certify?
   a. Hospitals
   b. Long-term care facilities
   c. Nursing homes
   d. Retail pharmacies

3. Which regulatory agency may issue a drug recall?
   a. BOP
   b. DEA
   c. FDA
   d. TJC

4. Which committee develops a formulary for an institution?
   a. BOP
   b. FDA
   c. TJC
   d. P&T

5. What types of substances require a Safety Data Sheet (SDS—formerly known as Material Safety Data Sheet)?
   a. Hazardous drugs and chemicals
   b. Investigational drugs
   c. Intravenous drugs
   d. OTC drugs

6. Which of the following is not required on the label of a repackaged medication?
   a. Date of repackaging
   b. Generic name of the medication
   c. Manufacturer's name and lot number
   d. Beyond-use date after repackaging

7. How many different risk levels did ASHP establish for pharmacy-prepared sterile products?
   a. Two
   b. Three
   c. Four
   d. Five

8. Which chapter of the USP addresses sterile compounding?
   a. USP <642>
   b. USP <795>
   c. USP <797>
   d. USP <808>

9. If an employee is at work and is exposed to pathogens, to whom should the report be submitted?
   a. CDC
   b. DEA
   c. FDA
   d. TJC

10. Which form of communication is the most effective?
    a. E-mail
    b. Face to face
    c. Letter
    d. Telephone

11. Which federal agency is responsible for the administration of FAERS?
    a. CMS
    b. DEA
    c. FDA
    d. OSHA

12. For states requiring that pharmacy technicians be certified, for what period of time is their certification valid?
    a. 1 year
    b. 2 years
    c. 3 years
    d. 5 years

13. Which of the following organizations works closely with the drug manufacturers when drug shortages occur?
    a. ASHP
    b. CMS
    c. DEA
    d. FDA

14. Which of the following is a concern of MERP?
    a. Medication error understanding
    b. Medication error reporting
    c. Medication error prevention
    d. All of the above

15. When should hypoallergenic gloves be changed?
    a. After each usage
    b. At the end of the shift
    c. Hourly
    d. All of the above

16. What color is a sharps container?
    a. Blue
    b. Green
    c. Red
    d. Yellow

17. Which federal agency is responsible for the oversight of Safety Data Sheets (SDS—formerly known as MSDS)?
    a. DEA
    b. FDA
    c. OSHA
    d. TJC

18. Which of the following statements is not true?
    a. Persons involved in the preparation of sterile products should scrub their hands with an appropriate antibacterial agent for a predetermined time and dry them with paper towels.
    b. The procedure should be repeated if possible contamination occurs.
    c. Jewelry should be worn during aseptic technique because of the possibility of contamination.
    d. Makeup should not be worn because of the particulate nature of the substance.

19. Which is the most effective method of communication?
    a. E-mail
    b. Face to face
    c. Memos
    d. Telephone

20. Which organization oversees VAERS?
    a. FDA
    b. ISMP
    c. OSHA
    d. TJC

21. Which organization oversees MedWatch?
    a. FDA
    b. ISMP
    c. OSHA
    d. TJC

22. Which organization oversees MERP?
    a. DEA
    b. FDA
    c. ISMP
    d. TJC

23. Which of the following is not an example of good customer service?
    a. Develop a personal relationship with the customer.
    b. Preserve customer confidentiality.
    c. Demonstrate compassion toward the customer.
    d. Support the customer's decisions.

24. What type of alcohol should be used when cleaning pill trays?
    a. Ethyl alcohol
    b. Isopropyl alcohol
    c. Methyl alcohol
    d. All of the above

25. What is the minimum number of times a prescription should be viewed when filling a prescription?
    a. Two
    b. Three
    c. Four
    d. Five

26. Which of the following documents is used to document medications administered to a patient?
    a. CSAR
    b. MAR
    c. POS
    d. TAR

27. What is placed in a sharps container?
    a. Biohazardous waste
    b. Controlled substances
    c. Hazardous waste
    d. Used syringes

28. Which of the following is not true when handling of syringes?
    a. Bend needles by hand.
    b. Never recap used needles using both hands or perform any other technique that involves directing the point of the needle toward the body.
    c. Use a one-handed "scoop" technique or a mechanical device designed for holding the needle sheath.
    d. Do not remove used needles from disposable syringes by hand.

29. How often does a HEPA filter need to be certified?
    a. Monthly
    b. Every 3 months
    c. Every 6 months
    d. Once a year

30. What part of new drug development does FAERS (formerly known as AERS) support?
    a. Phase I
    b. Phase II
    c. Phase III
    d. Postmarket surveillance

31. Which organization establishes standards for the identity, strength, quality, and purity of medicines, food ingredients, and dietary supplements?
    a. FDA
    b. ISMP
    c. USP
    d. TJC

32. Which of the following methods of providing a pharmacy with a prescription or medication order is preferred?
    a. E-prescribing
    b. Faxed
    c. Handwritten
    d. Telephoned

33. Which organization is responsible for reducing the spread of infectious disease?
    a. CDC
    b. CMS
    c. ISMP
    d. TJC

34. Where must recalled medications be stored in the pharmacy?
    a. In a locked cabinet
    b. In the narcotic safe
    c. Isolated from the other medications
    d. Spread throughout the pharmacy

35. How often do pharmacy weights need to be calibrated?
    a. Every 3 months
    b. Every 6 months
    c. Every 9 months
    d. Once a year

Chapter 6

Medication Order Entry and Fill Process

Chapter Objectives

Upon completion of Chapter 6, the pharmacy technician student will be able to

1. Recall the tasks a pharmacy technician may perform during the prescription filling process.
2. Explain the purpose and importance of a pharmacy policies and procedures manual.
3. Do the following regarding pharmacy language:
   - Recall the meaning of the various medical and pharmacy abbreviations that may appear on a patient's prescription, medication order, or patient profile.
   - Discriminate between the various root words, prefixes, and suffixes that are used to create the medical terminology that pharmacy technicians may be exposed to in their practice of pharmacy.
   - Explain the meaning of the various root words, prefixes, and suffixes used in medicine.
4. Discuss the prescription filling process, including:
   - Name the methods by which a prescription may be presented in a pharmacy.
   - Identify the different types of prescription or medication orders.
   - Describe each step in the prescription filling process.
   - List the required information on a prescription and medication order.
5. Name and explain the meaning of the various dispense as written (DAW) codes that that are used in data entry.
6. Discuss the labeling process, including:
   - Differentiate between the information required on the various types of labels.
   - List the information that is required to be included on a repackaging log.
7. Explain unit-dose packaging procedures, including:
   - Differentiate between expiration date and beyond-use dating.
   - Identify the information required to complete a unit-dose log.
8. Discuss packaging requirements, including:
   - Identify the various types containers used in filling prescription.
   - Interpret the terminology associated with the various storage temperatures.
9. List the information contained in a patient product insert and the types of medication that require a patient product insert be provided to a patient.
10. Identify drug distribution systems and provide examples of automated dispensing systems.

PTCB Knowledge Domains

- **6.2** Intake, interpretation, and data entry
- **6.4** Fill process (e.g., select appropriate product, apply special handling requirements, measure, and prepare product for final check)
- **6.5** Labeling requirements (e.g., auxiliary and warning labels, expiration date, patient-specific information)
- **6.6** Packaging requirements (e.g., type of bags, syringes, and glass, PVC, child resistant, light resistant)
- **6.7** Dispensing process (e.g., validation, documentation and distribution)

PHARMACY TECHNICIAN TASKS

Pharmacy technicians are permitted to perform a wide range of tasks during the order entry and prescription filling process. Some of these tasks include:

- Accepting new prescriptions from the patient
- Receiving prescription refills from the patient
- Requesting refill authorization from the patient's prescriber
- Collecting patient information
- Maintaining patient profiles
- Entering patient, prescriber, and medication information into the pharmacy's information system
- Interpreting the prescription's signa
- Billing prescription to third-party prescription providers
- Counting and pouring the correct medication
- Labeling prescription bottles
- Returning medication bottles to the pharmacy shelves
- Repackaging medication
- Preparing unit-dose medications

PRACTICE SITE POLICIES AND PROCEDURES

Each pharmacy will have a policies and procedures manual.

- **Mission statement:** States the purpose and goals of an organization
- **Policy:** A definite course or method of action; a plan establishing goals and objectives
- **Procedure:** Process of accomplishing a task to ensure efficiency and consistency; a step-by-step method to accomplish a policy

Policies and procedures are found in all types of pharmacy practice. They are required by professional and regulatory agencies, such as the American Society of Health-System Pharmacists (ASHP), the American Pharmacists Association (APhA), and The Joint Commission (TJC). Policies and procedures provide standards for the operation of a pharmacy. The policy and procedure manual can be used as a reference book and can promote safety in the workplace.

ExCPT Knowledge Domains

- **1.1** Overview of technician duties and general information
  - ***1.1.2*** Functions that a technician may and may not perform
  - ***1.1.3*** Prescription department layout and workflow
- **3.1** Prescription information
  - ***3.1.1*** Information required on a valid prescription form
  - ***3.1.2*** Telephoned and faxed prescriptions
  - ***3.1.3*** Refill requirements
  - ***3.1.4*** Patient information (age, gender, etc.)
  - ***3.1.5*** Interpreting prescribers' directions for prescription labels
  - ***3.1.6*** Recognizing and using common prescription abbreviations
- **3.2** Preparing and dispensing prescriptions
  - ***3.2.3*** Automated dispensing systems
  - ***3.2.4*** Procedures for preparing prescriptions and data entry
  - ***3.2.5*** Labeling prescriptions properly
  - ***3.2.6*** The purpose and use of patient records
  - ***3.2.7*** Proper packaging and storage
- **3.4** Sterile products, unit doses, and repackaging
  - ***3.4.1*** Drug distribution systems used in hospitals
  - ***3.4.2*** Procedures for repackaging medications

PHARMACY LANGUAGE

Pharmacy technicians must be aware of common medical and pharmacy abbreviations, as well as general medical terminology.

MEDICAL ABBREVIATIONS

Pharmacy technicians may encounter medical abbreviations on patients' prescriptions, in patients' medical charts, and in various types of drug literature they may encounter. Therefore pharmacy technicians must have the knowledge to interpret these abbreviations correctly so that errors do not occur. When in doubt about an abbreviation, pharmacy technicians should never guess but rather ask a pharmacist about it. Table 6-1 provides a small list of medical abbreviations.

PHARMACY ABBREVIATIONS

Pharmacy abbreviations are found in prescriptions, medication orders, and patient charts. Many of the abbreviations are derived from Latin and are used to identify weights, volumes, dosage forms, routes of administration, frequency of taking the medication, directions in compounding, and names of medications. These abbreviations may be either capitalized or in lower case letters. Many of the abbreviations used have been found to cause errors; therefore the Institute of Safe Medication Practices (ISMP) and the TJC have issued a list designating those abbreviations

TABLE **6-1** Medical Abbreviations

BODY CONDITION	MEANING
AIDS	acquired immunodeficiency syndrome
BM	bowel movement
BP	blood pressure
BPH	benign prostatic hypertrophy
BS	blood sugar
CA	cancer
CAD	coronary artery disease
CHF	congestive heart failure
COPD	chronic obstructive pulmonary disease
CP	chest pain
CVA	cerebrovascular accident
DJD	degenerative joint disease
DM	diabetes mellitus
DT	delirium tremens
GERD	gastroesophageal reflux disease
GI	gastrointestinal
GT	gastrostomy tube
GU	genitourinary
HA	headache
HBP	high blood pressure
HIV	human immunodeficiency virus
HR	heart rate
HT, HTN	hypertension
JRA	juvenile rheumatoid arthritis
NKA	no known allergies
NKDA	no known drug allergies
N&V, N/V	nausea and vomiting
OA	osteoarthritis
OCD	obsessive-compulsive disorder
P	pulse
PTT	prothrombin time
PVC	premature ventricular contraction
RA	rheumatoid arthritis
RBC	red blood cell
SCT	sickle-cell trait
SOB	shortness of breath
Sx	symptom
TED	thromboembolic disease
Tx	treatment
UA	uric acid, urinalysis
URI	upper respiratory infection
UTI	urinary tract infection
VS	vital sign
WBC	white blood cell

and symbols. In hospital practice, the Pharmacy and Therapeutics Committee may identify a list of approved abbreviations for the institution. In community practice, there is no such list. Pharmacy abbreviations may be found in the superscription, inscription, subscription, or the sig (signa) of the prescription. The superscription is the Rx symbol, inscription contains the name of the medication and its quantity, the subscription informs the pharmacist how to compound the prescription, and the sig are the directions for taking the medication. Table 6-2 presents examples of common pharmacy abbreviations. A more complete list of pharmacy abbreviations is located in Appendix G.

TABLE **6-2** Examples of Pharmacy Abbreviations

ABBREVIATION	MEANING
ac	before meals
am	before noon or morning
bid	twice a day
cap	capsule
dtd	give of such doses
fl oz	fluid ounce
g	gram
hs	bedtime or hour of sleep
IM	intramuscular
IV	intravenous
mg	milligram
mL	milliliter
NS	normal saline
oint	ointment
pc	after meals
pm	after noon
po	by mouth
qid	four times a day
tab	tablet
tid	three times a day

MEDICAL TERMINOLOGY

Medical terminology consists of root words, prefixes, and suffixes. By combining the various root words, prefixes, and suffixes, medical words are formed. Table 6-3

TABLE **6-3** Medical Terminology: Root Words, Prefixes, and Suffixes

ROOT WORD	MEANING
card	heart
derm	skin
gastro	stomach
lipo	fat
pulmo	lung
pyr/o	fever
ren/o	kidney
PREFIX	**MEANING**
brady-	slow
hyper-	above
hypo-	below
intra-	across
peri-	around
tachy-	fast
tri-	three
SUFFIX	**MEANING**
-algia	pain
-emia	blood
-itis	inflammation
-ology	study of
-pathy	disease
-phagia	eat
-uria	urine

contains some of many of the root words, prefixes and suffixes that you will encounter in your practice as a pharmacy technician. It presents examples of common medical root words, prefixes, and suffixes. A more complete list is found in Appendix B of this text.

PRESCRIPTION FILLING PROCESS (OVERVIEW)

THE MEDICATION ORDER

1. Receiving the prescription
   a. Method of receipt
      (1) Walk in
      (2) Call in (original prescription of nonscheduled II controlled substances may be telephoned in by the prescriber or his or her representative. A patient may call in a refill on his or her prescription.)
      (3) E-prescribing
      (4) Fax
   b. Patient profile: The patient profile provides the patient's health history. It is to be completed the first time a prescription is filled in a pharmacy and updated with subsequent new prescriptions and refills. Information contained in a patient profile may include:
      (1) Name, age, sex, race, occupation, address, weight
      (2) Medical history to include surgeries
      (3) Medication history to include current prescription medications, over-the-counter (OTC) medications, vitamins, and herbal supplements
      (4) Drug and food allergies
      (5) Adverse drug effects
   c. Prescription information
      (1) Patient information: Includes the patient's name, home address (street number, street, city, state, zip code), telephone number, and birth date
      (2) Prescriber information: Includes the prescriber's name, office address (street number, street, city, state, zip code), office telephone number (including area code), National Provider Identifier (NPI) number, and Drug Enforcement Administration (DEA) number (only for controlled substances)
      (3) Prescription information
2. Interpreting the prescription
   a. Identify the name, strength, dosage form, and quantity of medication to be dispensed.
   b. Identify the route of administration.
   c. Identify the frequency of administration.
   d. Determine if a generic drug may be dispensed.
   e. Identify the number of refills permitted by the prescriber. (If no refills are indicated by the prescriber, then 0 refills will be permitted.)
   f. When in doubt about interpreting the prescription, ask the pharmacist for clarification. If the pharmacist has questions regarding a prescription, the physician will be contacted.
3. Entering information into computer system
   a. Information required is prompted.
   b. Quantities are expressed in metric units.
   c. Input the correct dispense as written (DAW) code (e.g., DAW 1 would indicate the prescriber wants the brand name drug dispensed).
   d. Calculate a day's supply of medication.
   e. Third-party adjudication: Submitting prescription for payment by third-party drug insurance provider. If the prescription drug insurance company denies payment, the patient is responsible for full payment of the prescription unless the rejected claim is corrected and resubmitted to the third-party prescription drug provider.
   f. Drug utilization evaluation (review): Process of verifying that the prescription being processed does not interact adversely with the other medications on a patient's profile. If a warning is observed, the pharmacist is to be notified immediately to determine the proper course of action in filling the prescription, such as contacting the physician or to continue filling the prescription. The pharmacist makes a decision based on the information on hand.
4. Filling the prescription
   a. Verify all prescription information has been entered properly.
   b. Pull medication from the shelf and check prescription label against the NDC number found on bulk container; scan the UPC code on the bottle to ensure the correct medication was selected.
   c. Measure or count the medication; if counted manually, count in multiples of five. Whether counting manually or using automatic counting equipment, recount the quantity for accuracy. If any penicillin or a sulfa drug is dispensed, the pill counting tray should be wiped down using isopropyl alcohol. When dispensing oral chemotherapeutic or hazardous agents, the pharmacy technician should wear gloves to prevent the skin from coming in contact with the medication and the counting tray wiped down using isopropyl alcohol.
   d. Select an appropriately sized container and pour the medication into the container.
   e. Place an appropriately sized child-resistant top on the container. If a patient requests an EZ-open top, have the patient sign the back of the original prescription indicating the request.

f. Place the labels on the container and the upper backhand corner of the original prescription.
g. Add printed auxiliary labels to the prescription container.
h. Place the completed prescription container on top of the original prescription with the bulk container that has been pulled from the shelf.
i. The pharmacist checks the completed prescription and bags the prescription.
j. The completed prescription is placed in the appropriate bin.
k. The bulk medication bottle is returned to shelf.

5. Patient consultation
   a. Ask the patient or person picking up the prescription if he or she has any questions for the pharmacist. If yes, inform the pharmacist, who will counsel the patient. In some situations, the pharmacist may wish to speak with a patient to make sure he or she understands how to take a medication.
   b. Pharmacy technicians are not permitted to counsel patients.

TYPES OF PRESCRIPTION (MEDICATION) ORDERS

- **STAT:** A medication order that should be filled within 15 minutes of receiving it in a hospital
- **ASAP (as soon as possible):** A medication order that does not have the priority of a STAT order but needs to be processed as soon as possible
- **PRN (as needed):** An order that may be filled or administered when a patient requests it, but there may be limitations associated with it

REQUIRED PATIENT INFORMATION

Information collected from either the patient or his or her representative by the pharmacy technician is maintained in a patient profile. Every patient has a profile. This information is necessary for the pharmacist to ensure that patients receive the proper medications and to reduce potential adverse effects. This information includes the following:

- **Patient information:** Name, sex, address, and age of patient; obtaining the telephone (home, mobile, and work) numbers of the patient is highly recommended
- **Billing information:** Who is responsible for payment of prescription, whether it is the patient or a third-party provider. The third-party provider information includes a group number and subscriber identifier (may be either a numeric or alphanumeric) and the individual's relationship to the cardholder (cardholder, spouse, or dependent).
- **Disease states or health conditions:** Specific medications can have an adverse effect on a disease state or condition; drug–disease interactions
- **Medications patient is taking:** Prescription, OTC, or complementary and alternative medications; this information is used to prevent drug–drug interactions
- **Drug allergies:** Any medication allergies the patient is known to possess. This information is necessary to ensure that the patient does not receive a medication that can have an adverse effect on the patient.

REQUIRED PRESCRIBER INFORMATION

Prescriber information includes:

- Name of physician or prescriber
- Office address of physician (prescriber), including the street number, street name (office or suite number if applicable), city, state, and zip code
- DEA number for controlled substances
- NPI number
- State license (depending on state regulations)

REQUIRED PRESCRIPTION INFORMATION

- Date the prescription was written
- Patient information:
  - Patient's name
  - Patient's home address, including the number, street, city, state, and zip code
- Inscription
  - Name of medication (may be either brand or generic)
  - Strength of medication (if applicable)
  - Dosage form
  - Quantity of medication to be dispensed
- Subscription: Instructions to the pharmacist
- Physician's signature: Must be in ink (handwritten prescriptions); stamped signatures are illegal

REQUIRED MEDICATION ORDER INFORMATION

- Prescriber's information, including the physician's name, DEA number (controlled substances only), and hospital-assigned ID
- Date of order
- Patient information, including the room number, bed number, and ID number assigned to the patient
- Name, strength, and dosage form of medication
- When to be administered (frequency); in some hospitals, the frequency is assigned a specific time
- Duration of therapy
- Prescriber's signature

PRESCRIPTION REFILL INFORMATION

The following information should be obtained from a patient when they call in a prescription refill:

- Patient's name
- Patient contact information
- Patient's date of birth

- Patient's home telephone number
- Prescription number
- Name of the medication, strength, dosage form, and quantity

If the patient does not have all of this information, the patient's profile can be accessed by the computer by the patient providing his or her name and date of birth.

If the prescription does not have any refills remaining, the pharmacy technician may contact the prescriber by telephone or fax or electronically.

DATA ENTRY IN PRESCRIPTION PROCESSING

- The pharmacy technician is prompted by computer as to order of the information to be entered.
- The patient's name is searched by entering the last name followed by the first name. The patient's birth date is used to distinguish between individuals with the same name.
- The patient's third-party prescription insurance card will contain a Bank Identification Number (BIN) number, plan group number, and patient's ID number.
- The patient's relationship to the cardholder will need to be entered; many plans use the following relationship holder codes:
  - 01: Cardholder
  - 02: Spouse
  - 03: Dependent
- The physician's name is searched by last name followed by first name. Using a physician's DEA or NPI number can identify a doctor from other doctors with the same name. A physician may have multiple office locations.
- Drug name must be entered, and the NDC number of the medication selected must be the same as the medicine being dispensed.
- The quantity of medication dispensed must be entered as a metric quantity.
- The DAW code is entered based on how the prescription is written.
- A pharmacy's computer system may have sig codes or shortcuts when entering the prescription's signa. Each computer system has sig codes that are appropriate for that system (different systems may have different sig codes). A sig code is not always the same as pharmacy abbreviation. The sig code will be interpreted by the computer and will translate into the appropriate directions for the patient.

DISPENSE AS WRITTEN CODES

Dispense as written codes are used to ensure the pharmacy is properly reimbursed by a third party provider for a prescription being dispensed. These codes are as follows:

0 = No product selection indicated
1 = Substitution not allowed by provider
2 = Substitution allowed; patient requested product dispensed
3 = Substitution allowed; pharmacist-selected product dispensed
4 = Substitution allowed; generic drug not in stock
5 = Substitution allowed; brand drug dispensed as generic
6 = Override
7 = Substitution not allowed; brand drug mandated by law
8 = Substitution allowed; generic drug not available in marketplace
9 = Other

LABELING PROCESS

REQUIRED PRESCRIPTION LABEL INFORMATION

- Date when the prescription was filled
- Serial (prescription) number of the prescription
- Name and address of the pharmacy
- Name of the patient
- Name of the prescribing physician
- All directions for use of the prescription
- Generic or brand name of the prescription
- Strength of the medication
- Name of the drug manufacturer
- Quantity of the drug
- Expiration date of the prescription
- Initials of the licensed pharmacist
- Number of refills allowed

REQUIRED MEDICATION ORDER LABEL INFORMATION

- Name and location of the patient
- Trade or generic name of drug
- Strength of drug
- Quantity of drug for the outpatient prescription labels
- Expiration date of medication
- Lot number of medication

STERILE PRODUCT PRESCRIPTION LABELING

- Pharmacy name
- Patient name
- Date of filling
- Ingredients (strength and quantity of each)
- Total volume
- Directions for use

- Infusion rate
- Beyond-use date

REPACKAGED MEDICATIONS

Only enough medication as needed for a limited time period should be repackaged, and the following information is required on the package:

- Name of medication
- Drug manufacturer's name
- Dosage form
- Strength of drug
- Beyond-use date (BUD)
- Lot number (batch number) of medication

REPACKAGING LOG

The repackaging log contains documentation required for repackaging medication and must be signed by the pharmacist.

- Date of repackaging
- Name of drug
- Drug strength
- Dosage form
- Drug manufacturer
- Lot (batch) number
- Drug manufacturer's expiration date
- Beyond-use date (BUD) assigned by the pharmacy
- Quantity repackaged
- Pharmacy technician's initials (if repackaged by a pharmacy technician)
- Pharmacist's initials
- Repackaging log must be maintained

UNIT-DOSE LABELING

- Trade or generic name of drug
- Drug manufacturer
- Strength of drug
- Beyond-use date (BUD)
- Lot number of medication
- A unit-dose log must be maintained.

AUXILIARY (ANCILLARY) LABELS

Auxiliary labels provide additional information, such as special instructions, warnings, or storage conditions, to the patient. Auxiliary labels are printed with the prescription label and should be affixed to the container such that they do not cover any words on the prescription label. They may provide information on the administration of the drug. Examples of auxiliary labels include:

- Do Not Drink Alcohol
- May Cause Drowsiness
- Take with Food or Milk
- Avoid Sunshine
- Take on an Empty Stomach
- Shake Well
- Refrigerate

COMMON AUXILIARY LABELS FOR DOSAGE FORMS

DOSAGE FORM	TYPE OF AUXILIARY LABEL
Suspension	SHAKE WELL
Ophthalmic preparations	FOR THE EYE
Otic preparations	FOR THE EAR
Ointments, creams, and lotions	FOR EXTERNAL USE ONLY FOR TOPICAL USE
Suppositories	FOR RECTAL USE FOR VAGINAL USE
Patches	APPLY TO SKIN

UNIT-DOSE PACKAGING PROCEDURES

PERSONNEL

- Possess the education and training to perform the necessary functions

FACILITY

- Low relative humidity and controlled room temperature

EQUIPMENT

- Appropriate design should allow cleaning to prevent cross-contamination.
- Equipment and utensils should be cleaned, maintained, and sanitized at appropriate times.

MATERIALS USED

- Should not be reactive, additive, or absorptive

BLISTER PACK COMPONENTS

- Blister: Holds the medication
- Lidding stock: Material (e.g., aluminum) that seals the blister

PACKAGING

- Manually
- Automatic

UNIT-DOSE CONTAINERS

CONTAINER	DOSAGE FORM
Amber blister packs	Tablets and capsules
Amber glass	Liquids
Applicators	Suppositories, creams, and ointments
Foil cups	Liquids and suspensions
Heat-sealed strip packs	Tablets, capsules, and troches
Oral syringes	Liquids
Plastic cups	Liquids and suspensions
Plastic suppository shells	Suppositories
Syringes	Parenterals, oral liquids, and transdermal gels

TYPES OF UNIT-DOSE PACKAGES

- **Unit-dose system:** A system that provides a medication in its final "unit of use." Unit-dose packaging machines may be manual, semiautomatic, or automatic. It may be a single-drop (60 packages/min) or double-drop (120 packages/min) system.
- **Modified unit-dose system:** A drug distribution system that combines unit-dose medications, which are blister packaged onto a multiple-dose card instead of being placed in a box. Synonymous with *punch cards, bingo cards,* and *blister cards.*
- **Blended unit-dose system:** Combines a unit-dose system with a non–unit-dose system. May be a multiple-medication package or a modular cassette. A multiple-medication package has all the medication, which is administered at the same time. A modular cassette is a combination cassette or drawer exchange system.

STORAGE OF UNIT-DOSE MEDICATIONS

- Products should be rotated to ensure first-in, first-out processes.
- Temperature should not exceed 25° C.
- The final product should be examined for instability caused by changes in color or odor.

COMPLAINTS

- A process is in place to handle all oral and written complaints.

RETURNED GOODS

- A process is in place to handle all returned medications. Returned unit dose medications should be credited to the patient's account. The returned unit dose medications may be redispensed because they are in unit-dose packages.

REPROCESSING

- Transferring medication from one unit-dose container to another unit-dose container is not permitted.
- Removing the blister card from the cardboard carrier and placing it in another cardboard carrier is permitted.

UNIT-DOSE LOG RECORD

The following information is required to be filled out on a unit-dose log record:

- Date unit dose was prepared
- Drug (generic name)
- Medication strength
- Dosage form
- Quantity prepared
- Drug manufacturer
- Drug manufacturer lot number
- Manufacturer's expiration date
- Pharmacy-assigned beyond-use date (BUD)
- Pharmacy lot number
- Pharmacy technician's initials
- Pharmacist's initials

BEYOND-USE DATE

The expiration date of a medication is determined by the drug manufacturer. Beyond-use dating is used when medications are repacked from a bulk container into a unit-dose form. There are two methods of determining the beyond-use date:

- 6 months or ¼ of the manufacturer's expiration date, whichever is less
- Maximum of 1 year as long as drug does not exceed the safety margin of the drug manufacturer

PACKAGING REQUIREMENTS

CONTAINER USES

- **Round vials:** Used for solid dosage forms such as tablets or capsules
- **Prescription bottles:** Used for liquids of low viscosity
- **Wide-mouth bottles:** Used for bulk powders or large quantities of tablets, capsules, and viscous liquids that cannot be poured readily from narrow-necked containers
- **Dropper bottles:** Used for ophthalmic, nasal, otic, or oral liquids to be administered by drop
- **Applicator bottles:** Used for applying liquid medications to a wound or skin surface
- **Ointment jars and collapsible tubes:** Used to dispense semisolid dosage forms
- **Hinged-lid or slide boxes:** Used for dispensing suppositories and powders

CLASSIFICATION OF CONTAINERS

- **Tamper-evident packaging:** A container or individual carton of a sterile article intended for ophthalmic or otic use must be so sealed that the contents cannot be used without obvious destruction of the seal.
- **Light-resistant container:** Protects the contents from the effects of light caused by the contents of the container
- **Well-closed container:** Protects the contents from other solids and from loss of the article under normal conditions
- **Tight container:** Protects the contents from contamination by liquids, solids, or vapors
- **Hermetic container:** Impervious to air or gas
- **Single-unit container:** Designed to hold a quantity of drug product intended for administration as a single dose
- **Single-dose container:** A single-unit container for parenteral administration

- **Unit-dose container:** Unit-dose container is a single-unit container intended for administration other than parenteral
- **Unit-of-use container:** One that contains a specific quantity of a drug product that is intended to be dispensed as such without further modification except for appropriate labeling
- **Multiple-unit container:** Permits withdrawal of successive portions of the contents without changing the strength, quality, or purity of the remaining portion
- **Multiple-dose container:** Multiple unit container for parenteral administration

STORAGE CONDITIONS (UNITED STATES PHARMACOPEIA)

- **Freezer:** A place where the temperature is maintained thermostatically between −25° and −10° C (13° and 14° F)
- **Cold:** Any temperature not exceeding 8° C (46° F)
- **Cool:** Any temperature between 8° and 15° C (46° and 59° F)
- **Room temperature:** The temperature prevailing in a working environment
- **Controlled room temperature:** A temperature maintained thermostatically that encompasses the usual and customary working environment of 20° to 25° C (68° to 77° F)
- **Warm:** Ay temperature between 30° and 40° C (86° and 104° F)
- **Excessive heat:** Any temperature above 40° C (104° F)
- **Protect from freezing:** In the addition to the risk of breaking the container, freezing subjects the item to a loss of strength or potency.
- **Dry place:** Denotes a place that does not exceed 40% relative humidity

CHILD-RESISTANT CONTAINERS

- The Consumer Product Safety Commission requires drug manufacturers to place prescription drugs in child-resistant containers if the original package is intended to go directly from the pharmacist to the patient.
- All legend drugs intended for oral use must be dispensed by the pharmacist to the patient having safety closures unless the prescribing physician or patient requests otherwise. If a patient requests a non–child-resistant container, the prescription may be dispensed in a non–child-resistant container, but the patient must sign the back of the prescription indicating he or she has requested a non–child-resistant container.
- Select medications, such as oral contraceptives and select cardiovascular medications such as nitroglycerin, are exempted from child-resistant packaging.
- Drugs that are used or dispensed in inpatient institutions, such as hospitals, nursing homes, and extended stay facilities, are not required to be in child-resistant containers.

PATIENT PACKAGE INSERT REQUIREMENTS

A patient package insert is an informational leaflet written for the lay public describing the benefits and risks of medications. Information found on a package insert includes the following:

- Description
- Clinical pharmacology
- Indications and usage
- Contraindications
- Warnings
- Precautions
- Adverse reactions
- Drug abuse and dependence
- Overdosage
- Dosage and administration
- How supplied
- Date of the most recent revision of the labeling

A pharmacy is required to provide patient package inserts to all patients receiving metered-dose inhalers, oral contraceptives, estrogen, progesterone, and isotretinoin.

DRUG DISTRIBUTION SYSTEMS

AUTOMATED DISPENSING SYSTEMS

A storage, dispensing, and charging system that is used to save time, improve inventory control tracking, and reduce medication errors. These systems are most commonly found in hospitals and may be centralized or decentralized.

- **Centralized pharmacy:** Found in the central pharmacy that is used to improve manual unit-dose cart fill process. A disadvantage of the centralized system is its inability to handle all dosage forms.
- **Decentralized pharmacy:** Found in the patient care areas of a hospital to eliminate or reduce management issues that include narcotic diversion and poor record keeping. Advantages of this system include the ability to dispense and return medications, document medication waste, and produce reports.

EXAMPLES OF AUTOMATED DISPENSING SYSTEMS (DECENTRALIZED)

- **Pyxis MedStation system:** Automated dispensing system supporting decentralized medication

management. Bar code scanning ensures accurate medication dispensing, features to prevent loading of the wrong medication, and active alerts to provide an added safety precaution for high-risk medications.

- **Cubie system:** Restricts access to only one medication at a time during the removal process. The system helps reduce the risk of nurses selecting a medication from the wrong pocket.
- **Pyxis CII Safe:** Tracks and monitors the replenishment of controlled substance inventory within a hospital
- **Pyxis anesthesia system:** Provides visibility to medication inventory and utilization to help pharmacy ensure anesthesia providers can access the needed medication for patients. The system has a biometric access system and a variety of drawer types, including a new controlled access drawer for larger high-risk medications.

CHAPTER 6 REVIEW QUESTIONS

1. What is the subscription on a prescription?
   a. Any special instructions or directions to the pharmacist
   b. Directions to be typed on the prescription label
   c. Name, strength, and quantity of medication
   d. The Rx symbol

2. Which of the following must be done if a patient requests an easy-open container?
   a. Verify with the physician that the dispensing of a medication in an easy-open container is permitted.
   b. Verify that there are no children younger than 12 years living with the patient.
   c. Verify that the patient has activated charcoal at home in case of a potential overdose.
   d. Have the patient sign the back of the prescription indicating that he or she has requested an easy-open container.

3. Which of the following pieces of information is not needed on a patient's prescription?
   a. Patient's name
   b. Patient's ID number
   c. Name of the medication
   d. Directions for use

4. Which of the following is not required on a medication order label?
   a. Expiration date of medication
   b. Lot number of medication
   c. Medication number
   d. Name and location of patient

5. Which of the following is not found on a patient package insert?
   a. Description of medication
   b. Expiration date and lot number of medication
   c. Indications for medication
   d. Date of drug approval

6. Which piece of information is not required on a medication order label?
   a. Expiration date of medication
   b. Pharmacist or technician who processed the order
   c. Lot number of medication
   d. Trade or generic name of medication

7. Which of the following medications does not require that a patient package insert be given to the patient?
   a. Isotretinoin
   b. ACE inhibitors
   c. Estrogens
   d. Oral contraceptives

8. In multiples of what number should medication be counted?
   a. Two
   b. Three
   c. Five
   d. Ten

9. A physician prescribes a prescription for a noncontrolled schedule prescription with "prn" refills. For what period of time is the prescription valid?
   a. 1 year from the date the prescription was written
   b. 1 year from the date the prescription was filled
   c. 1 year from the date the prescription was picked up by the patient
   d. 6 months from the date the prescription was written

10. A prescription is written for one pint of a prescription drug. What volume must be entered in the computer system?
    a. One pint
    b. Two cups
    c. 240 mL
    d. 480 mL

11. Which of the following is not required on a prescription?
    a. Name of the medication
    b. Patient's birthday
    c. Patient's social security number
    d. Prescriber's information

12. What is the maximum number of refills permitted on a schedule IV prescription?
    a. 0
    b. 1
    c. 5
    d. 6

13. What is the purpose of an auxiliary label?
    a. Identifies medications that require a patient product insert be provided to the patient
    b. Identifies the expiration date of the medication
    c. Identifies the lot or batch number of the medication
    d. Provides additional information about the medication that may include when to take the medication, storage, and possible adverse effects

14. Which of the following is true regarding EZ-open prescription bottle lids?
    a. All prescriptions require that one is placed on it; however, a patient may request that it not be used.
    b. A prescriber or a patient may request that one is placed on the container.
    c. They must be provided to any individual who does not have children living in his or her home.
    d. They must be provided to all senior citizens.

15. A noncontrolled prescription is written with three refills and filled today at the pharmacy. Two weeks later, the patient requests that it be transferred to another pharmacy. How many times may it be transferred?
    a. Zero times
    b. One time
    c. Two times
    d. Three times

16. Which of the following pieces of information does not need to appear on a prescription label for a controlled substance?
    a. Directions for use
    b. Name of medication
    c. Patient's name
    d. Prescriber's DEA number

17. What DAW code is assigned if no product is selected?
    a. DAW 0
    b. DAW 1
    c. DAW 2
    d. DAW 3

18. What does the suffix *-ology* mean?
    a. Disease
    b. Heart
    c. Inflammation
    d. Study of

19. What is the meaning of the pharmacy abbreviation "bid"?
    a. Four times a day
    b. Every other day
    c. Three times a day
    d. Twice a day

20. The pharmacy receives a prescription for Synthroid 0.1 mg. What term refers to the name and strength of the medication?
    a. Inscription
    b. Prescription
    c. Signa
    d. Subscription

21. The pharmacy receives a prescription for the following:
    Amoxicillin 500 mg #30
    1 cap po tid
    How many days will this prescription last?
    a. 6 days
    b. 10 days
    c. 15 days
    d. 30 days

22. What does "prn" refills mean?
    a. The patient may refill the prescription at any time.
    b. The patient may refill the prescription for 1 year from the date the prescription was filled.
    c. The patient may refill the prescription for 1 year from the date the prescription was written.
    d. The prescriber must be notified before the prescription is refilled.

23. A pharmacy technician may not:
    a. Collect patient information.
    b. Counsel patients.
    c. Enter data into the pharmacy's information system.
    d. Update patient profiles.

24. What is the meaning of the following sig: "2 tab po qid ac and hs"?
    a. Place two tablets under the tongue four times a day.
    b. Take two tablets by mouth four times a day.
    c. Take two tablets by mouth four times a day after meals and at bedtime.
    d. Take two tablets by mouth four times a day before meals and at bedtime.

25. Which of the following auxiliary labels would be appropriate for a suspension?
    a. For Ears Only
    b. For External Use Only
    c. For Eyes Only
    d. Shake Well

26. What is the meaning of the prefix *hyper-*?
    a. Above
    b. Across
    c. Below
    d. Fast

27. A pharmacy technician is preparing unit doses of a medication. What form must be completed?
    a. DEA Form 224
    b. Mixing record
    c. SDS
    d. Unit-dose log

28. What term refers to a temperature of 10° C?
    a. Cold
    b. Cool
    c. Freezer
    d. Room temperature

29. What term is used to describe the date assigned to a unit-dose package?
    a. Beyond-use date
    b. Expiration date
    c. Packaged date
    d. Unit date

30. An individual's patient profile indicates he has CHF. What does this mean?
    a. Cardiac heart failure
    b. Congestive heart failure
    c. Cardiac heart fibrillation
    d. Cardiac heart flutter

31. A prescriber writes in her own handwriting: "Brand Name Medically Necessary." What DAW number should be assigned to the prescription?
    a. DAW 0
    b. DAW 1
    c. DAW 2
    d. DAW 3

32. What type of container prevents air from reaching the medication?
    a. Hermetic
    b. Multidose
    c. Single dose
    d. Unit dose

33. Which of the following pieces of information does not need to appear on a prescription for fluoxetine?
    a. Medication strength
    b. Prescriber's DEA Number
    c. Prescriber's office telephone number
    d. Quantity of medication

34. Which of the following drug classifications does not need to be dispensed in a child-resistant container?
    a. Antibiotics
    b. Antiviral medications
    c. Oral contraceptives
    d. Oral hypoglycemic agents

35. Of the following tasks, which may a pharmacy technician not perform?
    a. Accepting a prescription from a patient
    b. Entering a prescription into the computer
    c. Handing a patient's prescription medication to him or her
    d. Patient counseling

36. Which of the following does not need to appear on a unit-dose log?
    a. Color of medication
    b. Medication lot number
    c. Medication NDC number
    d. Pharmacy technician's initials

37. What dosage form would be placed in an amber blister pack?
    a. Capsule
    b. Ointment
    c. Suspension
    d. Syrup

38. What relationship code would be used to identify the cardholder of a prescription drug card?
    a. 01
    b. 02
    c. 03
    d. 04

39. Which part of a prescription indicates the directions to the patient?
    a. Inscription
    b. Signa
    c. Subscription
    d. Superscription

40. What does "dtd" mean on a prescription?
    a. Give of such doses
    b. Of each
    c. Weight
    d. Write on label

Chapter 7

Pharmacy Inventory Management

Chapter Objectives

Upon completion of Chapter 7, the pharmacy technician student will be able to

1. Define inventory, the importance of inventory management, and the mechanisms used to obtain inventory management goals in the practice of pharmacy.
2. Identify the various types of inventories performed in the practice of pharmacy.
3. Explain the purpose of National Drug Code (NDC) numbers, lot numbers, expiration dates, and beyond-use dates.
4. Discuss the purpose of a formulary in the practice of pharmacy.
5. Discuss the ordering and receiving process, including:
   - Recognize the various factors that should be considered during the procurement of medications.
   - Differentiate between the various sources where medications may be obtained.
   - List the components of a purchase order.
   - State the steps to be followed when receiving medications.
   - Discuss the various types of unit-dose systems.
6. Recall the terminology established by the USP involving the storage of medications.
7. Discuss medication disposition, including:
   - Differentiate between the various types of drug recalls.
   - Explain the steps involved with drug recalls.
   - Differentiate between pharmacy waste and hazardous waste.
   - Cite examples of the various types of hazardous waste.
8. Explain the use of investigational new drugs, including:
   - Identify the processes involved in new drug development.
   - Discuss the ordering, storage, usage, and disposition of investigational drugs.
9. Identify the security mechanisms used in the practice of pharmacy.
10. Define the various financial accounting terms used in inventory management.

PTCB Knowledge Domains

- **7.1** Function and application of NDC, lot numbers, and expiration dates
- **7.2** Formulary or approved/preferred product list
- **7.3** Ordering and receiving processes (e.g., maintain par levels, rotate stock)
- **7.4** Storage requirements (e.g., refrigeration, freezer, warmer)
- **7.5** Removal (e.g., recalls, returns, outdates, reverse distribution)

ExCPT Knowledge Domains

- **1.1** Overview of technician duties and general information
  - ***1.1.3*** Prescription department layout and workflow
  - ***1.1.4*** Pharmacy security
  - ***1.1.5*** Inventory control
  - ***1.1.6*** Stocking medications
  - ***1.1.7*** Identifying expired drugs
- **2.1** Drug classification
  - ***2.1.4*** NDC number
- **3.3** Calculations
  - ***3.3.7*** Business calculations (pricing, mark-up, inventory record)
- **3.4** Sterile products, unit dose and repackaging
  - ***3.4.2*** Procedures for repackaging medications

INVENTORY

- Refers to the quantity and medication on hand

INVENTORY MANAGEMENT

Focuses on the procurement, drug storage and inventory control, repackaging and label considerations, distribution systems, and recapture and disposal of used and unused pharmaceutical products

PURPOSE OF INVENTORY MANAGEMENT

- Provides an adequate stock of pharmaceuticals and supplies
- Reduces unexpected stock-outs and temporary shortages, which may affect patient care
- Reduces carrying cost (financial investment) in drug products
- Minimizes costs associated with placing orders to the wholesaler
- Minimizes time spent on purchasing functions
- Minimizes capital charge on average inventory
- Minimizes shrinkage, breakage, and obsolescence of inventory
- Reduces purchasing dollars spent by selecting products based on organizational formulary requirements, bioequivalence, and cost

INVENTORY MANAGEMENT PROCESSES AND TOOLS

- **Just-in-time ordering:** A strategy of ordering a product just before it is used. This process minimizes tying up funds for long periods and reduces the cost associated with inventory management. Just-in-time ordering prevents overstock and out-of-stock conditions.
- **PAR (periodic automatic replacement) value:** The amount of drug that is automatically reordered. In automatic reordering systems, when a drug falls below a predetermined quantity, it is automatically reordered.
- **Minimum and maximum:** A predetermined number that states the minimum and maximum amounts of medication to be kept on a shelf. The smaller the range, the more accurate the quantity to be stocked. This system eliminates guesswork from an individual ordering the medication. The system is based on historical data for an institution and current trends.
- **ABC analysis:** A method used to identify and define inventory items based on their usage. Products are ranked based on their purchase history and dollar amount of total annual costs. Focuses efforts based on the products that will have the greatest inventory turnover rate (Table 7-1).
- **80/20 rule:** 80% of a pharmacy's drug costs are derived from 20% of the pharmaceuticals carried. Focuses on inventory control of the top 20% of the items carried.
- **Inventory turnover rate:** The cost of goods sold over the average inventory value. The greater the number of inventory turns indicates better utilization of financial resource of an institution.
- **Economic order quantity (minimum cost quantity):** A method used that incorporates the point in which the combination of order costs and inventory holding costs are taken into consideration.

TABLE **7-1** ABC Analysis

ABC ITEM RANK	TOTAL ANNUAL % OF COSTS	% OF PRODUCTS
A	80	20
B	15	15
C	5	65
Total	100	100

INVENTORY MANAGEMENT REPORTS

- **80/20 report (velocity report):** A detailed summary of purchasing history based on the 80/20 rule, designating medications that account for 80% of the drug costs for that period of time
- **Compliance report:** A report summarizing all items that were not purchased on bid

TYPES OF INVENTORIES

- **Initial:** An accurate inventory of all controlled substances taken before opening a new pharmacy or when there is a change in the pharmacist in charge
- **Biennial:** An inventory required by the Drug Enforcement Agency (DEA) of all controlled substances every 2 years. An accurate count of all Schedule II medications must be performed; Schedules III, IV, V, and "exempt narcotics" may be estimated.
- **Perpetual:** An inventory that reflects exactly what is on hand at a particular time. Often perpetual inventories are maintained on Schedule II medications and any other medication the pharmacy may wish to keep track.
- **Physical:** An inventory conducted on a basis (typically yearly) to determine exactly what is on hand at a particular moment in time and the value of the inventory based on the current cost of that item at that time

NATIONAL DRUG CODE NUMBERS, LOT NUMBERS, AND EXPIRATION DATES

NATIONAL DRUG CODES NUMBERS

Each drug is assigned a specific 11-digit number to identify it. The first five numbers identify the manufacturer, the next four numbers identify the drug product, and the final two numbers represent the package size and packaging. If a medication is reformulated, it will be given a new National Drug Code (NDC) number. If a drug manufacturer purchases another drug company, the NDC number will also change.

LOT NUMBERS (BATCH NUMBERS)

Lot numbers are assigned by the drug manufacturer to identify a given batch of medication.

EXPIRATION DATES

Expiration dates are assigned by the manufacturer and ensure the amount of time a product will be pure, safe, and effective for use by a patient. The expiration date is the last day of a particular month of a given year. Both the lot number and expiration date are used in drug recalls whether by the manufacturer or the Food and Drug Administration (FDA).

BEYOND-USE DATES

A beyond-use date is assigned by the pharmacy when repacking or compounding a medication. There are two possible methods, 6-month and 1-year methods. The 6-month method is either 6 months or one fourth of the manufacturer's expiration date. The 1-year method is a maximum of 1 year as long as it does not exceed the expiration date of the manufacturer. Beyond-use dates for sterile compounded medications do not follow this method because of United States Pharmacopeia (USP) 797 requirements.

FORMULARY

- A list of drugs that are approved for use in an institution such as a hospital or whose cost will be reimbursed by a third-party carrier to a pharmacy
- Established by the pharmacy and therapeutics committee of a hospital or managed care organization
- Three types:
  - **Open formulary:** All pharmaceutical products carried
  - **Closed formulary:** Limited number of products of each drug classification covered
  - **Restricted formulary:** A hybrid of both open and closed formularies
- Formularies may define policies, procedures, and guidelines established by the medical staff regarding a medication's usage.
- Should be updated periodically to ensure medication available is appropriate based on prescribing habits

ORDERING AND RECEIVING PROCESS

PROCUREMENT CONSIDERATIONS

- Procurement includes drug selection, source selection, cost analysis, group purchasing, prime vendor relationships, purchasing procedures, record keeping, and receiving control.
- Drug selection includes a cost analysis (cost per dose, cost per day, or cost per treatment). Cost–benefit analysis examines the perceived benefit versus the cost of the medication.
- Source selection is deciding whether a generic or brand name drug is to be purchased. It examines

the therapeutic equivalency of the products. Examination of the reputation of the drug manufacturer and knowledge of drug analysis data are taken into consideration. Consideration of product is affected by the *ASHP (American Society of Health-System Pharmacists) Guidelines for Selecting Pharmaceutical Manufacturers and Suppliers.*

- Cost analysis is an examination of acquisition and storage costs and the costs associated with the time required to prepare or package a drug.
- Group purchasing organizations allow hospitals to purchase medications at a lower cost based on volume. These organizations negotiate prices but do not make purchases for an institution. The ability to purchase contract items is known as a "bid" or "contract compliance."
- A primary or prime vendor is one source, a wholesaler, from which as many products as possible are purchased. When choosing a primary vendor, one should consider the following: delivery rate of items, 24-hour emergency service, computer system for ordering drugs from the vendor, electronic order entry devices, bar-coded shelf labels, competitive pricing, purchasing history reports (80/20 and compliance reports), pricing updates, return policy, and drug recalls.
- Purchasing procedures include negotiating discounts and establishing payment schedules, terms of payment, prepayment policies, nonperformance penalties, and returned and damaged goods policies.
- Records must be maintained to meet government regulations, standards of practice requirements, accreditation standards, policies, and management information requirements. Records may include purchase orders that authorize the purchase of a product.
- Receiving procedures include shipments, invoices, and purchase orders that must be reconciled by item. Quantity and strength of each item must be checked, prices on invoice should correspond to price that has been negotiated, and discrepancies must be addressed promptly with the pharmacist and the vendor.

TYPES OF INVENTORY ORDERING PROCESSES

- **Purchase from drug manufacturers:** Allows pharmacies to purchase in bulk, resulting in a savings for the company. Wholesalers may not always stock specific medications because of storage conditions, expense, or low demand.
- **Purchase from wholesalers:** Wholesalers stock medications from all manufacturers. Pharmacies are able to purchase when they need a product rather than far in advance. Wholesalers may provide special services to the pharmacy, such as emergency deliveries, automated ordering systems, or automated purchasing systems.
- **Just-in-time ordering:** Ordering a product before running out; the product is shipped to the pharmacy immediately. The pharmacy will normally receive it the next business day. A method to keep an inventory low and maximize profit.
- **Point of sale:** An item is deducted from inventory as it is dispensed and in many situations is automatically reordered.
- **Purchase order:** A form that is used to order drugs and supplies from a wholesaler. Information found on a purchase order includes the following:
  - Name and address of the institution
  - Shipping address
  - Date the order was placed
  - Vendor's name and address
  - Purchase order number (a tracking number used to identify a purchase order)
  - Ordering department's name and location
  - Expected date of delivery
  - Shipping terms
  - Account name or billing designation
  - Description of items ordered
  - Quantity of items ordered
  - Unit price
  - Extended price
  - Total price of the order
  - Buyer's name and phone number

RECEIVING PROCESSES

- Verify incoming merchandise (drug, dosage form, strength, package size, number of units, and expiration date) against packing slip or invoice.
- Hazardous substances must be handled by trained personnel wearing personnel protective equipment (PPE).
- Any inventory appearing to be damaged or out of date should be noted on the packing slip and the vendor contacted immediately.
- Any merchandise requiring special storage, such as refrigeration, should promptly be verified and placed in proper conditions to avoid damage or loss of potency.
- Sign and date invoice or packing slip.
- Forward documentation to accounts payable.
- Place merchandise on shelf and rotate product by placing product with shortest dating in front and longest dating behind it. Be aware of look-alike, sound-alike products, misleading product labels, and product storage when placing products into the pharmacy's inventory.
- Retain appropriate paperwork in the pharmacy as outlined in the Controlled Substances Act,

Occupational Safety and Health Administration requirements, or the institution's policies and procedures manual.

UNIT-DOSE SYSTEMS

- **Unit-dose system:** A system that provides a medication in its final "unit of use." Unit-dose packaging machines may be manual, semiautomatic, or automatic. May be a single-drop (60 packages/min) or double-drop (120 packages/min) system.
- **Modified unit-dose system:** A drug distribution system that combines unit-dose medications, which are blister packaged onto a multiple-dose card instead of being placed in a box. Synonymous with *punch cards, bingo cards,* and *blister cards.*
- **Blended unit-dose system:** Combines a unit-dose system with a non–unit-dose system. May be a multiple-medication package or a modular cassette. A multiple-medication package has all the medication, which is administered at the same time. A modular cassette is a combination cassette or drawer exchange system.

STORAGE REQUIREMENTS

TEMPERATURE DEFINITIONS

All medications have specific storage conditions determined by the manufacturer, which include the type of container (e.g., a light-resistant container) and temperature. The following definitions indicate the proper temperature at which a drug is to be stored.

- **Freezer:** Temperature is maintained thermostatically between −25° and −10° C (−13° and 14° F)
- **Cold:** Not to exceed 8° C (46° F)
- **Cool:** Any temperature between 8° and 15° C (46° and 59° F)
- **Room temperature:** Any temperature between 15° and 30° C (59° and 86° F)
- **Warm:** Any temperature between 30° and 40° C (86° and 104° F)
- **Excessive heat:** Any temperature above 40° C (104° F)
- **Protect from freezing:** Freezing medication leads to a loss of strength, potency, or destructive alterations
- **Dry temperature:** Conditions do not exceed 40% humidity at controlled room temperature

MEDICATION DISPOSITION

DRUG RECALL

- Can be initiated either by the drug manufacturer (voluntary recall) or the FDA
- Common causes include drug package mislabeling, drug contamination, lack of potency, or a lack of good manufacturing practices

DRUG RECALL CLASSIFICATIONS BY THE FOOD AND DRUG ADMINISTRATION

- **Class I:** There is a reasonable probability that use of the product will cause or lead to serious adverse health events or death.
- **Class II:** Probability exists that use of the product will cause adverse health events that are temporary or medically reversible
- **Class III:** Use of product will probably not cause an adverse health event.

RECALLED MEDICATION PROCESSES

- The pharmacy is notified by the manufacturer or wholesaler by e-mail, mail, or fax of the reason of the recall. Information contained in a recall notice includes the drug manufacturer's name, drug name, strength, package size, lot (batch) number, and expiration date.
- The pharmacy determines if the recalled medication is currently in stock.
- The pharmacy contacts patients who may have received the medication. If a customer has the recalled product, the medication should be returned to the pharmacy for refund or substitution.
- The pharmacy follows disposition directions from the drug manufacturer.
- Recalled medication is returned to manufacturer for credit.
- Medication that has been recalled is reordered. Notify the physician of the recalled medication; inquire if the physician wishes to change the medication order, especially if the product may not be available for a long period.

EXPIRED MEDICATIONS

- Policies are established by each pharmacy regarding the process of pulling medications that will expire within a given period.
- A system must be in place in all practices of pharmacy to check for expired medications. Expired medications must be kept away from in-date medications.
- Both pharmacists and pharmacy technicians must be familiar with the institution's policy regarding outdated medications.
- Medication should never be dispensed to a patient if it has passed its expiration date or will expire before the patient is able to complete the current course of therapy. Multidose containers cannot be redispensed to another patient (refer to state

regulations for direction on this issue); unit-dose medications can be redispensed to other patients.
- Contracts with wholesalers and manufacturers will determine if products may be returned for partial or full credit. Proper inventory management skills may eliminate the necessity of returns to the manufacturer if a product is being properly rotated.
- Cytotoxic medications are destroyed with biohazardous waste goods.
- Reconstituted or compounded drugs are not returnable to the manufacturer. Other examples of nonreturnable items include partially used bottles of medication.
- Controlled substances can be returned only by institutions having a DEA number. For example, long-term facilities cannot return controlled substances to pharmacies because long-term care facilities do not have a DEA number.
- The DEA must be notified at least 2 weeks before the destruction of controlled substances through the issue of Form 41 for expired controlled substances. A copy of Form 41 must be maintained for a minimum of 2 years after the destruction of controlled substances at the pharmacy site. The destruction of medications must follow all local, state, and federal guidelines involving environmental issues, such as burning, flushing, and rinsing. (**Note:** At the time of publication, the DEA is reviewing the proper destruction methods of controlled substances.)

PHARMACY WASTE

- Defined as any chemical product, vaccine, or allergenic whose intended use is for the diagnosis, cure, mitigation, treatment, or prevention of disease or injury in humans or other animals

Minimize Pharmacy Waste

- Maximize use of opened chemotherapy vials.
- Label drugs for home use.
- Prime and flush intravenous lines with saline solution.
- Examine size of containers relative to use.
- Replace prepackaged unit-dose liquids with patient-specific oral syringes.
- Eliminate generation of controlled substances that are also hazardous waste.
- Use hard plastic buckets for delivery of chemotherapeutic drugs to hospital floors.
- Monitor dating of emergency syringes.
- Review inventory control to minimize outdates.

Pharmacy Waste Disposition

- Select a vendor to handle the waste.
- Options include segregation of waste at point of generation, centralizing segregation of waste, or managing all drug waste as hazardous.
- If pharmacy waste is considered hazardous, use hazardous waste labels to identify it.
- Keep containers covered when not in use.
- Limit quantity and allow for 3 days to remove waste when limit is reached.

Hazardous Waste

- Defined as waste that is dangerous or potentially harmful to human health or the environment
- Regulated under the Resource Conservation and Recovery Act (RCRA)
- Appears on one of four hazardous waste lists (F, K, P, or U) or exhibits at least one of four characteristics (ignitable, reactive, toxic, or acutely hazardous)
- **Ignitable:** Has a flashpoint less than 60° C; examples include potassium permanganate, silver nitrate, and collodion
- **Corrosivity:** Has a pH less than 2 or greater than 12.5; includes glacial acetic acid and sodium hydroxide
- **Reactivity:** Liable to explode, react violently, or release toxic gases when in contact with water; an example is nitroglycerin
- **Toxicity**: Contains a regulated substance at a concentration above the limit; examples include zinc and selenium
- **K-list waste** exhibits one or more of the following characteristics: corrosive, ignitable, reactive, or toxic; examples include veterinary pharmaceuticals and inorganic and organic chemicals
- **P- and U-list waste** are defined as a chemical substance that is the commercially pure grade, a technical grade, or a formulation in which the chemical is the sole active ingredient. Examples of P-list waste include warfarin (>0.3%), phentermine, nicotine, physostigmine, epinephrine, and nitroglycerin. U-list waste examples include mitomycin, chloral hydrate, chlorambucil, lindane, melphalan, mercury, phenol, reserpine, selenium sulfide, and warfarin (<0.3%).
- Treat the following drugs as hazardous waste:
  - Drugs with more than one active ingredient
  - All chemotherapy agents
  - Drugs with low LD50s
  - Endocrine disruptors
  - All drugs on the P and U lists

INVESTIGATIONAL NEW DRUG

Investigational drugs are dispensed for a controlled study only, which is sponsored by a drug manufacturer, institution, or agency. The FDA may allow dispensing of a particular drug for a particular situation when all other methods of treatment have been exhausted. The pharmacy and therapeutic committee

asks the pharmacy to maintain administrative control over the clinical investigation. Duties of the hospital pharmacy include the following:

- Distribution and control of investigational drugs, which includes drug procurement, storage, inventory management, packaging, labeling, distribution, and disposition
- Clinical services, such as patient education, staff in-service training, and monitoring and reporting of adverse drug reactions
- Research activities, such as participation in the preparation or review of research proposals and protocols and assisting in data collection and research
- Clinical study management; writing accountability reports to the drug sponsor

DRUG APPROVAL PROCESS

- An investigational drug is one that is under study (as in clinical trials), but does not have the permission from the FDA to be legally marketed and sold in the United States
- Clinical research is conducted by pharmaceutical and bio-tech companies, as well as federal agencies such as the National Institutes of Health and the National Cancer Institute, cooperative research groups such as the Southwest Oncology Group and Eastern Cooperative Oncology Group, and individual investigators.
- Preclinical studies are performed on animals to help establish boundaries of safety when human testing begins. An Investigational New Drug Application is submitted to request permission to begin human testing (not an application for approval).
- **Phase I:** Determines the appropriate dose range with regard to safety and toxicity
  - Conducted with a small number (20–80) of healthy individuals
  - Nine to 18 months in length
- **Phase II:** Performed in 100 to 300 patients who have the disease or condition to be treated
  - Often involves hospitalized patients for close monitoring
  - Preliminary evaluation of safety and efficacy; may focus on dose-response and dosing schedule
- **Phase III:** Conducted in larger (several hundred to several thousand) patients in groups for which the medication is ultimately intended
  - Comparison is between new treatment and standard therapy or placebo.
  - Medication is used in the manner in which it will be used after approval.
  - May take 2 to 5 years to complete
- **Phase IV:** Postmarketing evaluation
- **New Drug Application (NDA):** Application to the FDA for marketing approval
  - Submitted after clinical studies are completed and the sponsor believes there are adequate data to support safety and effectiveness
- **FDA indication:** For a very specific disease or cause of a specific disease
  - Sponsor must label (with package insert) only for the specific indication
  - Limits what the sponsor can "promote" the drug for

ORDERING

Physicians initiate the process of studying investigational drugs. They must do the following:

- Obtain approval for any study of investigational agents from the institutional review board (IRB).
- Interactive voice response system (IVRS): Call-in electronic menu that allows for screening, randomization, environment, and assignment of the subject study drug. A PIN (personal identification number) and password are provided for tracking purposes. Provides confirmatory fax. Allows for reorder of drug supply
- Complete the Investigational Drug Data Form and return it to the pharmacy.
- Provide the pharmacy with a copy of the signed consent form.
- Instruct the manufacturer to supply the pharmacy with all pharmacologic and stability data.
- Make arrangements for the transfer of the drug to the pharmacy.
- Arrange for the pharmacy to maintain a minimum level of the medication.

RECEIVING

- Drug shipment record accompanies study drug.
- Inventory, store, and record shipment upon arrival.
- Ensure shipping records match shipment exactly.
- Note any differences in quantity received, lot numbers, and labeling errors.
- Record quantity and lot number required.

STORAGE

- Investigational drugs are secured in an area with limited access and must be kept separate from other medications.
- Must have a backup power source
- Daily log of temperature must be maintained.
- Storage of study drugs under appropriate conditions of temperature, humidity, and light so that the identity, strength, quality and purity of the study drugs are not affected
- Site is responsible for investigational medications being safely stored, controlled, administered, and destroyed.

- Acceptable storage conditions, temperature, storage times, and reconstitution requirements should be determined by the sponsor of all investigational products.
- Packaging of study drugs to prevent contamination and deterioration during transport and storage

ACCOUNTABILITY AND RECORD KEEPING

- Accurate drug accountability records demonstrate that the study drug was dispensed or administered according to protocol; dispensing records are kept for the sponsor.
- Check expiration dates and graduated dosing regimens.
- Support the validity of the study data and conclusions from those data.
- Document the handling of the study drug from receipt to dispensing to return or disposal.

INVESTIGATIONAL DRUG ACCOUNTABILITY RECORD

- Sign out all study drug at time of dispensing; best practice is to double check on drug assignment and have two individuals initial.
- Fill out dispensing information completely.
- Never scratch out, white out, or alter any entry on the Drug Accountability Record (DAR); instead, line through entry with a single line, date, and initial. The original entry needs to be readable; write in the correct entry.
- Write entry on DAR at time of dispensing. Do not wait until later. Enter data into each column; do not leave blank.
- All entries should be neat and readable.
- Use the subject's initials consistently.
- Do not make any entry below the last line of the form.
- All entries must be written completely (e.g., do not use " . . . " instead of writing the same entry multiple times).

PATIENT EDUCATION

- Instruct the patient on use, handling, storing, and returning study drug.
- Inform the patient that his or her drug intake is being measured.
- Inform the patient of consequences of missed doses or varied timing.
- Warn the patient against sharing the study drug.
- Provide a list of prohibited medications or supplements or other potential interactions.
- Return empty bottles.

COMPLIANCE

- Must have reasonable assurance that majority of study drug was actually taken by the subject
- Usually will require at least 80% compliance to be considered evaluable

DISPOSITION

- After the study has been completed, the leftover drugs are returned to the sponsor.
- Obtain medication reconciliation instruction in writing from the sponsor.
- Return to sponsor.
- In rare situations, approved drugs may be dispensed to patients for compassionate use (may require continued collection of adverse effects).

PHARMACY SECURITY

- All pharmacies are required to have a workable alarm service when the pharmacy is closed.
- Closed-circuit televisions and hold-up alarm buttons may be installed in pharmacies, but such installation is at the discretion of the institution.
- Each facility (organization) will have established policies and procedures to ensure the safety of staff, customers, and property.
- Facilities may provide lockers for employees' belongings in a secure area.
- Keys may be required to be signed out from a secure location to gain access to a pharmacy.
- Motion detectors must be installed and in working condition.
- Only licensed pharmacists may dispense a prescription and supervise pharmacy technicians.
- Only pharmacists or designated employees will have access to keys to open or close the pharmacy.
- Security requirements that restrict access to medications to "authorized personnel only" are in place because of legal and institutional standards and standards of practice.
- Touch pads and scannable means of identification may be used for employees to gain access to a particular area.

FINANCIAL ACCOUNTING TERMINOLOGY

- **Allowances:** A deduction is given from the purchase price by the seller to the purchaser.
- **Average cost method:** An inventory costing method that uses the weighted average unit cost to allocate the costs of goods available for sale to inventory and cost of goods sold
- **Consigned goods:** Goods held for sale by one party (the consignee), although ownership of the goods is retained by another party
- **Cost of goods available for sale:** The sum of the beginning merchandise inventory and the cost of goods purchased

- **Cost of goods purchased:** The sum of the net purchases and freight charges associated with a product
- **Cost of goods sold:** The total cost of merchandise sold during the period, determined by subtracting ending inventory from the cost of goods available for sale
- **Credit terms:** Terms that specify the amount of cash discount and the time period during which it is offered. They indicate the length of time in which the purchaser is expected to pay the full invoice price. An example includes 2/10, where a 2% discount can be taken off the invoice price less any returns or allowances if the invoice is paid within 10 days of the invoice date.
- **Current replacement cost:** The current cost to replace an inventory item
- **Days in inventory:** Measure of the average number of days the inventory is held; calculated as 365 divided by inventory turnover rate
- **Depreciation:** A process of allocating to expense the cost of a plant asset over its useful life in a rational and systematic manner. It is not a process of asset valuation. Depreciation takes into account the cost (all expenditures necessary to acquire the asset and make it ready for intended use), the useful life (estimate of the expected life based on need for repair, service life, and vulnerability to obsolescence), and the salvage value (an estimate of the asset's value at the end of its useful life). Can be computed by the straight-line, declining-balance, or units-of-activity method.
- **First in, first out:** An inventory costing method that assumes the cost at the earliest purchase of goods is the first to be recognized as the cost of the goods sold
- **FOB (free on board) destination:** Freight term indicating that the goods are placed free on board at the buyer's place of business and the seller pays the freight cost; goods belong to the seller while in transit
- **FOB shipping point:** Freight term indicating that the goods are placed free on board the carrier by the seller; the buyer pays the freight cost; goods belong to the buyer while in transit
- **Inventory turnover rate:** A ratio that measures the number of times on average the inventory sold during the period; computed by dividing cost of goods sold by the average inventory during the period
- **Last in, first out:** An inventory costing method that assumes that the costs of the latest units purchased are the first to be allocated to cost of goods sold
- **Lower of cost or market basis:** A basis whereby inventory is slated at the lower of cost or market (current replacement cost)
- **Net purchases:** Purchases less purchase returns and allowances and purchase discounts
- **Periodic inventory system:** An inventory system in which costs are allocated to ending inventories and cost of goods sold at the end of the period. Cost of goods is computed at the end of the period by subtracting the ending inventory (costs are assigned to a physical count of items on hand) from the cost of goods available for sale.
- **Purchase discount:** A cash discount claimed by a buyer for prompt payment of a balance due
- **Purchase invoice:** A document that supports each credit purchase
- **Sales discounts:** A reduction given by a seller for prompt payment of a credit sale
- **Specific identification method:** An actual physical flow costing method in which items still in inventory are specifically costed to arrive at the total cost of the ending inventory
- **Weighted average unit cost:** Average cost that is weighted by the number of units purchased at each unit cost

CHAPTER 7 REVIEW QUESTIONS

1. Who establishes the formulary for an institution?
   a. Food and Drug Administration
   b. Pharmacist in charge
   c. Pharmacy and therapeutics committee
   d. State board of pharmacy

2. What type of inventory indicates the actual quantity of a specific quantity of medication on hand at a particular moment in time?
   a. Biannual inventory
   b. Biennial inventory
   c. Initial inventory
   d. Perpetual inventory

3. If a pharmacy stocks hazardous chemicals, what must be provide to the purchaser?
   a. Facts and Comparison Data Sheet
   b. Manufacturer's Product Insert
   c. Safety Data Sheets
   d. Patient Product Insert

4. Which of the following may require an adjustment of a pharmacy's inventory of a particular medication?
   a. Change in prescribing habits of a physician
   b. Change in the number of prescriptions filled in a pharmacy
   c. Seasonal usage
   d. All of the above

5. How often must controlled substances be inventoried?
   a. Every 6 months
   b. Every year
   c. Every 2 years
   d. Monthly

6. Which of these reasons may result in a pharmacy's inventory being returned to the drug manufacturer?
   a. Damaged medication
   b. Drug recall
   c. Expired medication
   d. All of the above

7. What is the purpose of a group purchasing organization for a hospital pharmacy?
   a. Negotiate prices with drug manufacturers
   b. Negotiate prices with a local drug wholesaler
   c. Purchase drugs from a drug manufacturer for the hospital
   d. Purchase drugs from a local drug wholesaler

8. Which regulatory agency may issue a drug recall?
   a. BOP
   b. DEA
   c. FDA
   d. TJC

9. What type of agreement is made between a pharmacy and a wholesaler in which the pharmacy agrees to purchase the majority of its product from that wholesaler?
   a. Prime purchaser agreement
   b. Prime vendor agreement
   c. Purchase order
   d. Velocity agreement

10. Which of the following forms is required to be completed in the destruction of noncontrolled substances?
    a. DEA Form 41
    b. DEA Form 106
    c. DEA Form 222
    d. No form is required.

11. What type of drug recall is associated with irreversible damage or death to an individual?
    a. Class I
    b. Class II
    c. Class III
    d. Class IV

12. Which of the following is not an environmental factor affecting the storage of medications?
    a. Heat
    b. Humidity
    c. Light
    d. Security

13. What type of agreement is made between a pharmacy and a wholesaler in which the pharmacy agrees to purchase the majority of its product from that wholesaler?
    a. Prime purchaser agreement
    b. Prime vendor agreement
    c. Purchase order
    d. Velocity agreement

14. Where are controlled substances stored in a pharmacy?
    a. Dispersed throughout the pharmacy
    b. In a locked room
    c. In a locked safe
    d. All of the above

15. What term refers to an inventory of controlled substances conducted every 2 years?
    a. Biannual
    b. Biennial
    c. Initial
    d. Perpetual

16. Which DEA form must be submitted when a theft of a controlled substance occurs?
    a. DEA Form 41
    b. DEA Form 106
    c. DEA Form 222
    d. No form is required.

17. What phase in drug development determines the appropriate dose with regard to safety and toxicity?
    a. Phase I
    b. Phase II
    c. Phase III
    d. Phase IV

18. Which of the following is not a characteristic of a hazardous waste?
    a. Ignitable
    b. Innocuous
    c. Reactive
    d. Toxic

19. What term refers the form used to order drugs or supplies from a wholesaler?
    a. Just-in-time ordering
    b. Point of service
    c. Purchase order
    d. Want book

20. What type of drug would use a Drug Accountability Record?
    a. Behind-the-counter medications
    b. Controlled substances
    c. Investigational drugs
    d. Proprietary drugs

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Chapter 8

Pharmacy Billing and Reimbursement

Chapter Objectives

Upon completion of Chapter 8, the pharmacy technician student will be able to

1. Do the following regarding managed care:
   - Define managed care, managed care organization, and pharmacy benefit management company.
   - Identify the various types of reimbursement systems found in the various health care systems.
   - Differentiate between the various types of managed care providers.
2. Explain the payment of prescriptions using health saving accounts, private plans, medication assistance programs, coupons, and self-pay.
3. Contrast Medicare and Medicaid.
4. Recognize the various pharmacy networks used today.
5. Discuss the various methods used in calculating the pricing and reimbursement of medications.
6. Discuss the various types of formulary systems used in managed care.
7. Explain online adjudication and the purpose of a National Provider Identifier number.
8. Do the following regarding prescription processing:
   - List the information contained on a prescription card.
   - Differentiate between the various dispense as written codes used in submitting third-party claims.
   - Explain the role of prior authorization in online adjudication.
   - Cite the various reasons why a prescription claim could be rejected.
9. Identify the various types of limitations used by manage care.
10. Identify various types of health care reimbursement services.
11. Contrast deductible and copay, and recall the various types of copayments.
12. Cite examples of cost containment practices.
13. Demonstrate comprehension in the calculation of overhead, gross profit, percent gross profit, percent net profit, markup, inventory, and turnover rate.

PTCB Knowledge Domains	
8.1	Reimbursement policies and plans (e.g., HMOs, PPO, CMS, private plans)
8.2	Third party resolution (e.g., prior authorization, rejected claims, plan limitations)
8.3	Third-party reimbursement systems (e.g., PBM, medication assistance programs, coupons, and self-pay)

ExCPT Knowledge Domains	
3.3	Calculations
3.3.7	Business calculations (pricing, markup, inventory control)

MANAGED CARE

- Provides both the financing and delivery of health care to its members

MANAGED CARE ORGANIZATION

- A health care organization that both insures and provides health care services
- Services are provided for a predetermined amount of money that has been negotiated and paid in advance.

PHARMACY BENEFIT MANAGEMENT COMPANY

- Focuses on the pharmacy services provided under a health care plan
- Contracts with an insurer to provide prescription drugs to members usually through community pharmacies

MANAGED CARE REIMBURSEMENT

- **Capitation:** Paying a fixed, prepaid fee per person to provide a range of health services; paid before the services are provided
- **Fee for service:** A set fee is paid for each type of service that is performed and is paid at the time of service

MANAGED CARE PROVIDERS

Health Maintenance Organizations

- Goal of health maintenance organizations (HMOs) is to keep patients healthy
- Proactive health care instead of reactive health care
- Based on capitation reimbursement system
- Provides a predictable cost of payment for services
- Health care providers work directly for the HMO
- Little flexibility in selection of providers
- Primary care physician (PCP) directs all medical care for the member
- Provides coverage for routine inpatient and outpatient care
- Small copays
- Usually no deductibles
- Low premiums

Preferred Provider Organizations

- Preferred provider organizations (PPOs) provide health care services to members at a discounted fee for service.
- Nonexclusive contract with network of providers
- Members pay a copay at time of service
- Often members have a yearly deductible to meet before insurance coverage begins
- Insurance pays a percentage of the medical bills
- Members may select a non-PPO provider, but member must pay the difference between the discounted fee and regular fee
- The percentage paid by the insurance is lower if services are provided by an out-of-network provider.
- No referral is required for specialist services.

Point of Service Plans

- In a point of service plan (POS), members may choose an HMO or PPO for services.
- PCP directs the medical care
- Member may see out-of-network providers.
- Higher cost for out-of-network providers
- Higher premiums

Exclusive Point of Service

- The exclusive point of service (EPOS) is a hybrid of PPO in which the PPO does not make payment to providers outside of network.

HEALTH SAVINGS ACCOUNTS

- Health savings accounts (HSA) are financial accounts established by an individual or family to pay for qualified medical expenses.
- U.S. federal regulations require citizens to have a minimum deductible on their health insurance from all sources to make tax-deductible contributions to their HSAs.
- HSAs combine the benefits of both traditional and Roth 401(k)s and IRAs for medical expenses. Taxpayers receive a 100% income tax deduction on annual contributions, they may withdraw HSA funds tax free to reimburse themselves for qualified medical expenses, and they may defer taking such reimbursements indefinitely without penalties.
- HSA limits: $3250 for individuals (self-only coverage) and $6450 for family coverage

PRIVATE PLANS

- A private plan is one in which the patient obtains a prescription drug card from a pharmacy benefits manager.
- Private plans are extremely expensive for individuals to purchase.

MEDICATION ASSISTANCE PROGRAMS

- Programs established by drug manufacturers and various other organizations to provide medications to qualified patients who are unable to afford their medications

COUPONS

- Some drug manufacturers provide coupons for specific drug products to physicians. This is an incentive for physicians. The physician distributes these coupons to patients when they receive new prescriptions.
- The coupon is for the original filling of a new prescription.

- The pharmacy bills the drug manufacturer electronically for the value of the coupon.
- The value of the coupon is deducted from what the patient is responsible for paying.
- In situations when a patient has a third-party prescription plan, the value of the coupon is deducted from the cost of the prescription being billed to the insurance provider.

SELF-PAY

Some patients are responsible for the full price of their prescriptions. In these situations, the patients may pay with cash, check, credit, or debit card.

FEDERAL FUNDED HEALTH CARE PROGRAMS

MEDICARE

- Federal program to provide health care for elderly adults, persons with disabilities, and patients with end-stage renal disease
- **Medicare Part A** covers inpatient hospital care, skilled nursing facilities, hospice, and home health care. There is no cost if the patient worked for 10 years in a Medicare-covered employer.
- **Medicare Part B** provides for physician services, outpatient care, and some physical and occupational therapy; Medicare Part B requires an extra monthly payment.
- **Medicare Advantage (Part C)** allows participants in Medicare Part A and B to obtain coverage through an HMO or PPO that provides additional services at a higher cost.
- **Medigap (Medicare Supplement Policy)** is an additional policy that covers the gaps in the original Medicare program.
- **Medicare Part D** provides for prescription medications, biologicals, insulin, vaccines, and select medical supplies. All medications are not covered under Medicare Part D.

MEDICAID

- A federal program that is based on income and other circumstances
- Each state determines its own eligibility rules, services provided, and copays.
- Eligibility is determined on a month-by-month basis.
- In most situations, Medicaid covers physician visits, emergency care, hospital care, vaccinations, prescription drugs, vision, hearing, long-term care, and preventive care for children.

PHARMACY PROVIDER NETWORKS

NETWORK

- A group of health care providers linked through a contract to provide health care services to its members

COMMUNITY PHARMACY NETWORK

- Consists of both chains and independent pharmacies
- May be either an open (any community pharmacy may participate) or closed (only select community pharmacies) network

IN-HOUSE NETWORK

- Pharmacy owned by an HMO
- Normally located in the HMO facility
- Provides pharmacy services only for members of the network

MAIL-ORDER PHARMACY NETWORK

- A mail-order pharmacy owned and operated by a managed care organization
- Members obtain their filled prescriptions through the mail; in some situations, members may be eligible to obtain prescriptions from a community pharmacy.

PHYSICIAN DISPENSING NETWORK

- Physicians dispense medications from their offices.

PHARMACY REIMBURSEMENT FROM MANAGED CARE

- Reimbursement formula = Ingredient cost + Dispensing fee, where the dispensing fee may be either a predetermined dollar amount or a predetermined percent
- **Average wholesale price (AWP):** Refers to the average price that wholesalers sell a medication. The AWP is not regulated by the government and does not take into account discounts based on volume. Managed care reimbursement may be calculated by using the following equation: [AWP − % Discount] + Dispensing fee
- **Actual acquisition cost (AAC):** Actual cost the pharmacy paid for the medication. AAC + Dispensing fee
- **Maximum allowable cost (MAC):** Used in calculating the reimbursement formula for generic medications. MAC + Dispensing fee. The MAC is determined by a managed care organization.

FORMULARY USAGE IN MANAGED CARE

- A list of medications approved for use or reimbursement under a prescription plan
- Each managed care organization determines its own formulary to be used.
- Used to control prescription costs
- **Open formulary:** Includes a variety of several medications in each therapeutic classification. In addition, multiple tiers of pricing may be used. In a multiple tier system, there will be a distinct price for branded drugs, generic drugs, lifestyle drugs, and drugs not covered by the formulary.
- **Closed formulary: A** very limited number of drugs are available with a limited number of medications available in each therapeutic classification. In some situations, an entire drug classification may not be available; however, an exception process is in place.
- **Restricted formulary:** A selective, limited, partially closed formulary in which some nonformulary medications are available; an exception process does occur.
- **Formulary exception process:** Process that allows the right to use select nonformulary and formulary medication to be dispensed
  - **Formulary override:** Process that requires the physician to request approval to prescribe a nonformulary medication and to document the reason the medication
  - **Prior authorization:** Process to obtain authorization to use select nonformulary drugs that requires the physician to request and document the reason why the medication is needed

ONLINE ADJUDICATION

- The process by which a pharmacy submits prescription claims electronically to a third-party provider when filling a prescription to ensure accurate copayments and timely payment. Online adjudication provides an immediate response from Medicare (Part D), Medicaid, and other insurance providers. It provides coverage information, reimbursement rates, and copays. In addition, it allows the pharmacy to verify a patient's eligibility and to determine the plan name, patient identification, and group number.
- All pharmacies must possess a National Provider Identifier (NPI), which is a unique number assigned to health care providers, to transmit health information according to the Health Insurance Portability and Accountability Act.

PRESCRIPTION PROCESSING

INFORMATION CONTAINED ON A PRESCRIPTION DRUG CARD

- **BIN (bank identification number):** A six-digit number used to identify the company that will reimburse the pharmacy for the prescription being filled
- **Plan code:** Prescription provider
- **Group code:** Employer that contracted the insurance company for the policy
- **Issuer:** The health insurance company who issued the card
- **ID:** May be either numeric or alphanumeric
- **Subscriber (cardholder) name:** Individual who purchased the policy
- **Primary Care Provider (PCP):** Optional depending on the plan
- **Copays:** May be identified on the card but not required
- **Help desk telephone number**
- **Dispense as written (DAW) codes:** Used to ensure the pharmacy is properly reimbursed by a third party provider for a prescription being dispensed. These codes are as follows:
  0 = No product selection indicated
  1 = Substitution not allowed by provider
  2 = Substitution allowed—patient requested product dispensed
  3 = Substitution allowed—pharmacist selected product dispensed
  4 = Substitution allowed—generic drug not in stock
  5 = Substitution allowed—brand drug dispensed as generic
  6 = Override
  7 = Substitution not allowed—brand drug mandated by law
  8 = Substitution allowed—generic drug not available in marketplace
  9 = Other

NATIONAL COUNCIL FOR PRESCRIPTION DRUG PROGRAMS REJECTION CODES

Prescription claims that are rejected will have at least one rejection code. The pharmacist or pharmacy technician must correct the prescription claim before resubmitting it to the managed care provider. Listed on the next page are some of the more common explanations provided for the rejection of a prescription claim.

PRIOR AUTHORIZATION

Prior authorization requires a physician to obtain approval from a managed care organization for a specific medication before it is dispensed by the pharmacy.

REJECTION CODE	REJECTION DESCRIPTION
1	Missing or invalid BIN
2	Missing or invalid version number
3	Missing or invalid transaction code
4	Missing or invalid processor control number
5	Missing or invalid pharmacy number
6	Missing or invalid group number
7	Missing or invalid cardholder ID number
8	Missing or invalid person code
9	Missing or invalid birth date
10	Missing or invalid gender code
11	Missing or invalid patient relationship code
15	Missing or invalid date of service
16	Missing or invalid prescription/service reference number
19	Missing or invalid days supply
20	Missing or invalid compound code
22	Missing or invalid dispense as written (DAW)/product selection code
25	Missing or invalid prescriber ID
26	Missing or invalid unit of measure
28	Missing or invalid date prescription written
29	Missing or invalid number of refills authorized

Prior authorization is an extra step in the prescription billing process before the insurance company decides to pay for the prescription. Without prior authorization, the patient may be responsible for the entire cost of the medication. Situations that may require prior authorization include the following:

- Brand name medications that have a generic available
- Expensive medications
- Medicines with age limits such as Retin-A
- Drugs used for cosmetic purposes such as Propecia
- Medications such as Cialis and Viagra prescribed for non–life-threatening medical conditions
- Drugs not usually covered by the insurance company but said to be medically necessary by the physician
- Medicines that are usually covered by the insurance company but are being used at a higher dose than "normal"

PLAN LIMITITATIONS

- Intended to control drug use and reduce drug costs
- Method of determining plan savings

PRESCRIPTION LIMITATIONS

- Maximum amount of medication that may be dispensed at one time
- Normally expressed as day's supply, which is 30 days for community pharmacies and 90 days for mail-order supplies

DRUG BENEFIT LIMITATIONS

- Dollar limit: A maximum amount that can be spent at one time on a prescription
- Spending or prescription cap: The maximum amount that can be spent per period of time, normally yearly
- Maximum number of prescriptions that can be dispensed to a member over a period of time, normally monthly
- Time limits for a prescription to include refills, which is normally 1 year for noncontrolled prescriptions

HEALTH CARE REIMBURSEMENT SERVICES

- **Ambulatory care parenteral therapy:** The Centers for Medicare and Medicaid Services has created a list of health insurance continuation program codes for drugs in this setting. Reimbursable costs are also included. Other fees include a professional fee component and a facility fee.
- **Cognitive services:** These services include prescriptive authority by the pharmacist, administration of medications by the pharmacist, patient assessment and treatment, pharmacist intervention with prescribers and other health care providers, patient education, and patient reassessment and monitoring. Reimbursement is based on prior years' data.
- **Community care:** Cost of medication plus a dispensing fee for dispensing, monitoring, and record keeping
- **Long-term care:** Per diem reimbursement (predetermined daily rate) that is based on prior medication costs of the facility. Formulary control is important. Regulatory agencies have developed

lists of medications they have deemed unnecessary based on excessive adverse effects or poor outcomes obtained.

DEDUCTIBLE

- A predetermined amount of money that must be spent on prescriptions before copayment begins
- Not all prescription drug plans have deductibles.

TYPES OF COPAYMENTS

The patient is responsible for all prescription deductibles and copays.

FIXED COPAYMENT

- A predetermined fixed or predetermined dollar amount per prescription filled

PERCENTAGE COPAYMENT

- A predetermined fixed percentage of the cost of the prescription filled

VARIABLE COPAYMENT

- A variable or different payment based on the type of drug being dispensed
- Examples of classifications used include generic drug, preferred brand name drug, nonpreferred brand name drug, and lifestyle drug.
- Variable copayments encourage use of generic and formulary drugs.
- Provides a greater access to drugs for the member but makes them responsible for higher copays
- Lowers the cost of prescription drug benefit to the employer and shifts more of the drug cost to the members

COST CONTAINMENT

Methods used include:

- Restrictive pharmacy networks
- Mail-order and Internet pharmacy
- Electronic claim submission
- Higher member copayments
- Tiered copayments
- Formulary management
- Prior authorization
- Competitive drug buying
- Benefit limitations
- Mandatory generic substitution

COMMERCIAL MATH FORMULAS

- **Cost:** Purchase price + Cost to dispense
- **Discount:** Purchase price × Discount rate
- **Discounted price:** Purchase price − Discount
- **Gross profit:** Selling price − Purchase price
- **Inventory turnover rate:** Annual dollar purchase ÷ Average inventory value
- **Markup:** Selling price − Purchase price
- **Net profit:** Overall cost × Desired percent profit
- **Overhead:** Sum of all expenses
- **Profit:** Selling price − Overall cost

CHAPTER 8 REVIEW QUESTIONS

1. What is the total overhead for a pharmacy that has the following expenses?

Pharmacist salary (2)	$90,000
Pharmacy technicians (3)	$30,000
Rent	$240,000
Pharmaceutical drugs	$2,850,000
Licenses	$545
Insurance	$2025
Electricity	$3625
Gas	$8525
Water	$895
Supplies	$1255
Software	$995

2. What is the gross profit for a drug that has an AWP of $59.99, has a dispensing cost of $3.75, and retails for $67.99?

3. What is the markup for a drug that costs $9.99, has a dispensing cost of $2.75, and retails for $13.99?

4. What is the markup rate for a drug that costs $19.99 and retails for $25.99?

5. What is the net profit for a drug that has an AAC of $99.99, has a dispensing cost of $4.25, and retails for $112.99?

6. The cost for a bottle of 100 test strips for a glucometer is $67.50. The overhead for the store is $3.50, and the store wants to make a net profit of $23.68. What should the selling price be?

7. How much will a pharmacy pay a wholesaler if the conditions are 2% net 30 if the invoice shows $1950.00?

8. What will the inventory turnover rate be for a pharmacy if the inventory value is $255,000 and the pharmacy has sales of $3 million?

9. How many inventory turns will a pharmacy experience if it has an initial inventory of $225,000, a final inventory of $250,000, and sales totaling $2.6 million during the year?

10. Which of the following is not an advantage of standardized prescription card format?
    a. Decreased problems with claims submission
    b. Increased calls to help desks
    c. Increased time for patient care
    d. Speedy prescription claim processing

11. Which DAW code should be assigned to a prescription where the physician has approved the dispensing of a generic drug but the patient has requested the brand name medication?
    a. DAW 0
    b. DAW 1
    c. DAW 2
    d. DAW 3

12. What term refers to the processing of a prescription claim to a third-party provider?
    a. Banking identification number
    b. Group number
    c. Online adjudication
    d. Rejection code

13. Which Medicare program will reimburse an outpatient pharmacy for a patient's prescription?
    a. Medicare Part A
    b. Medicare Part B
    c. Medicare Part C
    d. Medicare Part D

14. Which of the following managed care programs are provided to individuals or families that are below an income level during a calendar year?
    a. Health maintenance organization
    b. Medicaid
    c. Medicare
    d. Preferred provider organization

15. Which of the following circumstances would not require prior authorization before the medication is dispensed to the patient?
    a. Drugs not usually covered by an insurance company but said to be medically necessary
    b. Expensive medications
    c. Generic medications
    d. Prescription medications usually covered by insurance companies but are being prescribed at a higher-than-normal dosage

16. Which of the following is the basic formula for determining the price of a prescription being filled?
    a. AAC + Dispensing fee
    b. AWP + Dispensing fee
    c. Drug cost + Dispensing fee
    d. MAC + Dispensing fee

17. Which of the following groups does Medicaid not cover?
    a. Individuals with disabilities
    b. Persons with low incomes
    c. Pregnant women
    d. Single working individuals with above-average incomes

18. What term refers to a type of health care reimbursement plan in which the participant may make pre-tax contributions through payroll deductions to pay for prescription copays, prescriptions, and prescription deductibles?
    a. Copay
    b. Deductible
    c. Health care saving plans
    d. Premium

19. Which of the following terms refers to the price a pharmacy pays after all discounts and shipping costs have been applied?
    a. Actual acquisition cost
    b. Average wholesale price
    c. Deductible
    d. Maximum allowable cost

20. Which of the following should not be a factor in selecting medications for a formulary?
    a. Drug cost
    b. Drug source
    c. Medication effectiveness
    d. Medication safety

21. Which of the statements regarding the prescription drug benefits is true?
    a. All drug benefit plans are identical.
    b. Drug benefits are a mandatory part of health care coverage.
    c. Drug benefits can include tiered copays and exclude certain drugs.
    d. Members must use mail-order pharmacies for prescriptions.

22. Which of the following groups does Medicare not cover?
    a. Children
    b. Individuals with disabilities
    c. Patients undergoing dialysis
    d. Senior citizens

23. Which of the following pieces of information is not transmitted by online adjudication?
    a. Date the prescription is filled
    b. Name of the pharmacy filling the prescription
    c. Name, strength, and dosage form of the medication
    d. Pharmacy technician's name

24. Which of the following is an additional policy that covers the gaps in the original Medicare program?
    a. Medicare Part A
    b. Medicare Part B
    c. Medicare Part C
    d. Medigap

25. Which organization developed billing rejection codes for third-party prescriptions?
    a. BIN
    b. GMP
    c. NCPDP
    d. SCRIPT

Chapter 9

Information System Usage and Application

Chapter Objectives

Upon completion of Chapter 9, the pharmacy technician student will be able to

1. Do the following regarding the use of computers:
   - Differentiate between the various types of computers.
   - Explain the basic functions of a computer.
   - Identify the two different types of software and their function.
   - List the various types of computer input devices.
2. Discuss health information technology, including:
   - Explain the benefits and risks involved with health information technology.
   - Explain the purpose of health information standards.
   - Identify organizations that have been involved in establishing standards for health information technology.
3. Define pharmacy informatics and do the following:
   - Differentiate between e-prescribing and the electronic health record.
   - Explain the functions of computerized physician order entry.
4. Define point of care.
5. Identify ways technology promotes the Health Insurance Portability and Accountability Act.
6. List principles used in pharmacy documentation.
7. Do the following regarding ambulatory pharmacy computer functions:
   - List the four distinct types of databases that are found in a pharmacy database.
   - Distinguish the various systems that a pharmacy computer will interface.
   - Identify the various management functions performed by an ambulatory pharmacy computer.
8. List and explain the various patient monitoring functions found in a clinical decision support system, provide an example of a work list.
9. Explain the role of automation in the practice of pharmacy, including:
   - List the advantages and disadvantages of both centralized and decentralized automation.
   - Differentiate between a centralized and decentralized automation system.
10. List automation features that assist in reducing medication errors.
11. List the various technologies used in a pharmacy and their functions.

PTCB Knowledge Domains

9.1 Pharmacy-related computer applications for documenting the dispensing of prescriptions or medication orders (e.g., maintaining the electronic medical record, patient adherence, risk factors, alcohol drug use, drug allergies, side effects)

9.2 Databases, pharmacy computer applications, and documentation management (e.g., user access, drug database, interface, inventory report, usage reports, override reports, diversion reports)

ExCPT Knowledge Domains

3.2.2 Systems for checking prescriptions

3.2.3 Automated dispensing systems (including quality control)

COMPUTERS

- Process data
- Types of computers
  - **Mainframe:** Large, expensive, and powerful computer used to process large quantities of data
  - **Dumb terminals:** Allows a number of users to access patient information
  - **Minicomputers:** Smaller **scaled mainframe**s used by several people in an organization through the use of local area network (LAN)
  - **Microcomputers or personal computers (PCs):** Stand-alone systems that run software programs and manage data accessed from a larger source. PCs include a monitor, central processing unit (CPU), and printer. Used in the pharmacy for quality assurance, drug information, drug utilization evaluations, adverse drug reporting, nonformulary drug use, and workload statistics.
- Computers receive input, process the input, and produce outputs.
- **Hardware** components are controlled by software.
- **Software** consists of instructions that tell the computer hardware how to operate.
  - **Operating systems:** Govern basic operation of the hardware
  - **Software applications:** Support pharmacy practices and user desired tasks
- **Types of computer input devices:** Keyboard, mouse, trackball, microphone for voice recognition, touch screen, light pen
- **Types of computer outputs:** Monitor (display), speakers, printers, and plotters
- A **modem** is a device that allows a computer to communicate over a network.
- **Memory** (random access memory [RAM]): Provides the computer with a temporary workspace
- **Storage:** Permanent place; read-only memory (ROM) information
- **Processor:** "Brains" of the workstation
- **Interfaces:** Connections between two or more computer systems

HEALTH INFORMATION TECHNOLOGY

BENEFIT POTENTIAL OF HEALTH INFORMATION TECHNOLOGY

- Improved patient care
- Increased efficiency and productivity
- Improved communication and health care delivery
- Improvement in reimbursement processes
- Will be able to track the effectiveness of treatment options and quality of care

RISKS OF HEALTH INFORMATION TECHNOLOGY

- Patient safety risks have been identified during implementation of health information technology if implementation is not carefully planned and followed.
- Medication errors involved mislabeled bar codes and unclear (confusing) computer screens.
- Adverse events may occur because of strain on health care personnel if workflow becomes complicated.
- Patient safety becomes a concern if systems are not updated consistently of if data are incomplete or inconsistent.
- Alert fatigue occurs when excessive drug safety alerts occur.

THE JOINT COMMISSION RECOMMENDATIONS TO PREVENT PATIENT HARM WHEN IMPLEMENTING HEALTH INFORMATION TECHNOLOGY

- Examine workflow process and procedures for risks and inefficiencies; resolve them before implementation.
- During the introduction of new technology, monitor for problems and address issues promptly.
- Establish a training program for individuals who will be working with technology. The training should occur before implementation.
- Develop and communicate policies outlining who will be responsible for implementation, use, oversight, and safety review.
- Before taking technology live, ensure all standardized order sets and guidelines are developed, tested, and approved by the pharmacy and therapeutics (P&T) committee.
- Develop a system that eases potential harmful computerized physician order entry (CPOE) drug orders by requiring pharmacy review and sign off on orders that are created outside the usual guidelines. Use P&T committee oversight and approval for all electronic order sets.
- Provide an environment that protects staff involved in data entry when using technology.

HEALTH INFORMATION STANDARDS

- Are necessary to ensure the interchange of electronic information within the health care community
- Pharmacies need standards to communicate electronically with hospitals, physician offices,

laboratories, radiology, patients, and caregivers. In addition, it is necessary to communicate for billing, reimbursing, dispensing, and providing clinical functions.

STANDARDS DEVELOPMENT ORGANIZATIONS

- The National Council for Prescription Drug Programs (NCPDP) is the only standards development organization that focuses on pharmacy services. The NCPDP works to develop and maintain standards for each step in the prescribing process. The NCPDP has established e-prescribing standards known as SCRIPT.
- **SCRIPT standards:** Facilitates the transfer of prescription data among pharmacies, prescribers, intermediaries, and payers. The current standard supports messages regarding new prescriptions, prescription changes, refill requests, prescription fill status notification, prescription cancellation, medication history, and transactions for long-term care environments. Enhancements have been added for drug use or utilization review alerts, standardized signatures (instructions), allergies, and diagnosis information. Future improvements may include laboratory values, patient drug profiles, prescription transfers, and formulary inquiries.
- NCPDP standards for electronic prescribing process include:
  - Batch Transaction Standard
  - Billing Unit Standard
  - Financial Information Reporting Standard
  - Formulary and Benefit Standard
  - Medicaid Subrogation
  - Member Enrollment Standard
  - Payment Reconciliation Payment Tape Format
  - Pharmacy Identification Cards
  - Post-adjudication Standard
  - Prescription Transfer Standard
  - Telecommunication Standard
  - Universal Claim Form
  - Medication History Standard
- **Pharmacist Services Technical Advisory Coalition (PSTAC):** Consists of seven pharmacy organizations: the American College of Clinical Pharmacy, Academy of Managed Care Pharmacy, American Pharmacists Association, American Society of Consultant Pharmacists, American Society of Health System Pharmacists, National Association of Chain Drug Stores, and National Pharmacist Association. The PSTAC was established to improve the coding infrastructure for pharmacy billing and to secure a place for pharmacy in the electronic data interchange (EDI). Has established Health Insurance Portability and Accountability Act (HIPPA) compliant Current Procedural Terminology (CPT) billing codes for pharmacists when performing Medication Therapy Management (MTM) services.

PHARMACY INFORMATICS

Pharmacy informatics focuses on the use of information technology and drug information to maximize medication usage with patients. Hospital, long-term care, and retail pharmacies use technology for prescription management and billing while also providing computer-based education to patients and tracking medical compliance. Through the electronic communication of medication data, clinicians send prescription orders to pharmacies through secure channels. Medication orders are verified with other patient records, prepared, and dispensed with higher quality, thus avoiding undue risks and negative interactions. With database interconnectivity to insurance companies, medication orders are validated against formulary data and contracts to ensure proper usage and payment. Pharmacy informatics plays an important role in reducing errors and increasing medication treatment outcomes.

E-PRESCRIBING

- The paperless computer-to-computer transfer of prescription data among prescribers, pharmacies, and payers
- Connects health providers, patients, and agencies in real time and can include medication history, and messages regarding new prescriptions, prescription changes or cancellations, refill requests, and other prescription information
- Demonstrates efficiency with time savings, reduces medication errors, decreases pharmacy costs, improves prescriber and pharmacy administrative efficiency, eliminates handwriting interpretation errors, reduces phone calls between pharmacists and physicians, reduces data entry, creates electronic records, and speeds up refill requests
- A disadvantage of e-prescribing is the transaction fee the pharmacy incurs.
- e-Prescribing tools can include software programs, as well as hardware such as personal computers, handheld and wireless devices, and touch screens.
- e-Prescribing is one of the integral steps to achieving broad use of electronic health record (EHRs).
- Will reduce prescription errors in a variety of health care settings

ELECTRONIC HEALTH CARE RECORDS

- Electronic records of patient health information generated by one or more encounters in any care delivery setting

- Recorded in a digital, interoperable standard
- Included in this information are patient demographics, progress notes, problems, medications, vital signs, medical history, immunizations, laboratory data radiology reports, and advanced directives
- The EHR automates and streamlines the clinician's workflow.
- The EHR has the ability to generate a complete record of a clinical patient encounter as well as supporting other care-related activities directly or indirectly via interface, including evidence-based decision support, quality management, and outcomes reporting.

ELECTRONIC PERSONAL HEALTH RECORD

- The electronic personal health record (ePHR) originates and is controlled by health care providers.
- Can be generated by physicians, patients, hospitals, and pharmacies
- Controlled by the patient or legal proxy and is presented to the health care provider when and where the patient needs care
- Can be used by pharmacies in providing medication therapy management

COMPUTERIZED PHYSICIAN ORDER ENTRY

- The portion of a clinical information system that enables a patient's care provider to enter an order for a medication, clinical laboratory or radiology test, or procedure directly into the computer
- The system transmits the order to the appropriate department or individuals so that it can be carried out.
- The most advanced implementations of such systems also provide real-time clinical decision support such as dosage and alternative medication suggestions, duplicate therapy warnings, and drug–drug and drug–allergy interaction checking.

Computerized Physician Order Entry Attributes and Functions

- Access to the system is simple when the application sign on and sign off are accomplished through a combination of passwords, biometrics, or other devices. Biometrics use technologies that measure and analyze human body characteristics, such as DNA, fingerprints, eye retinas and irises, voice patterns, facial patterns, and hand measurements, for authentication purposes.
- Access to the needed decision support system is available from any patient care setting, pharmacy, physician's office, or home.
- Mobility is maintained through a combination of mobile and stationary devices that are readily available and located at various point of care locations based on the workflow of a specific patient care area.
- Navigation is from a main screen with direct links to screens designed for patient data review, ordering, and information directory. Moving forward and back to the main screen is clear and simple.
- Patient data to support the ordering process are readily available electronically. Decision support includes allergies, height, weight, current medications, laboratory values, radiology results, and medical problems.
- The maximum amount of relevant information is available on each screen.
- System responses are fast, and there is virtually no down time.

POINT OF CARE

- The place where the pharmacist and patient attempt to address, identify, resolve, and prevent drug-related problems
- May be either stationary or mobile in nature. A desktop computer is an example of a stationary system. Mobile systems include personal digital assistants (PDAs), notebook or tablet computers, and computers on wheels (COWs).

TELEPHARMACY

- Brings pharmacy care to patients when it is not possible to bring the patient to the pharmacy setting
- Video conferencing is used to provide real-time counseling.
- Cost-effective method to provide pharmacy services

TECHNOLOGY AND THE HEALTH INSURANCE PORTABILITY AND ACCOUNTABILITY ACT

- HIPAA requires that identifiable or protected health information (PHI) be held confidentially.
- Allows patients to have better access to their medical records
- Prescriber order entry complements technology with HIPAA.
- Patient information is portable and allows information stored on the Internet to be moved between systems.

DOCUMENTATION

- Coding systems are used in the documentation of drug-related problems and interventions.

DOCUMENTATION PRINCIPLES

- **Unique patient identification:** Provide unique identification of each patient when recording or accessing information.

- **Accuracy:** Promote accuracy throughout information capture and report generation and during transfer among systems.
- **Completeness:** Identify the minimum set of information required to complete the incident, observation, or intent; provide the means to ensure all recorded information meets legal, regulatory, institutional policy, or other requirements.
- **Timeliness:** Require health care documentation during or immediately after the event in memory.
- **Interoperability across documentation systems:** Enable authorized practitioners to capture, share, and report information from any system, whether paper or electronic
- **Retrievability:** Require use of standardized titles, formats, templates, macros, terminology, abbreviations, and coding; enable authorized data searches, indexing, and mining
- **Authentication and accountability:** Uniquely identify persons, devices, and systems that create or generate information and that take responsibility for the information's accuracy and timeliness; require that all information be attributable to a source (person or device); and require review of documents before authentication
- **Auditability:** Allow users to examine basic information elements, such as data fields, audit access, and disclosure of PHI; alert users of errors, inappropriate changes, potential and security breaches; and promote use of performance metrics.
- **Confidentiality and security:** Demonstrate adherence to related legislation, regulations, guidelines, and policies throughout the documentation process; alert users to potential confidentiality and security breaches.

AMBULATORY PHARMACY COMPUTER FUNCTIONS

Maintains a pharmacy database that contains:

1. Drug file
   a. Abbreviations
   b. Brand and generic name
   c. Price structure
2. Physician file
   a. Phone number
   b. Address
   c. Drug Enforcement Administration (DEA) number
   d. National Provider Identifier (NPI)
3. Clinical monitoring
   a. Drug–drug interactions
   b. Drug–food interactions
   c. Drug–disease interactions
   d. Drug–laboratory test interactions
   e. Dose range checking
4. Payer and insurance information

Permits a pharmacy computer to interface with other systems:

1. Patient information
   a. Demographic information (age, address, phone, gender)
   b. Allergies, weight, height, diagnosis
   c. Insurance
2. Prescription processing
   a. Patient selection
      (1) Name
      (2) Patient number
      (3) Room number
      (4) Prescription number
   b. Prescription information
      (1) Medication name, dose, route, frequency, duration, and expiration date
      (2) Quantity of medication and refills if allowed
      (3) Comments and special instructions
      (4) Patient education material
      (5) Receipts
   c. Verification
   d. Label generation
   e. Price inquiry
3. Pharmacist verification of orders entered by technicians

Provides management functions:

1. Generate reports: Used to evaluate and improve workflow
2. Examples of reports generated
   a. Nonformulary drug use
   b. Drug usage patterns
   c. Drug costs
   d. Productivity
   e. Workload
   f. Pharmacist interventions
3. Distribution reports, such as narcotic use records
4. Financial reports to include billing information
5. Workload data (productivity data)
6. File maintenance

PATIENT MONITORING FUNCTIONS

- Known as the clinical decision support system (CDSS)
- Patient monitoring functions include checking for:
  - **Therapeutic duplication:** Detects patients on drugs in the same pharmacologic-therapeutic classification
  - **Drug–allergy interactions:** Discovers a drug that is identified as a drug allergy in the patient's medical record
  - **Drug–drug interactions:** Identifies medications that may cause problems if taken together
  - **Drug–food interactions:** Informs user that a drug may cause specific problems if taken with certain food products

- **Drug–disease interaction:** Drugs that may cause problems with a patient's medical condition
- **Drug–laboratory test interactions:** Detects medication orders that may interfere with specific laboratory tests
- **Intravenous (IV) compatibility:** Checks medication orders for potential problems with physical incompatibilities and stability

OTHER PATIENT MONITORING FUNCTIONS

- Screen doses so that they do not exceed maximum dose
- Monitor drugs that are contraindicated in pregnant or lactating patients
- Customize dosing guidelines to specific patient populations, such as neonatal, pediatrics, and geriatrics
- Pharmacokinetic monitoring
- Intervention documentation: Improve continuity of care

INVENTORY AND NARCOTIC CONTROL

- Used to track costs, purchases and usage, wastage, and outdated inventory
- Document borrowed medications and supplies from other pharmacies
- Generate purchase orders when Periodic Automatic Replenishment (PAR) level is met
- Maintain records of purchase agreements to include minimum order quantity of a medication, price, payment policy, and return goods policy
- Reports for daily controlled substance use by patients and quantities dispensed to nursing units
- Narcotic and error discrepancy records
- Update inventory upon receipt and dispensing of controlled substances (perpetual inventory)
- Maintain records of expired controlled substances

WORK LISTS

- Used to perform a variety of pharmacy tasks
- May be printed daily or as needed
- Examples of work lists include:
  - Unit dose cart fill
  - Cart fill updates
  - IV pick
  - IV fill and IV fill updates
  - Labels
- Pick lists: Identify the quantity of each medication for a specific time period
- Generation of documents such as admission, discharge and transfer (ADT) notices, and medication administration records

AMBULATORY CARE PRESCRIPTION FUNCTION

- Payer, insurance carrier, and third-party billing functions allow for the processing of insurance claims.
- Computers prevent dispensing medications not covered by an insurance plan.
- Sharing of computer information between pharmacies of the same chain provide improved continuity of care.

ROLE OF AUTOMATION

- The general means that machines are used to perform work
- Used to include storage, packaging, compounding, dispensing, and distributing medications
- Used to replace labor-intensive tasks
- Can reduce medication errors, improve documentation, and increase authorized access to both medications and information
- Benefits include increased productivity, accuracy, drug use control, and improved patient care
- Primary use in pharmacy is to count, package, and label dosage forms
- May be centralized (pharmacy based) or decentralized (nursing units)
- Can repackage medications from bulk or use "overwrapping" of unit-dose medications
- Examples of automation include bar-pricing labels, video imaging of the medication, bar coding, pricing, adjusting inventory, and documenting the transaction

ADVANTAGES AND DISADVANTAGES OF AMBULATORY CARE AUTOMATION

Advantages

- Improved efficiency and accuracy in prescription filling and dispensing
- Capable of counting and prefilling containers of medication
- Allows pharmacist to provide clinical skills to the patient and reduce the amount of time checking prescriptions

Disadvantages

- Expensive to implement
- Requires a minimum number of prescriptions to be filled daily to be cost effective

CENTRALIZED AND DECENTRALIZED INPATIENT AUTOMATION

Centralized Automation Systems

- Located in the central pharmacy
- Used to improve manual filling of unit dose carts

Advantages of Centralized Automation

- Improved accuracy based on bar code recognition
- Improved efficiency of dispensing functions
- Cost savings based on bulk purchasing instead of unit dose
- Capability to track expiration dates
- Improved inventory management and dispensing activity reporting
- Reduced time needed for pharmacists to check work of pharmacy technicians

Disadvantages of Centralized Automation

- Equipment cost
- Remodeling costs
- All systems do not have the capability to stock specific types of drugs such as injectable, bulk, or refrigerated items.

Decentralized Automation Systems

- Located in patient care unit and often contain floor stock medication, supplies, and controlled substances
- Designed to solve medication management problems, such as lost billing charges, pilferage, narcotic diversion, and poor record keeping
- Used to dispense medications, return medications, and record medication waste

Advantages of Decentralized Automation

- Improves accuracy because of bar code recognition
- Perform dispensing functions in batch mode instead of "on demand"
- Improved inventory management and dispensing activity reporting ability
- Able to track expiration dates
- Reduced order turnaround time by moving inventory to point of care

Disadvantages of Decentralized Automation

- Equipment cost
- Remodeling costs

AUTOMATION AND PATIENT SAFETY

- Features that have demonstrated a reduction in errors in automated pharmacies:
  - Controls are comprehensive.
  - Electronic identification (bar coding)
  - Access to medications is limited and controlled.
  - Dispensing and administration are captured.
  - Drug use information is provided.
  - Labeling machine prints and affixes a label.
  - Controls are not easily compromised.
- No national standard for automated pharmacy systems has been established.
- An increase in automation will result in more complex distribution systems, resulting in additional training for the pharmacist and pharmacy technician to include:
  - How to operate an operated pharmacy system
  - The ability to recognize a system failure
  - How to protect patient safety when failures occur
  - How to correct failures

TECHNOLOGIES USED IN A PHARMACY

AUTOMATED DISPENSING SYSTEMS

- Consist of systems that store, dispense, charge, and inventory medications
- Some systems are capable of storing refrigerated drugs.

BAR CODES

- Bar codes on medication identify the drug, its dosage form, and its strength.
- Used to reduce dispensing and medication errors

Advantages of Bar Codes

- This handheld portable unit scans the NDC number bar code on the patient label or receipt and matches it to the scanned NDC number bar code on the stock drug container from which the prescription is being filled. Because it is portable, the scanner can be carried and used at any location during the prescription filling and checking process.
- Before a nurse administers medication in a hospital, he or she is able to scan the bar code on the drug against the patient's wristband. After this step has been taken, software compares the data with the physician's order to make sure that the right drug and dosage are being given to the correct patient at the appropriate time.
- It creates a better relationship between the patient and caregiver.

Disadvantages of Bar Codes

- Not all medications are bar coded to the dose.
- Not every drug is bar coded, and there are many unique dosage forms.
- The cost of implementing bar coding is high.

ROBOTICS

- A centralized system that uses bar coding technology, a network of computers, a conveyor system, and robots to pick medications according to a patient's profile and place the drug in the correct patient's medication drawer.

- The system checks the patient profile and requests the medication to be dispensed.
- Returned medication can be scanned and credited to the patient's account.

AUTOMATED COMPOUNDING DEVICES

- Computerized pumps are used to prepare IV admixtures for both adult and neonatal total parenteral nutrition. This device contains pumps that add the base solution, electrolytes, and nutrients.
- Some pumps are able to prefill syringes.

PAPERLESS CHARTING

- Uses an electronic patient medical record

CHAPTER 9 REVIEW QUESTIONS

1. Which of the following is not true regarding an interface?
   a. A connection between two or more computer systems
   b. Important for receiving information from other systems
   c. Necessary for the transfer of data between systems
   d. Unidirectional only

2. Which of the following is a means to access a pharmacy computer system?
   a. Biometrics
   b. Biometrics and electronic signature
   c. Electronic signature
   d. User name and password

3. Which of the following is not an input tool?
   a. Keyboard
   b. Monitor
   c. Mouse
   d. Voice recognition

4. Which of the following is considered the "brain" of a computer workstation?
   a. Memory
   b. Modem
   c. Processor
   d. Storage

5. Which of the following pieces of information would be found in an electronic health care record?
   a. Immunization history
   b. Medical history
   c. Patient medications
   d. All of the above

6. Which of the following is not an attribute of a CPOE?
   a. Access to system is simple.
   b. The minimum amount of relevant information is on each screen.
   c. Mobility is maintained through both mobile and stationary devices.
   d. System responses are fast.

7. In addition to choosing the correct entity, which of the following decisions must be made at the time an intravenous drug is being chosen during a computerized order entry system?
   a. The correct diluent solution
   b. The correct dosage for the amount being prepared
   c. The correct dosage form for the route of administration
   d. All of the above

8. Which of the following is an example of stationary point of care?
   a. COWs
   b. Desktop computer
   c. Notebook
   d. PDA

9. Which of documentation principles uses standardized titles, formats, and templates?
   a. Accuracy
   b. Auditability
   c. Confidentiality
   d. Retrievability

10. Which of the following would not be found in database maintenance?
    a. Clinical monitoring
    b. Drug file
    c. Patient information
    d. Physician file

11. Which of the following forms of computer technology are being used in the practice of pharmacy today?
    a. Automated dispensing systems
    b. Bar coding
    c. Touch screens
    d. All of the above

12. Which of the following functions may be performed with a pharmacy computer during prescription processing?
    a. Entering patient information
    b. Inputting prescription information
    c. Generate labels
    d. All of the above

13. Which of the following patient monitoring functions detects patients on drugs in the same therapeutic classification?
    a. Drug–allergy interaction
    b. Drug–drug interaction
    c. Drug–laboratory test interactions
    d. IV compatibility

14. Which of the following is not an example of a computer output?
    a. Light pens
    b. Plotter
    c. Printer
    d. Speaker

15. Which of the following is not an advantage of centralized automation?
    a. Able to track expiration dates
    b. Improves accuracy based on bar code recognition
    c. Improved inventory management
    d. Located in a patient care unit

16. Every computer system has a database of information files. These files must be
    a. Backed up daily
    b. Kept separately
    c. Kept in a procedure and policy manual
    d. Maintained in alphabetical order

17. Which of the following is not a characteristic of mouse technology?
    a. Causing a pointer to move on a screen
    b. Dragging the device across a flat surface
    c. Making a bell ring
    d. Pressing a button to select an item

18. Which of the following is not a characteristic of voice recognition?
    a. A system that accommodates a particular voice only
    b. Has no application in the practice of pharmacy
    c. May replace manual entry of information
    d. Technology has a limited vocabulary

19. Which of the following is not a goal of automation in ambulatory care?
    a. Increase costs
    b. Increase efficiency
    c. Increase productivity
    d. Streamline workflow

20. Which of the following is true regarding sign-on or access codes?
    a. All pharmacy staff have the same level of security assigned to their access codes.
    b. Everyone uses the same code.
    c. Sign-ons identify the individual using the code.
    d. A technician does not need to sign off before someone else uses the same terminal.

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Chapter 10

Practice Examinations

PRACTICE EXAMINATION I

1. Which of the following is NOT a "patient right"?
   a. Right dosage form
   b. Right drug
   c. Right price
   d. Right strength

2. What is the maximum number of refills allowed for a Schedule IV drug?
   a. None
   b. One
   c. Five
   d. Unlimited

3. What is the meaning of "DAW2" in billing a prescription to an insurance carrier?
   a. Brand dispensed as a generic
   b. Physician approved the use of a generic drug
   c. Physician approved the use of a generic drug; the patient requested brand name
   d. Physician requested brand name

4. Which of the following auxiliary labels should be placed on a prescription container of antianxiety, antidepressant, or anticonvulsant medication?
   a. Avoid dairy products
   b. May cause drowsiness
   c. Refrigerate
   d. Shake well

5. What is the basic reimbursement formula for pharmacies?
   a. Copayment
   b. Drug cost + Standard markup rate
   c. Drug cost + Dispensing fee
   d. Drug cost + Dispensing fee − Deductible

6. Which classification of drug recall occurs if the patient experiences a reversible side effect?
   a. Class I
   b. Class II
   c. Class III
   d. Class IV

7. What standards must be followed during extemporaneous compounding?
   a. DEA
   b. FDA
   c. GMP
   d. OBRA-90

8. A pharmacy is reimbursed by an insurance company for AWP + $3.25 per prescription. If the AWP for 100 tablets is $120.00, how much will the pharmacy be reimbursed for a prescription of 30 tablets?
   a. $36.00
   b. $39.25
   c. $120.00
   d. $123.25

9. What is the generic name for Glucophage?
   a. Glipizide
   b. Glyburide
   c. Metformin
   d. Pioglitazone

10. Which drug law stated that all drugs must be pure, safe, and effective?
    a. FDCA 1938
    b. Durham-Humphrey Amendment
    c. Kefauver-Harris Amendment
    d. Poison Prevention Act of 1970

11. What is the meaning of the abbreviation "qs ad"?
    a. A sufficient quantity for the left ear
    b. A sufficient quantity for the right ear
    c. A sufficient quantity for the right eye
    d. A sufficient quantity to make up to

12. What is the minimum amount of time that a patient must wait before purchasing another bottle of an exempt narcotic?
    a. 24 hr
    b. 48 hr
    c. 72 hr
    d. 96 hr

13. What system does tuberculosis affect?
    a. Cardiovascular
    b. Digestive
    c. Endocrine
    d. Respiratory

14. How much medication should a 70-lb child receive if the adult dose is 250 mg?
    a. 70 mg
    b. 79 mg
    c. 116 mg
    d. 1458 mg

15. Which of the following is a federal program for patients older than 65 years or with certain diseases?
    a. ADC
    b. Medicaid
    c. Medicare
    d. Workers' compensation

16. Which vitamin will increase the blood coagulation of a patient taking Coumadin?
    a. Vitamin B_1
    b. Vitamin B_6
    c. Vitamin C
    d. Vitamin K

17. During which of the following processes can a medication error occur?
    a. Administration
    b. Dispensing
    c. Prescribing
    d. All of the above

18. Which interpretation of the following instructions is correct? 30-mL MOM PO ac and hs prn
    a. Take one teaspoonful of Milk of Magnesia by mouth before meals and at bedtime as needed.
    b. Take one tablespoonful of Milk of Magnesia by mouth after meals and at bedtime as needed.
    c. Take 1 oz of Milk of Magnesia by mouth after meals and at bedtime as needed.
    d. Take 1 oz of Milk of Magnesia by mouth before meals and at bedtime as needed.

19. What is NOT found in a total nutrient admixture?
    a. Amino acid
    b. Dextrose
    c. Lipids
    d. Protein

20. What does FDA refer to?
    a. Food and Drug Abuse
    b. Food and Drug Administration
    c. Food and Drug Association
    d. Free Drug Assistance

21. What type of hospital error occurs when a patient receives his or her prescribed medication outside of the normal scheduled time?
    a. Monitoring drug error
    b. Omission error
    c. Wrong time error
    d. Wrong dosage form

22. Which of the following may require a potassium supplement?
    a. Aldactone
    b. Dyazide
    c. Dyrenium
    d. Lasix

23. How often must an inventory of controlled substances be taken?
    a. Weekly
    b. Monthly
    c. Yearly
    d. Every 2 years

24. Which of the following categories of medications does NOT appear on the list of "high-alert medications"?
    a. Antiarrhythmia
    b. Antibiotics
    c. Antithrombotics
    d. Oral hypoglycemic agents

25. Which of the following pharmacy abbreviations would NOT be used for a regularly scheduled maintenance medication?
    a. BID
    b. QID
    c. STAT
    d. TID

26. Which of the following should be used in lifting pharmacy weights to be placed on a balance?
    a. Filter paper
    b. Forceps
    c. Latex gloves
    d. Weighing papers

27. How many 150-mg clindamycin capsules are required to compound a prescription reading "clindamycin 2%, propylene glycol 5%, isopropyl alcohol qs ad 480 mL"?
    a. 10
    b. 64
    c. 96
    d. 112

28. Which of the following is NOT true with regard to ordering Schedule II drugs?
    a. Form 222 is a triplicate form.
    b. Form 222 must be kept in a secure location.
    c. If an error is made on Form 222, one can cross it out and initial it.
    d. A maximum of 10 different drugs can be ordered on one form.

29. A pharmacy bases its retail prices on AWP plus a professional fee as follows:

Fee	AWP
$2.25	$25.00 or less
$3.25	$25.01–$50.00
$10.00	$50.01–$75.00
$20.00	$75.01 or more

    A prescription is presented that reads "Sig: 2 tabs bid × 25 days." If the AWP of this drug is $321.66 for 500 tablets, what will be the retail price of the prescription?
    a. $66.53
    b. $70.20
    c. $74.33
    d. $85.25

30. Which DAW code should be used if the physician authorizes the use of a generic drug but the patient requests the brand name drug?
    a. 0
    b. 1
    c. 2
    d. 3

31. What is the direction for airflow in a horizontal laminar airflow hood?
    a. From the back of the hood to the front
    b. From the bottom of the hood to the top
    c. From the front of the hood to the back
    d. From the top of the hood to the bottom

32. At which part of the liquid does one look when measuring liquids?
    a. A point between the bottom and top of the meniscus
    b. Bottom of the meniscus
    c. Top of the meniscus
    d. None of the above

33. What is the generic for Lipitor?
    a. Atorvastatin
    b. Fluvastatin
    c. Pravastatin
    d. Simvastatin

34. If 120 mL of a 2% (w/v) is diluted with water to 1 pint, what will be the strength of the dilution?
    a. 0.25%
    b. 0.5%
    c. 1.0%
    d. 8.0%

35. Which of the following drugs is a Schedule II drug?
    a. Acetaminophen with codeine
    b. Alprazolam
    c. Cocaine
    d. Flurazepam

36. How many days will a prescription of 60 tablets last if the directions read "i-ii tabs PO q4-6h"?
    a. 5 days
    b. 7 days
    c. 10 days
    d. 15 days

37. What is the maximum number of refills allowed for a Schedule III drug?
    a. None
    b. One
    c. Five
    d. Six

38. What is the meaning of the Latin abbreviation *Rx* on a prescription?
    a. Insigna
    b. Sig
    c. Take this drug
    d. Write on label

39. If a patient taking warfarin is NOT having his or her INR or PTT performed, what type of medication error is occurring?
    a. Compliance error
    b. Improper storage error
    c. Monitoring error
    d. Unauthorized drug error

40. Which of the following is NOT a goal of inventory management?
    a. Maximize costs associated with placing orders to the wholesaler.
    b. Minimize time spent on purchasing functions.
    c. Minimize capital charge on average inventory.
    d. Minimize shrinkage, breakage, and obsolescence of inventory.

41. Drugs in which classification may yield side effects such as dry eyes, dry mouth, or difficult urination or defecation?
    a. Alpha-blockers
    b. Anticholinergics
    c. Beta-blockers
    d. Cephalosporins

42. Which of the following must appear on a unit-dose product label?
    a. Dose strength of the medication
    b. Expiration date of the medication
    c. Medication name
    d. All of the above

43. Which of the following inventory principles is defined as the cost of goods sold/average inventory value?
    a. Economic order quantity
    b. Inventory turnover rate
    c. Minimum–maximum
    d. PAR

44. What term refers to the amount of money a patient must pay in a given period before the third-party insurer will make a payment?
    a. AWP + dispensing fee
    b. Capitation
    c. Copayment
    d. Deductible

45. The following prescription is presented to the pharmacy:
    Hctz 50 mg #30
    i tab PO qod c OJ
    How many days will the prescription last the patient?
    a. 15 days
    b. 30 days
    c. 45 days
    d. 60 days

46. What is the maximum number of refills allowed on Accutane prescriptions?
    a. None
    b. One
    c. Six
    d. Twelve

47. According to the Medication Error Reporting and Prevention categories, what category of error is assigned if the error occurred but it did not reach the patient?
    a. A
    b. B
    c. C
    d. D

48. Which of the following is NOT a task completed by pharmacy technicians?
    a. Counseling patients
    b. Performing inventory management tasks
    c. Ordering medications
    d. Refilling prescriptions

49. Which of the following drugs is NOT a proton pump inhibitor?
    a. Esomeprazole
    b. Itraconazole
    c. Lansoprazole
    d. Pantoprazole

50. What type of inventory is performed before the pharmacy's first day of business?
    a. Biennial
    b. Initial
    c. Perpetual
    d. Physical

51. Which of the following would NOT be used in the preparation of intravenous medications?
    a. Ampules
    b. Class A prescription balance
    c. Laminar flow hood
    d. Syringes

52. Which of the following is NOT an effect of narcotics?
    a. Analgesia
    b. CNS stimulation
    c. Euphoria
    d. Sedation

53. Which of the following could be used to prepare an ointment if another technician is using the ointment slab?
    a. A graduate
    b. A mortar
    c. Parchment paper
    d. Weighing paper

54. Which of the following would be a cause of a medication error?
    a. Handwriting is illegible or unclear
    b. Knowledge deficit
    c. Performance deficit
    d. All of the above

55. Who assigns a lot number to a particular batch of medicine?
    a. Drug manufacturer
    b. FDA
    c. Pharmacist
    d. Pharmacy technician

56. Which instrument should be used to measure a volume less than 1.0 mL?
    a. Beaker
    b. Conical graduate
    c. Cylindrical graduate
    d. Pipette

57. What is the generic name for Zithromax?
    a. Azithromycin
    b. Clarithromycin
    c. Minocycline
    d. Ofloxacin

58. Which of the following workplace issues may contribute to a prescription error?
    a. Filling one prescription at a time
    b. Medication labels that use multiple color and size fonts
    c. Multitasking
    d. Quiet work environment

59. How much time does a pharmacist have to complete the partial filling of a Schedule II prescription?
    a. 24 hours
    b. 48 hours
    c. 72 hours
    d. 96 hours

60. Which of the following duties may the pharmacy technician NOT perform?
    a. Labeling medication doses, preparing intravenous admixtures, and maintaining the cleanliness of the laminar flow hood
    b. Maintaining patient records, filling and dispensing routine orders for stock supplies, and preparing routine compounding
    c. Prepackaging drugs in single dose or unit of use, maintaining inventories of drug supplies, and completing insurance forms
    d. Providing clinical counseling, providing clinical information to medical staff, and providing patient medical history data to requestors

61. Which of the following is NOT an automated dispensing system?
    a. TJC
    b. Pyxis
    c. Robot-Rx
    d. SureMed

62. If 500 mL of D5W is to be infused over 6 hours and the drop factor is 15 gtt/mL, what will the rate in gtt/min be?
    a. 1 gtt/min
    b. 2 gtt/min
    c. 10 gtt/min
    d. 20 gtt/min

63. How old must a person be to purchase an exempt narcotic?
    a. 12 years
    b. 16 years
    c. 18 years
    d. 21 years

64. Which of the following may be used to treat sleep disorders?
    a. Chromium picolinate
    b. Ginseng
    c. Glucosamine
    d. Melatonin

65. Which of the following is NOT an advantage of a plastic bag IV parenteral system?
    a. The plastic bag is light and cheap to transport.
    b. The plastic bag takes less room for storage and disposal.
    c. The quantity remaining in the bag is easy to read.
    d. All of the above

66. Which of the following is NOT a copayment arrangement designated by third-party providers?
    a. Fee for service
    b. Flat rate
    c. Percentage
    d. Variable rate

67. How much dextrose does 1 L of D10W contain?
    a. 10 mg
    b. 100 mg
    c. 1 g
    d. 100 g

68. Which of the following interpretations of "ii gtt bid os" is correct?
    a. Instill two drops in right ear twice per day.
    b. Instill two drops in left ear twice per day.
    c. Instill two drops in right eye twice per day.
    d. Instill two drops in left eye twice per day.

69. Which dosage form is described as "solid particles dispersed in liquid vehicle"?
    a. Emulsions
    b. Gel
    c. Lotion
    d. Suspensions

70. Where should an otic product be instilled?
    a. In the ear
    b. In the eye
    c. In the rectum
    d. Under the tongue

71. Which of the following ratings indicates that the drug is contraindicated in pregnancy?
    a. A
    b. B
    c. C
    d. X

72. What type of formulary would a retail pharmacy use?
    a. Closed
    b. Open
    c. Restricted
    d. None of the above

73. Which is the most common route of administration when taking nitroglycerin?
    a. Buccal
    b. Oral
    c. Rectal
    d. Sublingual

74. Which of the following functions are performed by pharmacy computers?
    a. Drug information
    b. Drug utilization evaluation
    c. Quality assurance
    d. All of the above

75. Which of the following dosage forms is NOT a solid dosage form?
    a. Capsule
    b. Elixir
    c. Plaster
    d. Powder

76. Which of the following is NOT a required text in a pharmacy?
    a. A copy of the Controlled Substance Act
    b. *USP-NF*
    c. *Drug Facts and Comparisons*
    d. All are required references.

77. According to MEDMARX, which of the following medications has been associated with a large number of medication errors?
    a. Amoxicillin
    b. Heparin
    c. Ibuprofen
    d. Prilosec

78. Which of the following is an advantage of bar coding?
    a. Ensures the patient receives the correct drug
    b. Ensures the patient receives the correct dosage
    c. Ensures the patient receives the correct dosage form
    d. All of the above

79. What term refers to placing medication with the longest expiration date behind those containers with a shorter expiration date?
    a. Beyond-use date
    b. Just-in-time date
    c. Product recall
    d. Product rotation

80. What USP term is assigned to any temperature between 15° and 30° C?
    a. Freezer
    b. Cool
    c. Cold
    d. Room temperature

81. Which organization has issued a "do NOT use list" of pharmacy abbreviations?
    a. ISMP
    b. National Association Boards of Pharmacy
    c. State Board of Pharmacy
    d. TJC

82. Which of the following is an example of biometrics used to log into a pharmacy computer?
    a. Each individual has a unique user name or password
    b. Eye scan
    c. Fingerprint
    d. Universal user name and passwords are used

83. A physician has authorized a generic medication to be dispensed to a patient but the patient wishes to receive the brand name drug. What DAW number would be used in submitting this prescription claim to the third-party provider?
    a. DAW 0
    b. DAW 1
    c. DAW 2
    d. DAW 3

84. Which of the following may require specific modifications to a pharmacy systems database?
    a. Drug–drug interactions
    b. Drug–food interactions
    c. Drug–laboratory interactions
    d. Maximum dose and dose range

85. What term is assigned to a storage temperature of 30° to 40° C?
    a. Controlled room temperature
    b. Excessive heat
    c. Room temperature
    d. Warm

86. What term is assigned to an organization that negotiates the price of a medication for a pharmacy?
    a. Direct purchasing
    b. Group purchasing organization
    c. Jobber
    d. Prime vendor

87. What is the meaning of CPOE?
    a. Cardiac Pulmonary Obstructive Embolism
    b. Complicated Pregnancy Obstruction Examination
    c. Computerized Prescriber Order Entry
    d. Congestive Pulmonary Obstructive Embolism

88. Which of the following has been implemented by the FDA to eliminate medication errors?
    a. Do NOT crush list
    b. Sound-alike, look-alike names
    c. "Tall man" letters
    d. All of the above

89. Which piece of legislation requires that a pharmacy maintain patient profiles for all patients?
    a. Kefauver-Harris Amendment
    b. MMA
    c. OBRA-87
    d. OBRA-90

90. Which of the following types of medications require pre-authorization before submission of a prescription claim?
    a. Noncovered drugs
    b. Nonformulary drugs
    c. Restricted drugs
    d. All of the above

91. Which of the following management functions can a pharmacy information system provide?
    a. Distribution reports
    b. File maintenance
    c. Financial reports
    d. All of the above

92. How many categories of medication errors are classified by MERP?
    a. 4
    b. 5
    c. 9
    d. 10

93. What term refers to the price a pharmacy pays for medication after all discounts have been applied to it?
    a. AAC
    b. AWP
    c. MAC
    d. Retail price

94. Which of the following is an example of computer technology used in pharmacy?
    a. Automated dispensing systems
    b. Bar coding
    c. Touch screens
    d. All of the above

95. Which of the following condition(s) will prevent an individual from preparing compounded sterile products?
    a. Rashes
    b. Respiratory infections
    c. Sunburn
    d. All of the above

96. Which of the following pharmacy abbreviations should NOT be used on a prescription due to the possibility of a prescription error?
    a. ac
    b. bid
    c. ou
    d. tab

97. Which organization has developed tools to reduce medication orders?
    a. CMS
    b. FDA
    c. ISMP
    d. TJC

98. What MERP classification occurs when the error did NOT reach the patient?
    a. No error
    b. Error, no harm
    c. Error, harm
    d. Error, death

99. What substance should be used to disinfect gloves after contacting nonsterile objects?
    a. Distilled water
    b. Sterile water
    c. 70% IPA
    d. 90% IPA

100. Which piece of legislation provided prescription drug coverage for patients receiving Medicare?
    a. Drug Listing Act
    b. OBRA-87
    c. OBRA-90
    d. MMA

PRACTICE EXAMINATION II

1. Which auxiliary label should be affixed to a container of tetracycline?
    a. Avoid sunlight
    b. Take 1 hr before or 2 hr after taking dairy products or antacids
    c. Take all medication
    d. All of the above

2. How many milligrams of atropine sulfate are needed to make 30 mL of a 1:200 solution?
    a. 1.5 mg
    b. 15 mg
    c. 150 mg
    d. 1500 mg

3. What is the generic name for the brand-name drug Bactrim DS?
    a. Amoxicillin–clavulanate
    b. Cephalexin
    c. Sulfamethoxazole–trimethoprim
    d. Sulfamethoxazole–trimethoprim DS

4. What is the maximum number of refills allowed for a prescription of oxycodone + APAP if authorized by the prescriber?
    a. None
    b. Five
    c. 12
    d. Unlimited

5. Which organization established standards for e-prescribing?
    a. APHA
    b. ISMP
    c. NCPDP
    d. SCRIPT

6. What does DUE mean?
    a. Directions under evaluation
    b. Doctor under examination
    c. Drug used externally
    d. Drug utilization evaluation

7. Which of the following is defined as the difference between the prescription selling price and the prescription cost?
    a. Discount
    b. Inventory turnover rate
    c. Markup
    d. Net profit

8. What temperature is considered room temperature?
   a. 8° C
   b. 8° to 15° C
   c. 15° to 30° C
   d. 30° to 40° C

9. What is the generic name for the beta-blocker Tenormin?
   a. Atenolol
   b. Metoprolol
   c. Propranolol
   d. Nadolol

10. What is the cost for 24 mg of an active ingredient used in a compound if the bulk bottle of the active ingredient costs $250.00/g?
    a. $1.50
    b. $3.00
    c. $6.00
    d. $9.00

11. What is MedWatch?
    a. A device that signals that an another IV bag needs to be hung in an institution
    b. A reporting program available to pharmacies indicating physicians who may be overprescribing narcotics
    c. A reporting program available to health care providers to report adverse events that pose serious health threats
    d. A service established by the AARP to monitor polypharmacy in elderly adults

12. Which form is required to dispense controlled substances?
    a. Form 222
    b. Form 224
    c. Form 225
    d. Form 363

13. Which DAW code is used when the physician writes "brand name only" on the prescription?
    a. 0
    b. 1
    c. 2
    d. 3

14. How many days would a prescription of 30 tablets last if the directions were "i tab tid ac"?
    a. 3 days
    b. 6 days
    c. 8 days
    d. 10 days

15. What is the flow rate of 1000 mL of Ringer's lactate to be infused over 8 hours?
    a. 6.25 mL/hr
    b. 12.5 mL/hr
    c. 62.5 mL/hr
    d. 125 mL/hr

16. Medications in which schedule have no medical use in the United States and possess an extremely high potential for abuse?
    a. Schedule I
    b. Schedule II
    c. Schedule III
    d. Schedule IV

17. What type of drug is affected by the expression "MAC"?
    a. Discontinued drugs
    b. Investigational drugs
    c. Nonproprietary drugs
    d. Proprietary drugs

18. Which of the following is NOT an advantage of e-prescribing?
    a. Increased pharmacy costs
    b. Reduce medication errors
    c. Reduce telephone calls to prescribers
    d. Time savings

19. Which of the following is NOT a manner for a new prescription to be presented for filling at a pharmacy?
    a. Called in by the physician
    b. Called in by the patient
    c. Fax
    d. Presented by the patient

20. What is the name of the opening of a needle?
    a. Bevel
    b. Hilt
    c. Lumen
    d. Point

21. Which of the following professional licenses does NOT confer the ability to prescribe medications?
    a. DDS
    b. LCSW
    c. MD
    d. PA

22. How many milliliters of water should be added to 100 mL of 10% stock solution of sodium chloride to prepare a 0.9% solution of sodium chloride?
    a. 10.1 mL
    b. 101 mL
    c. 1011 mL
    d. 1111 mL

23. Which of the following drugs is NOT a form of estradiol?
    a. Climara
    b. Estrace
    c. Estraderm
    d. Premarin

24. Which interpretation of "ii gtt os bid" is correct?
    a. Instill two drops in right ear twice a day.
    b. Instill two drops in right eye twice a day.
    c. Instill two drops in left ear twice a day.
    d. Instill two drops in left eye twice a day.

25. Which dosage form is an aqueous solution with sucrose?
    a. Emulsion
    b. Solution
    c. Suspension
    d. Syrup

26. What type of pharmacy balance is required in all pharmacies?
    a. Class A
    b. Class B
    c. Electronic
    d. Triple beam

27. How would one take a medication if the directions said "PO"?
    a. By mouth
    b. By rectum
    c. Left ear
    d. Topically

28. Which of the following is found in an electronic health record (EHR)?
    a. Advanced directive
    b. Immunization records
    c. Patient demographics
    d. All of the above

29. What size syringe should be used to measure 0.6 mL of fluid?
    a. 1 mL
    b. 5 mL
    c. 10 mL
    d. 20 mL

30. What form must be submitted to the Drug Enforcement Administration (DEA) to request to destroy controlled substances?
    a. Form 41
    b. Form 49
    c. Form 224
    d. Form 225

31. In multiples of what number should tablets or capsules be counted at a time using a spatula and a pill tray?
    a. 1
    b. 2
    c. 5
    d. 10

32. Which of the following organization is an advocate for the practice of pharmacy?
    a. APHA
    b. ISMP
    c. USP
    d. TJC

33. How many grams of dextrose are in 1 L of D5W?
    a. 50 mcg
    b. 50 mg
    c. 5.0 g
    d. 50 g

34. Amitriptyline is to TCA as venlafaxine is to _____.
    a. Calcium channel blocker
    b. H_2 antagonist
    c. Protease inhibitor
    d. SNRI

35. How many milligrams are equal to 2 gr?
    a. 1 mg
    b. 13 mg
    c. 130 mg
    d. 1300 mg

36. What is the meaning of the prefix *osteo-*?
    a. Bone
    b. Cell
    c. Lymph
    d. Muscle

37. Which of the following is an advantage of computerized physician order entry (CPOE)?
    a. Can be accessed from a patient care setting
    b. Can be accessed from a pharmacy
    c. Can be accessed from a physician's office
    d. All of the above

38. A child weighs 30 kg and is prescribed a 10-mg/kg dose of amoxicillin tid. The pharmacy stocks 50 mg/mL. How much medication would the patient receive each day?
    a. 3 mL
    b. 6 mL
    c. 13 mL
    d. 18 mL

39. What is the generic name for Zyprexa?
    a. Donepezil
    b. Metaxalone
    c. Olanzapine
    d. Risperidone

40. How many tablets should be given to a patient with the following prescription?
    Hctz 50 mg 1 month supply
    1 tab PO qod
    ref × 6
    a. 15
    b. 30
    c. 90
    d. 180

41. How many pairs of latex gloves should be worn when preparing IV admixtures?
    a. None
    b. One
    c. Two
    d. Three

42. Which of the following drugs is NOT a Schedule II drug?
    a. Codeine
    b. Fentanyl
    c. Lorazepam
    d. Meperidine

43. Which of the following terms is defined as a process that requires the physician to request approval to prescribe a nonformulary medication and to document the reason the medication?
    a. Formulary exception process
    b. Formulary override
    c. Online adjudication
    d. Prior authorization

44. A patient weighs 60 lb and has been given a prescription in which she is to receive 3 mg/lb each day. How many milligrams will the patient receive each day?
    a. 170 mg
    b. 175 mg
    c. 180 mg
    d. 185 mg

45. What is another name for a nonproprietary drug?
    a. Brand name drug
    b. Generic drug
    c. Investigational drug
    d. OTC drug

46. What may a pharmacy technician do as a result of OBRA-90?
    a. Call a physician and recommend a different drug dosage.
    b. Counsel a patient with regard to his or her drug therapy.
    c. Offer to counsel a patient, if allowed by state law.
    d. Screen patient profiles for drug–disease contraindications.

47. Which of the following topical corticosteroid dosage forms is most potent?
    a. Cream
    b. Gel
    c. Lotion
    d. Ointment

48. Which of the following is false regarding technology and HIPAA?
    a. Patient confidentiality is maintained
    b. CPOE complements the technology
    c. Limits patient access
    d. Portability

49. You have received a medication order for Lasix 40 mg bid for 10 days. You prepare a unit dose of Lasix suspension (10 mg/mL). How much would you dispense for a unit dose?
    a. 4 mL
    b. 8 mL
    c. 10 mL
    d. 18 mL

50. What hospital committee is responsible for creating and maintaining the drug formulary?
    a. Infection Control Committee
    b. Nursing and Pharmacy Committee
    c. Pharmacy and Therapeutics Committee
    d. Product Evaluations Committee

51. Which of the following organizations accredits continuing education for both pharmacists and pharmacy technician?
    a. ACPE
    b. APHA
    c. ASHP
    d. TJC

52. What term refers to the process of placing newly purchased medications placed on the shelf behind those that will expire sooner?
    a. Inventory rotation
    b. Perpetual inventory
    c. Physical inventory
    d. Stock rotation

53. Which of the following statements is false regarding continuous quality improvement (CQI)?
    a. CQI promotes decisions to be made on the basis of objective data only.
    b. CQI is a systemic approach to quality.
    c. CQI focuses on problems caused by individuals.
    d. Both a and b

54. Which of the following is considered a mechanical error?
    a. Failing to counsel a patient
    b. Failing to make the correct decision during drug utilization evaluation
    c. Failing to screen a patient properly
    d. Performing incorrect pharmacy calculations

55. How much Demerol would be given to a patient if the dose on hand was 50 mg/mL and the patient was to receive 75 mg?
    a. 0.5 mL
    b. 1.0 mL
    c. 1.5 mL
    d. 2.0 mL

56. What type of hospital error occurs when a patient is administered a dose that is greater or less than the prescribed amount?
    a. Improper dose error
    b. Omission error
    c. Wrong dosage form
    d. Wrong dose preparation

57. What is the meaning of the term "non rep"?
    a. Do not repeat
    b. No known allergies
    c. Nothing by mouth
    d. Refill

58. Which of the following documentation principles must be adhered to with information technology?
    a. Auditability
    b. Retrievability
    c. Unique patient identification
    d. All of the above

59. What is the brand name of enalapril?
    a. Accupril
    b. Monopril
    c. Vasotec
    d. Zestril

60. Which of the following is NOT required on a prescription label?
    a. Directions for usage
    b. Drug name with strength and quantity
    c. Physician's DEA number
    d. Prescription or serial number

61. Interpret the following: "ii caps stat, then i cap q hr, max 5 caps/12 hr."
    a. Take two capsules by mouth immediately, then one capsule at bedtime, maximum of five capsules in 5 hours.
    b. Take two capsules by mouth immediately, then one capsule each hour, maximum of five capsules in 12 hours.
    c. Take 11 capsules by mouth immediately, then one capsule at bedtime, maximum of five capsules within the next 12 hours.
    d. Take 11 capsules by mouth immediately, then one capsule each hour, maximum of five additional capsules in 12 hours.

62. Which of the following is federally funded reimbursement program?
    a. HSA
    b. HMO
    c. Medicare
    d. Medication assistance programs

63. Which Medication Error Reporting and Prevention (MERP) is assigned when the error occurred may have contributed to the patient's death?
    a. Category G
    b. Category H
    c. Category I
    d. Category J

64. What is the meaning of the acronym JIT?
    a. Joint Institute of Therapeutics
    b. Joint information technology
    c. Just-in time
    d. None of the above

65. What type of drug recall will be issued if may cause reversible harm or injury to an individual?
    a. Class I
    b. Class II
    c. Class III
    d. Class IV

66. Which of the following is NOT an advantage of automatic dispensing system?
    a. Cost
    b. Efficiency
    c. Productivity
    d. Reduction in medication errors

67. Which body system is affected by GERD?
    a. Cardiovascular
    b. Endocrine
    c. Gastrointestinal
    d. Pulmonary

68. At what standard time would a patient receive medication if it was 0800 hours military time?
    a. 7 AM
    b. 8 AM
    c. 7 PM
    d. 8 PM

69. Which of the following is an example of clinical decision support systems (CDSS)?
    a. Nonformulary drug use
    b. Patient information
    c. Pharmacist intervention
    d. Therapeutic duplication

70. Which organization oversees MedWatch?
    a. FDA
    b. IOM
    c. ISMP
    d. TJC

71. How are cytotoxic drugs disposed?
    a. Discarded in the pharmacy garbage
    b. Placed in a sharps container
    c. Placed in a specialized sharps container label "hazardous waste"
    d. Rinsed down the sink or flushed down the toilet

72. What color C should be stamped on controlled substance prescriptions?
    a. Black
    b. Blue
    c. Green
    d. Red

73. A patient is to receive 1 L of D5/0.45 NS with 20 mEq solution over 24 hours. What is the flow rate?
    a. 21 mL/hr
    b. 24 mL/hr
    c. 41 mL/hr
    d. 84 mL/hr

74. Which of the following is NOT a reason why a medication would be recalled?
    a. Adulteration
    b. Incorrect expiration date
    c. Medication box is crushed
    d. Misbranding

75. Which of the following medications should NOT be crushed?
    a. Accutane
    b. Ambien
    c. Amoxicillin
    d. Ampicillin

76. Which of the following is/are a way to control quality in the pharmacy?
    a. Follow the standard operating procedures manual.
    b. Maintain proper temperatures.
    c. Use proper packaging.
    d. All of the above

77. Which of the following drugs is NOT available in a transdermal dosage form?
    a. Clonidine
    b. Estradiol
    c. Fentanyl
    d. Fexofenadine

78. What term refers to all of the drugs available for dispensing in a pharmacy?
    a. Inventory
    b. Investigational drugs
    c. Reclamation
    d. Returns

79. Which of the following is NOT a MERP recommendation?
    a. Develop written policies and procedures for personnel who administer medications.
    b. Provide training to personnel who are responsible for medication management.
    c. Ensure that controlled medications are stored properly to prevent theft and diversion.
    d. When a medication error occurs, determine who was responsible for the error.

80. Which of the following is an example of a work list that can be generated through a pharmacy's information system?
    a. Cart fill updates
    b. Intervention documentation
    c. Narcotic dispensing records
    d. PAR levels

81. Which of the following medical payment programs uses tax-deductible dollars?
    a. HSA
    b. Manufacturer drug coupons
    c. Medicare
    d. Self-pay

82. Who is responsible for ordering investigational medications?
    a. Hospital
    b. Pharmacist in charge
    c. Pharmacy technician
    d. Physician

83. After compounding a sterile preparation, where does one remove one's gloves?
    a. Ante room
    b. Buffer room
    c. Clean side of the ante room
    d. Any of the above areas

84. Which of the following drug classifications is NOT used to treat depression?
    a. Anticholinergics
    b. MAOIs
    c. SSRIs
    d. TCAs

85. What term can be described as "the rules of a facility or institution"?
    a. Policy
    b. Procedure
    c. Protocol
    d. Standard

86. What is "buPROPion-busPIRone" an example of?
    a. "Do NOT chew" drug list
    b. "Do NOT use list"
    c. Look-alike, sound-alike drugs
    d. "Tall man" letters

87. Which of the following can be returned to a drug manufacturer?
    a. Compounded medications
    b. Reconstituted medications
    c. Repackaged medications
    d. Unopened bottles of medication in the original manufacturer's bottle

88. What type of mortar and pestle should be used in mixing a liquid?
    a. Glass
    b. Porcelain
    c. Wedgewood
    d. Any of the above

89. Which organization provides packaging guidelines to the drug manufacturers?
    a. DEA
    b. FDA
    c. ISMP
    d. USP

90. Which of the following types of medications require special handling?
    a. Controlled substances
    b. Investigational drugs
    c. Repackaged medications
    d. All of the above

91. Which of the following is a disadvantage of centralized automation?
    a. Accuracy caused by bar code recognition
    b. Cost savings caused by bulk purchasing
    c. Specific medications may not be stocked
    d. Track expiration dates

92. Two tablespoonfuls of 85% boric acid solution is diluted to 10%. How many 3-oz bottles will the technician be able to fill with the diluted solution?
    a. One
    b. Two
    c. Three
    d. Eight

93. In the ante area, how often are the sink, all contact surfaces, and floor cleaned?
    a. Daily
    b. Weekly
    c. Biweekly
    d. Monthly

94. Which organization oversees MEDMARX?
    a. ASHP
    b. IOM
    c. ISMP
    d. USP

95. Which of the following pieces of information is contained in an organization's formulary?
    a. Identification of proprietary or nonproprietary names of medication
    b. Product package size
    c. Product strength
    d. All of the above

96. Which of the following may be a side effect of an antihistamine?
    a. Drowsiness
    b. Rapid heartbeat
    c. Stomach distress
    d. Watery eyes

97. Which of the following forms of managed care uses capitation?
    a. EPOS
    b. HMO
    c. POS
    d. PPO

98. Drugs in what classification may yield side effects such as dry mouth, difficult urination, or constipation?
    a. Alpha-blockers
    b. Anticholinergics
    c. Beta-blockers
    d. Cholinergics

99. What term describes the response when two or more drugs combine to provide a response that is greater than the sum of the two individual drugs?
    a. Additive effect
    b. Potentiation
    c. Synergistic effect
    d. None of the above

100. What term is assigned to a vendor when a pharmacy agrees to purchase 90% to 95% of its drug purchases?
    a. ABC analysis
    b. Group purchasing organization
    c. Prime vendor agreement
    d. 90-10 rule

PRACTICE EXAMINATION III

1. What is the purpose of postmarketing monitoring of new drugs?
    a. Ensure GMP
    b. Monitor the quality of new drugs
    c. Removal of unsafe drugs
    d. Testing for purity and effectiveness of new drugs

2. What does the abbreviation "hs" mean on a prescription?
    a. At bedtime
    b. Hours
    c. House
    d. None of the above

3. What is the maximum number of refills allowed for a Schedule III drug?
    a. None
    b. One
    c. Five
    d. 10

4. Which of the following drugs is NOT an NSAID?
    a. Colchicine
    b. Celecoxib
    c. Ibuprofen
    d. Oxaprozin

5. What auxiliary label should be included on a container of medication that has the following instruction: "i gtt os bid"?
    a. For external use
    b. For the ear
    c. For the eye
    d. Use rectally

6. A technician is given 120 mL of a 50% (w/v) potassium chloride solution and is told to add 6 oz of sterile water to it. What will be the final w/v percentage concentration of the solution?
    a. 10%
    b. 20%
    c. 33%
    d. 47%

7. How long must a laminar airflow hood be on before being used?
    a. 15 minutes
    b. 30 minutes
    c. 1 hour
    d. 2 hours

8. Which of the following is a prescribing error?
    a. Failing to perform drug utilization evaluation (DUE) properly
    b. Ear medication placed in the eye
    c. Failure to offer to counsel patient
    d. Failing to review patient's allergies

9. Why would a pharmacy receive a noncompliance report?
   a. The pharmacy failed to maintain adequate controlled substance records and has been cited by the DEA on an audit.
   b. The pharmacy failed to properly fill out a Form 222.
   c. The pharmacy failed to purchase medications from a specific vendor with whom an agreement had been negotiated by the group purchasing organization (GPO).
   d. The pharmacy purchased more drugs than it is permitted based on its budget.

10. Which of the following drugs would be contraindicated with vitamin K therapy?
    a. Glyburide
    b. Heparin
    c. Pentoxifylline
    d. Warfarin

11. What is a computer interface?
    a. A connection between two computer systems
    b. A device that connects the computer to a network
    c. The "brains" of a computer
    d. Provides the computer with temporary memory

12. What term refers to all of a business's expenses?
    a. Gross profit
    b. Margin
    c. Net profit
    d. Overhead

13. Which of the following drugs must be placed in a child-resistant container?
    a. Inhalation products
    b. Mebendazole tablets
    c. Ranitidine
    d. Sublingual nitroglycerin tablets

14. How often is a biennial inventory taken in a pharmacy?
    a. Monthly
    b. Twice per year
    c. Yearly
    d. Every 2 years

15. The pharmacy technician receives a prescription for Flexeril 10 mg, and the instructions read "i PO tid." What is the total daily dose?
    a. 10 mg
    b. 20 mg
    c. 30 mg
    d. 40 mg

16. Which part of the body would be affected by a condition with the word root *arthro*?
    a. Arm
    b. Artery
    c. Joint
    d. Membrane

17. How many grams of fluorouracil will a 154-lb patient receive in 5 successive days at a dosage rate of 12 mg/kg/day?
    a. 0.84 g
    b. 1.848 g
    c. 4.2 g
    d. 9.24 g

18. What are the two methods of pharmacy claims submission to third-party payers?
    a. Electronic and e-mail
    b. Electronic and fax
    c. Electronic and FedEx
    d. Electronic and hard copy

19. Which of the following is NOT a task a pharmacy technician would perform?
    a. Counting medication
    b. Extemporaneous compounding
    c. Reconstituting medications
    d. Counseling a patient

20. Antidepressants in which of the following classifications need to be washed out of the body before a patient switches to another antidepressant?
    a. Lithium
    b. MAOIs
    c. SSRIs
    d. TCAs

21. What term is used to describe a situation when a computer user is exposed to excessive safety alerts?
    a. Alert fatigue
    b. Alertism
    c. Alert phobia
    d. Environmental distractions

22. How much guaifenesin with codeine would you dispense for a 5-day supply if the prescription calls for "Guaifenesin c Codeine 5 cc q4h PO prn"?
    a. 120 mL
    b. 150 mL
    c. 450 mL
    d. 480 mL

23. What type of alcohol is used to clean a laminar airflow hood?
    a. Ethyl alcohol
    b. Isopropyl alcohol
    c. Methyl alcohol
    d. Rubbing alcohol

24. Which of the following interpretations of "i cap qid ac and hs" is correct?
    a. Take one caplet by mouth 1 hour before meals and at bedtime.
    b. Take one capsule by mouth 1 hour before meals and at bedtime.
    c. Take one capsule by mouth after meals and before bedtime.
    d. Take one capsule by mouth before meals and at bedtime.

25. Capsules of which of the following sizes contain the smallest quantity?
    a. 0
    b. 1
    c. 2
    d. 4

26. What term refers to a pharmacy receiving a predetermined amount of money for a patient regardless of the number of prescriptions filled or the value of the prescriptions each month?
    a. Capitation
    b. Copayment
    c. Deductible
    d. Fee for service

27. Cephalexin is to cephalosporin as ciprofloxacin is to _____.
    a. Macrolide
    b. Penicillin
    c. Quinolone
    d. Tetracycline

28. What is the meaning of AAC?
    a. Actual acquisition cost
    b. Average acquisition cost
    c. Average assessed cost
    d. Average acquisition cost containment

29. What is the generic name for Zestril?
    a. Enalapril
    b. Fosinopril
    c. Lisinopril
    d. Quinapril

30. Which term refers to the name of the medication, its strength, and the quantity to be dispensed?
    a. Inscription
    b. Rx
    c. Signa
    d. Subscription

31. Which of the following medications is an example of hazardous waste?
    a. Epinephrine
    b. Heparin
    c. Hydrocodone
    d. Insulin

32. How many grams of a 10% and 1% ointment should be used to make 45 g of a 2% ointment?
    a. 5 g of the 1%, 40 g of the 2%
    b. 5 g of the 1%, 40 g of the 10%
    c. 5 g of the 10%, 40 g of the 2%
    d. 5 g of the 10%, 40 g of the 1%

33. What should a pharmacy technician do while processing a prescription if he or she receives a contraindication message on the pharmacy terminal screen?
    a. Bypass the screen and continue to process the prescription.
    b. Contact the physician and ask that a different drug be prescribed.
    c. Inform the patient that you cannot fill the prescription because the physician made an error.
    d. Inform the pharmacist of the message.

34. Which organization is responsible for drug recalls?
    a. Board of pharmacy
    b. DEA
    c. FDA
    d. NABP

35. What type of hospital error occurs when a medication is compounded incorrectly and administered to the patient?
    a. Wrong administration
    b. Wrong dosage form
    c. Wrong drug preparation
    d. Unauthorized drug error

36. What type of drug recall occurs when a drug is NOT likely to cause a temporary adverse health consequence?
    a. Class I recall
    b. Class II recall
    c. Class III recall
    d. No recall is required.

37. Which of the following drugs, if expired, can result in a fatality?
    a. Amoxicillin
    b. Cephalexin
    c. Clarithromycin
    d. Tetracycline

38. Where should used needles be placed after use?
    a. In a biohazard container
    b. In a red plastic bag
    c. In a sharps container
    d. With normal trash

39. How many days will the following prescription last? Amoxicillin 125 mg/5 mL 75 mL i tsp PO tid
    a. 1
    b. 5
    c. 10
    d. 15

40. What do the first five digits of an NDC number represent?
    a. Drug item
    b. Drug manufacturer
    c. Drug package
    d. None of the above

41. Which of the following medications should NOT be chewed?
    a. Actonel
    b. K-Dur
    c. Nitroglycerin
    d. None of them should be chewed.

42. In what schedule is methylphenidate classified?
    a. Schedule I
    b. Schedule II
    c. Schedule III
    d. Schedule IV

43. Which of the following drugs is a calcium channel blocker?
    a. Carvedilol
    b. Nadolol
    c. Nifedipine
    d. Valsartan

44. Which of the following is federal prescription program for senior citizens?
    a. Health maintenance organization (HMO)
    b. Medicaid
    c. Medicare
    d. All of the above

45. What is the maximum number of different items that may be ordered on a DEA Form 222?
    a. 5
    b. 10
    c. 15
    d. 20

46. How many days would 40 capsules of a medication last if the directions were "i cap qid"?
    a. 4 days
    b. 6 days
    c. 8 days
    d. 10 days

47. Which of the following can a physician order using a CPOE?
    a. Laboratory tests
    b. Medical procedures
    c. Medications
    d. All of the above

48. Which dosage form would use the process of inunction to be absorbed into the body?
    a. Capsules
    b. Inhalants
    c. Ointments
    d. Suppositories

49. Why is it important to follow the procedures of an institution?
    a. Following procedures will result in a promotion.
    b. Following procedures will result in a pay increase.
    c. Procedures are established to prevent errors from occurring in a pharmacy.
    d. The Pharmacy Technician Certification Board (PTCB) and state boards of pharmacy (BOPs) follow up with pharmacy technicians to ensure that they are following procedures. Failure to follow procedures may result in either a suspension or a revocation of one's certification.

50. How many kilograms are in 4.4 lb?
    a. 0.2 kg
    b. 2.0 kg
    c. 20 kg
    d. 200 kg

51. Which of the following would NOT be found on a CSAR?
    a. Amount of medication administered
    b. Amount of medication wasted
    c. Date and time of the administration of a drug
    d. Expiration date of the drug administered

52. Dissolve 40 g of urea in enough liquid to make a 20% solution. What is the total volume?
    a. 2 mL
    b. 8 mL
    c. 20 mL
    d. 200 mL

53. Which of the following drugs is NOT a cephalosporin?
    a. Keflex
    b. Lorabid
    c. Suprax
    d. Vantin

54. What is a drug monograph?
    a. A picture of the drug from the manufacturer
    b. A price list for the drug from the manufacturer
    c. Literature on the drug
    d. Literature on the drug manufacturer

55. Which of the following is an example of telepharmacy?
    a. Computers on wheels
    b. CPOE
    c. Teleconferencing
    d. All of the above

56. What is the correct interpretation of "10 mg MSO4 IM q4h prn pain"?
    a. Inhale 10 mg of morphine sulfate every 4 hours as needed for pain.
    b. Insert 10 mL of morphine sulfate intramuscularly every 4 hours as needed for pain.
    c. Inject 10 mg of morphine sulfate intravenously every 4 hours as needed for pain.
    d. Inject 10 mg of morphine sulfate intramuscularly every 4 hours as needed for pain.

57. Which of the following is an indication for NSAIDs?
    a. Analgesic
    b. Antiinflammatory
    c. Antipyretic
    d. All of the above

58. What is the flow rate of 1 L of NS to be infused over 8 hr?
    a. 8 mL/hr
    b. 12.5 mL/hr
    c. 125 mL/hr
    d. 1000 mL/hr

59. Which of the following medications should NOT be given to individuals younger than age 18 years?
    a. Cephalexin
    b. Ciprofloxacin
    c. Clarithromycin
    d. Clindamycin

60. Which of the following is NOT a duty performed by a pharmacy technician?
    a. Answering telephones
    b. Accepting a new prescription over the phone from a physician's office
    c. Preparing prescription labels
    d. Pricing prescriptions

61. Which is the correct way to write five milligrams?
    a. 5 mg
    b. 5.0 mg
    c. 5.00 mg
    d. All of the above

62. How many milliliters of water must be added to 250 mL of a 0.9% (w/v) stock solution of sodium chloride to prepare a ½ NS solution?
    a. 125 mL
    b. 250 mL
    c. 375 mL
    d. 500 mL

63. Which of the following is the federal legend that must appear on all prescriptions?
    a. Caution: Federal law prohibits dispensing without a prescription
    b. Caution: Federal law prohibits the transfer of this prescription to anyone other than the intended
    c. Package not child resistant
    d. Warning: May be habit forming

64. What does the word root *cardio* mean?
    a. Ears
    b. Eyes
    c. Heart
    d. Skin

65. Who controls the electronic personal health record (EPHR)?
    a. Health care providers
    b. Patient
    c. Pharmacies
    d. Physicians

66. Which organization ensures a safe environment for employees?
    a. DEA
    b. EPA
    c. FDA
    d. OSHA

67. What advice should be given to a patient taking metronidazole?
    a. Avoid alcohol.
    b. Take with food.
    c. Take all of the medication.
    d. All of the above

68. How many grams of a 10% and 2% ointment should be used to make 25 g of a 5% ointment?
    a. 2%: 9.4 g; 10%: 15.6 g
    b. 2%: 10 g; 10%: 15 g
    c. 2%: 12.5 g; 10%: 12.5 g
    d. 2%: 15.6 g; 10%: 9.4 g

69. What does PCA stand for?
    a. Patient-calibrated analysis
    b. Patient-controlled analgesia
    c. Partially collapsed artery
    d. Perennial circumvented arteriosclerosis

70. Which phase of new drug development determines the appropriate dose range of the medication with regard to safety and toxicity?
    a. Preclinical
    b. Phase I
    c. Phase II
    d. Phase III

71. For which of the following may "u" (unit) be mistaken?
    a. cc
    b. Four
    c. Zero
    d. All of the above

72. By what route should Phenergan 25 mg suppository be taken?
    a. PO
    b. PR
    c. SL
    d. TOP

73. What is done with leftover investigational medications?
    a. Destroyed by pharmacy
    b. Retain for future use
    c. Return to drug manufacturer
    d. Submit a DEA Form 41 and dispose of as directed

74. What was the purpose of the Occupational and Safety Act?
    a. Ensure good manufacture practices are being employed.
    b. Prevent reimportation of medications into the United States.
    c. Provide a safe and healthful working environment for employees.
    d. Reduce accidental poisonings.

75. Which of the following can be added to a pharmacy database?
    a. Insurance plans
    b. Patient
    c. Physician
    d. All of the above

76. What term is defined as the process of identifying the most up-to-date list of all the medications a patient is taking?
    a. Drug utilization evaluation
    b. Drug utilization review
    c. Medication reconciliation
    d. Patient profile update

77. Which of the following is NOT a characteristic of an automated dispensing system?
    a. All functions are performed on a patient-specific basis.
    b. Automated dispensing systems are storage, dispensing, and charging devices.
    c. Decentralized automated dispensing systems are not for tracking inventory.
    d. The system requires entry of patient medication orders unless obtained from an interface.

78. What DEA form is used to document the breakage of spillage of a controlled substance in a pharmacy?
    a. DEA Form 41
    b. DEA Form 106
    c. DEA Form 222
    d. DEA Form 224

79. What is the most common error made during the repackaging process?
    a. Failing to maintain a repackaging log
    b. Failing to record information in repackaging log
    c. Labeling
    d. Selecting the wrong medication

80. Who establishes a formulary for an institution or managed care organization?
    a. Pharmacists
    b. Pharmacy and Therapeutics Committee
    c. Pharmacy benefit manager
    d. Physicians

81. If a patient is to receive 2.4 g of medication per day and the drug is available in 600-mg tablets, how many tablets are needed for a day's dose?
    a. Half a tablet
    b. 1 tablet
    c. 4 tablets
    d. 8 tablets

82. Which of the following terms refers to the reducing a substance to small, fine particles?
    a. Blending
    b. Comminution
    c. Levigation
    d. Tumbling

83. Which of the following is an advantage of purchasing medications from a drug manufacturer?
    a. Deliver 95% to 98% of order on schedule
    b. Lower drug cost
    c. Provide electronic order devices and supplies
    d. 24-hour/7-day-per week emergency service

84. Which of the following is NOT a characteristic of a "dumb terminal"?
    a. Can be hooked up to a mainframe system
    b. Functions as a personal computer on its own
    c. Inexpensive
    d. Useful for a large number of people to access the system

85. Which of the following abbreviations should NOT be used in prescriptions?
    a. "aa"
    b. "dc"
    c. "dtd"
    d. "emul"

86. Who may handle the disposition of controlled substances?
    a. DEA
    b. FDA
    c. Drug manufacturer
    d. Reverse distributor

87. What factor(s) influence(s) the effect of a drug on an individual?
    a. Age
    b. Disease
    c. Gender
    d. All of the above

88. Which of the following accredits pharmacy technician programs?
    a. ACPE
    b. ASHP
    c. PTCB
    d. PTCE

89. Which form of insurance is required and enforced by the government for employees who are injured on the job?
    a. Medicaid
    b. Medicare
    c. Medigap
    d. Worker's compensation

90. How often should a fentanyl patch be changed?
    a. Once per day
    b. Every 3 days
    c. Once per week
    d. Once per month

91. What DEA Form is used to order Schedule III, IV, and V medications?
    a. DEA Form 41
    b. DEA Form 106
    c. DEA Form 222
    d. No DEA Form is required.

92. Which of the following is a disadvantage to e-prescribing?
    a. Connects prescribers and patients in real time
    b. Creates electronic records
    c. Pharmacy incurs the fee
    d. All of the above

93. According to MEDMARX, which of the following medications has resulted in a large number of medication errors?
    a. Hydrochlorothiazide
    b. Naproxen
    c. Propranolol
    d. Warfarin

94. Which of the following pharmacy technician responsibilities can be improved through automation?
    a. Filling carts
    b. Preparing IV admixtures
    c. Replacing floor stock
    d. All of the above

95. What is the role of the state board of pharmacy?
    a. Investigate complaints of professional misconduct by pharmacists and pharmacy technicians
    b. Licensure of both pharmacies and pharmacists
    c. Oversee the practice of pharmacy in the state
    d. All of the above

96. Where would a buccal tablet be placed?
    a. Between the cheeks and gum
    b. Orally
    c. Rectally
    d. Under the tongue

97. How much water should be added to 1 L of 70% isopropyl alcohol to prepare a 30% solution?
    a. 2.33 mL
    b. 42.86 mL
    c. 1333 mL
    d. 2.33 L

98. Which of the following medications is NOT measured in international units?
    a. Heparin
    b. Insulin
    c. Vitamin B
    d. Vitamin E

99. Which organization established standards for batch transactions, pharmacy identification cards, and medication history?
    a. ISMP
    b. NCPDP
    c. PSTAC
    d. SCRIPT

100. What disease may result in the formation of a goiter?
    a. Cancer
    b. Hypertension
    c. Hypoglycemia
    d. Hyperthyroidism

PRACTICE EXAMINATION IV

1. You have received a medication order to prepare a 250-mL bag of NS with 1 g of Kefzol. The patient is to receive a 250-mg dose per hour. The infusion is calibrated at 10 gtt/mL. What flow rate is needed to deliver the dose?
    a. 1 gtt/min
    b. 10 gtt/min
    c. 15 gtt/min
    d. 20 gtt/min

2. Which process brings a drug from the administration site into the bloodstream?
    a. Absorption
    b. Distribution
    c. Metabolism
    d. Elimination

3. What is the generic name for Lotensin?
    a. Benazepril
    b. Enalapril
    c. Lisinopril
    d. Prinivil

4. How many inches inside a laminar airflow hood should one prepare a sterile product?
    a. 4 inches
    b. 6 inches
    c. 10 inches
    d. 12 inches

5. Which dosage form features a gelatin shell?
    a. Caplet
    b. Capsule
    c. Enema
    d. Suppository

6. Which law is being violated if a drug is dispensed without a valid prescription?
    a. Controlled Substances Act of 1970
    b. Durham-Humphrey Amendment
    c. FDCA 1938
    d. OBRA-90

7. What does AWP stand for?
   a. Actual warehouse price
   b. Actual wholesale price
   c. Average wholesale price
   d. Average wholesale promotion

8. When a pharmacy technician is performing geometric dilution, when does the technician add the most potent ingredient, which may also have the smallest weight or smallest volume, to the mortar?
   a. Any time
   b. As the first ingredient
   c. As the last ingredient
   d. Intermittently during the compounding process

9. How many days will the following prescription last?
   Ampicillin 250 mg #40
   i cap PO qid ac and hs
   a. 5 days
   b. 8 days
   c. 10 days
   d. 20 days

10. Which of the following is a calcium channel blocker?
    a. Atenolol
    b. Carvedilol
    c. Diltiazem
    d. Lisinopril

11. How many 500-mg doses can be prepared from a 10-g vial of cefazolin?
    a. 15
    b. 20
    c. 25
    d. 50

12. Which of the following might be used to treat arthritis?
    a. Feverfew
    b. Ginger
    c. Ginkgo
    d. Glucosamine

13. Which of the following agents is used to increase the viscosity of a suspension?
    a. Emulsifier
    b. Flocculating agent
    c. Mucilage
    d. Thickening agent

14. Which of the following is true regarding sign-in or computer access codes?
    a. All employees have the same sign-in or access code.
    b. A sign-in or access code identifies the individual using the computer system.
    c. All pharmacists and pharmacy technicians have the same level of security assigned to them.
    d. The state board of pharmacy assigns sign-in or access codes to all certified pharmacy technicians.

15. What is the generic name for Fosamax?
    a. Alendronate
    b. Calcitonin–salmon
    c. Etidronate
    d. Raloxifene

16. Which of the therapeutic equivalence codes states that the product meets the necessary bioequivalence requirements?
    a. AA
    b. AB
    c. B
    d. BC

17. Which of the following is an example of a health maintenance organization (HMO)?
    a. Blue Cross-Blue Shield
    b. CHAMPUS
    c. Kaiser Permanente
    d. Worker's compensation

18. Which of the following would NOT be a reason for a prescription to be rejected by an insurance provider?
    a. Compounded drugs with one ingredient being a legend drug
    b. Incorrect NDC number
    c. Invalid ID number
    d. Prescription coverage has expired

19. What is the generic name for Zyprexa?
    a. Nefazodone
    b. Olopatadine
    c. Olanzapine
    d. Trazodone

20. How many grams of boric acid are required to make 4 fl oz of the following boric acid solution?
    Boric acid 50 g
    Purified water qs to make 1000 mL
    a. 0.006 g
    b. 0.06 g
    c. 0.6 g
    d. 6 g

21. What type of label is placed on medications to warn patients or provide additional information?
    a. Auxiliary label
    b. Patient product insert
    c. Patient profile
    d. Prescription label

22. Which of the following is NOT an input device for a computer?
    a. Bar code technology
    b. Keyboard
    c. Printer
    d. Touch screen applications

23. What drug is abbreviated HCTZ?
    a. Hycomine
    b. Hycodan
    c. Hydrochlorothiazide
    d. Hydrea

24. Which of the following drugs does NOT need to be packaged in a child-resistant package?
    a. Digoxin
    b. Ibuprofen
    c. Nitroglycerin
    d. Simvastatin

25. Which of the following products is NOT used to treat hyperlipidemia?
    a. Aspirin
    b. Fibric acid derivatives
    c. HMG-CoA reductase inhibitors
    d. Metamucil

26. Which of the following terms refers to a "member" or "recipient" in managed care organizations?
    a. Deductible
    b. Provider
    c. Subscriber
    d. Third payer

27. Which drug classification of antibiotics should be taken with caution if the patient is allergic to penicillin?
    a. Aminoglycosides
    b. Cephalosporins
    c. Macrolides
    d. Quinolones

28. What is the sensitivity of a class A balance?
    a. 1 mg
    b. 6 mg
    c. 10 mg
    d. 20 mg

29. What is the percent equivalent of a 1:20 ratio?
    a. 0.05%
    b. 0.5%
    c. 5.0%
    d. 50%

30. What does "U&C" mean when billing prescriptions?
    a. Unusual customer
    b. Unusual and customary
    c. Usual customer
    d. Usual and customary

31. Which of the following expressions defines the quantity of a product in stock reaches a predetermined point?
    a. Desired level
    b. Minimum/maximum level
    c. Par level
    d. Stock level

32. Gentamicin 120 mg in 100 mL D5W is administered over 30 min every 8 hr with a 10-drop kit. What will the rate be?
    a. 2 gtt/min
    b. 4 gtt/min
    c. 16 gtt/min
    d. 33 gtt/min

33. Which of the following would be a correct DEA number for Dr. A. Shedlock?
    a. AB135426
    b. BS2456879
    c. FS1578926
    d. MS2254235

34. What type of inventory is performed on controlled substances?
    a. Biennial inventory
    b. Open inventory
    c. Perpetual inventory
    d. Physical inventory

35. Which of the following forms of computer technology are used in the practice of pharmacy today?
    a. Automated dispensing systems
    b. Bar coding
    c. Touch screens
    d. All of the above

36. Which of the following is considered a solid dosage form?
    a. Cream
    b. Emulsion
    c. Suspension
    d. Tablet

37. What is the maximum number of refills for a Schedule IV drug if authorized by the physician?
    a. None
    b. Five
    c. 12
    d. Unlimited

38. Which of the following terms refers to cost of health insurance?
    a. Benefit
    b. Copay
    c. Deductible
    d. Premium

39. What assumption should a pharmacy technician make if she observes a white, fluffy precipitate in a 250-mL bag of D5W?
    a. The solution has been contaminated.
    b. The solution has been exposed to the cold.
    c. The solution has been exposed to bright light.
    d. The solution should be shaken to disperse the precipitate before dispensing.

40. How many refills may a physician order for a Schedule II drug?
    a. None
    b. One
    c. Five
    d. Unlimited refills in a 1-year time frame

41. What is the meaning of CSAR?
    a. Controlled studies are reviewed
    b. Controlled substance administration record
    c. Controlled substance audit and review
    d. Cost, sales, allocation, and resources

42. What is the percentage strength of a solution that is made by adding 100 mL of purified water to 600 mL of a 25% solution?
    a. 4.2%
    b. 12.5%
    c. 21.4%
    d. 30.00%

43. What do the three sets of numbers in a National Drug Code (NDC) number reflect?
    a. Drug manufacturer, drug product, and the year the New Drug Application (NDA) was filed
    b. Drug manufacturer, drug product, and package size
    c. Drug manufacturer, drug name, and drug strength
    d. None of the above

44. Levothyroxine is to hypothyroidism as glyburide is to _____.
    a. ACE inhibitor
    b. Beta-blocker
    c. Oral hyperglycemic agent
    d. Oral hypoglycemic agent

45. In which schedule would you find the combination product oxycodone + acetaminophen?
    a. Schedule II
    b. Schedule III
    c. Schedule IV
    d. Schedule V

46. Which of the following drugs is NOT used for asthma?
    a. Albuterol
    b. Ipratropium
    c. INH
    d. Salmeterol

47. Which organization accredits pharmacy technician programs?
    a. ACPE
    b. APHA
    c. ASHP
    d. All of the above

48. For which of the following drugs is it mandatory that a customer receive a Patient Product Insert (PPI)?
    a. Amoxicillin
    b. Lithonate
    c. Premarin
    d. Synthroid

49. Which dosage form is produced by compression?
    a. Capsule
    b. Lozenge
    c. Suppository
    d. Tablet

50. Which of the following drugs is safe to take for a headache if the patient has peptic ulcer disease?
    a. Acetaminophen
    b. Acetylsalicylic acid
    c. Ibuprofen
    d. Naproxen sodium

51. Who makes notations in and signs medication administration records (MARs) in an institution?
    a. Doctors
    b. Nurses
    c. Pharmacists
    d. Pharmacy technicians

52. What is the meaning of "i gtt ou tid ud"?
    a. Instill one drop in each ear three times a day as directed.
    b. Instill one drop in each eye two times a day as directed.
    c. Instill one drop in each eye three times a day as needed.
    d. Instill one drop in each ear twice a day as directed.

53. How many milligrams are in "gr i$\overline{ss}$"?
    a. 32.5 mg
    b. 65 mg
    c. 97.5 mg
    d. 130 mg

54. Which of the following is true regarding reporting prescription errors?
    a. All prescription errors must be reported to the National Association of Boards of Pharmacy.
    b. All prescription errors must be reported to state board of pharmacy.
    c. It is mandatory to report.
    d. It is voluntary to report.

55. How many days does a pharmacy have to fill a prescription of Accutane?
    a. 1 day
    b. 7 days
    c. 30 days
    d. 180 days

56. You have a solution of heparin 100,000 units/L with an infusion apparatus labeled 60 gtt/mL. What is the flow rate to deliver a dose of 20 units/min?
    a. 3 gtt/min
    b. 12 gtt/min
    c. 15 gtt/min
    d. 20 gtt/min

57. Which of the following would NOT be a correct auxiliary label for a patient taking doxycycline?
    a. Avoid dairy products
    b. Avoid sunlight
    c. Not to be taken by pregnant women or children younger than age 9 years
    d. Take on an empty stomach

58. How many drops per milliliter does a "mini-drip" system provide?
    a. 10 gtt/mL
    b. 15 gtt/mL
    c. 30 gtt/mL
    d. 60 gtt/mL

59. Where would you prepare hazardous drugs in a pharmacy?
    a. In a biologic safety hood
    b. In a horizontal laminar airflow hood
    c. In a vertical laminar airflow hood
    d. On an ointment slab

60. Rx: Codeine phosphate 30 mg/tsp
    Tussin syrup 30 mL
    Elixophyllin qs 240 mL
    Sig: 5 mL qid pc hs
    If 5 mL of Tussin syrup contains 100 mg of guaifenesin, how many milligrams of the drug would be taken daily?
    a. 2.5 mg
    b. 5 mg
    c. 10 mg
    d. 50 mg

61. What is the first thing a pharmacy technician should do if he or she discovers a prescription error?
    a. Apologize to the patient.
    b. Contact the physician.
    c. File a report with MEDMARX.
    d. Inform the pharmacist.

62. The cost of 100 tablets of a particular medication is $2.00. What would the retail price be if there were a 30% gross profit?
    a. $0.60
    b. $2.00
    c. $2.30
    d. $2.60

63. Where would oxycodone with acetaminophen be stored in the pharmacy?
    a. In the refrigerator
    b. In the pharmacy safe
    c. With the "fast movers"
    d. With the pills and tablets

64. Which of the following drugs is NOT used as a prophylactic product?
    a. Amoxicillin
    b. Imitrex
    c. Norgestimate–ethinyl estradiol
    d. Propranolol

65. Which of the following products can be used as a smoking cessation product and as an antidepressant?
    a. Bupropion
    b. Nicotine
    c. Trazodone
    d. Zolpidem

66. A patient informs the pharmacy technician that he experienced an adverse event caused by a vaccine he received. What report should be submitted?
    a. FAERS
    b. Insurance claim
    c. VAERS
    d. Worker's compensation

67. How much of a D10W solution contains 100 g of dextrose?
    a. 0.01 L
    b. 0.1 L
    c. 1 L
    d. 2 L

68. What does an 80/20 report tell a pharmacist or pharmacy technician?
    a. Products that have an 80% gross profit
    b. Products that have a 20% gross profit
    c. Drug products that reflect 80% of the pharmacy's purchasing dollars
    d. Controlled substances that represent 20% of the total number of prescriptions filled

69. What units are used to measure electrolytes?
    a. mEq
    b. mg
    c. mL
    d. units

70. What type of drug requires a DEA number?
    a. Controlled substance
    b. Investigational drug
    c. Legend drug
    d. OTC drug

71. What was the purpose of the Durham Humphrey Amendment?
    a. Distinguished prescription and OTC medications
    b. Distinguished proprietary and nonproprietary medications
    c. Established schedules of medications based on their potential for abuse
    d. All of the above

72. Which of the following reports can be generated using the pharmacy computer?
    a. Controlled Substance Drug Report
    b. Customer History Report
    c. Daily Prescription Log Report
    d. All of the above

73. What piece of legislation required that drug utilization evaluation (DUE) be performed with each prescription?
    a. HIPAA
    b. OBRA-87
    c. OBRA-90
    d. MMA

74. Which of the following respiratory medications is NOT a combination product?
    a. Advair
    b. Allegra D
    c. Combivent
    d. Singulair

75. Which of the following is NOT an example of a dispersion?
    a. Emulsion
    b. Lotion
    c. Ointment
    d. Suppository

76. What term refers to a connection between two or more computer systems?
    a. Dumb terminal
    b. Interface
    c. Microcomputer
    d. Minicomputer

77. What is the meaning of "w/v"?
    a. Number of grams per 1 mL
    b. Number of grams per 100 mL
    c. Number of micrograms per 100 mL
    d. Number of milligrams per 100 mL

78. Who may recommend an OTC product to a patient?
    a. All pharmacy technicians
    b. All PTCB-certified technicians
    c. All technicians who have completed continuing education in OTC products
    d. None of the above

79. What type of card is provided to a patient that allows a patient to obtain medications at the contracted provider rate?
    a. Drug Coupon Card
    b. Drug Discount Card
    c. Medicare Card
    d. Medicaid Card

80. Which of the following statements is false regarding the expectations of a pharmacy technician in preventing medication errors?
    a. Ask the patient or the patient's representative any questions you may have filling the prescription.
    b. Read the prescription at least three times during the prescription filling process.
    c. Show all pharmacy calculations to the pharmacist before compounding a prescription.
    d. None of them are false.

81. What is the route of administration for a prescription with the directions "i supp pr q6h prn"?
    a. Orally
    b. Rectally
    c. Urethrally
    d. Vaginally

82. Which of the following is true concerning pharmacy technician inputted medication orders?
    a. Highlighting or flashing is used to identify pharmacy technician-entered orders.
    b. After a medication order has been entered by a pharmacy technician, it cannot be modified by a pharmacist.
    c. Orders entered by a pharmacy technician are active immediately.
    d. Pharmacy technicians are not allowed to enter medication orders.

83. Which of the following types of medications requires a special form to be submitted when ordering?
    a. Cytotoxic medications
    b. Hazardous substance
    c. Proprietary and nonproprietary drugs
    d. Schedule II medications

84. Which of the following is NOT a goal of automation in an ambulatory care pharmacy?
    a. Increase costs
    b. Increase efficiency
    c. Increase productivity
    d. Simplify workflow

85. What is the percent equivalent of a 1:10 ratio?
    a. 0.01%
    b. 0.1%
    c. 1.0%
    d. 10.0%

86. Which of the following estrogen medications is NOT a transdermal dosage form?
    a. Climara
    b. Estraderm
    c. Premarin
    d. Vivelle

87. What type of drug recall may cause temporary health problems and have a low risk of creating a serious problem?
    a. Class I
    b. Class II
    c. Class III
    d. Class IV

88. Which of the following is true regarding the use of bar coding?
    a. Bar codes can identify products only.
    b. Bar codes require the use of a scanner to "read" the information on the bar code.
    c. Bar codes cannot be used in performing inventory control functions.
    d. Bar code scanners must be in a fixed position.

89. A pharmacy technician is preparing heparin 25,000 units in 500 mL of D5W. The appropriate concentration on the label should read _____.
    a. 50 units/mL
    b. 75 units/mL
    c. 100 units/mL
    d. 125 units/mL

90. How quickly must a multidose container be used after opening it?
    a. 7 days
    b. 14 days
    c. 21 days
    d. 28 days

91. Which of the following may increase the likelihood of a medication error?
    a. Excessive noise
    b. NOT scheduling sufficient help during peak times
    c. Poor lighting in the pharmacy
    d. All of the above

92. Deficiency of what vitamin may result in beriberi?
    a. Vitamin A
    b. Vitamin B_1
    c. Vitamin C
    d. Vitamin D

93. Which of the following is used to remove water-soluble residues found in the sterile compounding area?
    a. Clorox
    b. IPA 70%
    c. IPA 95%
    d. USP purified water

94. Which of the following is NOT an advantage of automated system using robotics?
    a. High degree of accuracy for filled medications
    b. Pharmacist checking of medication cassettes is quick using a bar code scanner
    c. Returned medications can be easily credited by scanning the patient ID label and the medication
    d. System automatically restocks itself

95. Which of the following is NOT a reason for a medication to be returned to a manufacturer?
    a. Medication has been damaged
    b. Medication has been recalled
    c. Medication is close to its expiration date
    d. Patient returns the medication

96. Which of the following can process control devices do?
    a. Add electrolytes and micronutrients to total parenteral nutrition (TPN)
    b. Batch-fill syringes
    c. Prepare base solutions for total parenteral nutrition (TPN)
    d. All of the above

97. You have received a prescription for amoxicillin 500 mg PO. The patient is unable to chew or swallow capsules or tablets. How many milliliters should be given in each dose if the concentration is 125 mg/5 mL?
    a. 5 mL
    b. 10 mL
    c. 15 mL
    d. 20 mL

98. What is the primary source of medication for community pharmacies?
    a. Chain pharmacy warehouses
    b. GPOs
    c. Manufacturers and wholesalers
    d. Store-to-store vendors

99. What body organ would be affected by hepatotoxicity?
    a. Intestines
    b. Kidneys
    c. Liver
    d. Thyroid

100. What is a universal precaution?
    a. An infection control principle
    b. An infection control principle that requires a health care provider to treat human blood as infectious
    c. An infection control principle required when using equipment
    d. Precautions used when handling hazardous waste

PRACTICE EXAMINATION V

1. What organ would be affected if a patient were experiencing rhinitis?
   a. Bladder
   b. Ear
   c. Eye
   d. Nose

2. What volume does a small-volume parenteral contain?
   a. 100 mL
   b. 250 mL
   c. 500 mL
   d. All of the above

3. What process occurs when a drug blocks the activity of metabolic enzymes in the liver?
   a. Additive effects
   b. Inhibition
   c. Potentiation
   d. Synergism

4. Which of the following auxiliary labels would NOT be appropriate for a prescription of sulfasalazine?
   a. Avoid sunlight
   b. Drink plenty of water
   c. Keep refrigerated
   d. May discolor urine

5. When opening a glass ampule, always use a gauze swab for which of the following reasons?
   a. To protect your finger from cuts
   b. To prevent contamination of the product inside the ampule
   c. To disinfect the ampule
   d. None of the above

6. How many inventory turns would a pharmacy experience if the initial inventory of the accounting period was $225,000, the final inventory of the period was $250,000, and the pharmacy had sales of $2.75 million?
   a. 12.22 turns
   b. 11.58 turns
   c. 11.00 turns
   d. 5.79 turns

7. Which organization is concerned with employee safety?
   a. HIPAA
   b. TJC
   c. OBRA
   d. OSHA

8. Which of the following may lead to a pharmacy calculation error?
   a. Incorrect conversions used
   b. Misplacing the decimal point
   c. Not rechecking your calculations
   d. All of the above

9. The pharmacist asks you to prepare 250 mL of a 25% acetic acid solution. How much acetic acid would you need to make this preparation?
   a. 62.5 mg
   b. 6250 mg
   c. 62.5 g
   d. 6250 g

10. Which of the following ophthalmic products should be refrigerated?
    a. Apraclonidine
    b. Brimonidine
    c. Brinzolamide
    d. Latanoprost

11. A pharmacy has 300 mL of a 50% solution; 200 mL is added to this solution to decrease the concentration. How many grams of active ingredient would be in the diluted solution?
    a. 7.5 g
    b. 30 g
    c. 150 g
    d. 300 g

12. In how many direction(s) does air flow in a laminar flow hood?
    a. One
    b. Two
    c. Three
    d. Four

13. Which answer best describes the information that should be included in a Schedule C-V sale log for Schedule C-V drugs sold without a prescription?
    a. Dispensing date, printed name, signature and address of buyer, name and quantity of the product sold, and the pharmacist's signature
    b. Dispensing date, signature and phone number of the buyer, product name, and product company with lot number
    c. Dispensing date, signature of the buyer, name and quantity of product sold, price of the product sold, and the lot number of the product sold
    d. Dispensing date, buyer signature, pharmacist signature, product name and amount, and the expiration date of the product

14. Which of the following is NOT a cardiovascular medication?
    a. Coreg
    b. Diovan
    c. Evista
    d. Plavix

15. What is another term for a master formula sheet?
    a. MAR
    b. MSDS
    c. Pharmacy compounding log
    d. Record log sheet

16. How would a prescriber write a prescription for "Zolpidem 5 mg at bedtime if needed"?
    a. Zolpidem 5 mg q hs prn
    b. Zolpidem 5 mg q hs ad
    c. Zolpidem 5 mg q 9 pm ad lib
    d. Zolpidem 5 mg q hs qs

17. What is another term for suggested retail price?
    a. Discounted price
    b. List price
    c. Net price
    d. Sale price

18. A pharmacy must ensure that its pharmacy records are "readily retrievable" for a pharmacy inspector. This means they must be able to be produced within how much time?
    a. 24 hours
    b. 48 hours
    c. 72 hours
    d. 96 hours

19. Which dosage form is a clear, sweetened, flavored hydroalcoholic solution containing water and ethanol?
    a. Collodion
    b. Elixir
    c. Suspension
    d. Syrup

20. The product Infants' Mylicon Drops contains 2 g of simethicone in a 30-mL container. How many milligrams of the drug are contained in each teaspoonful dose?
    a. 0.33 mg
    b. 33 mg
    c. 333 mg
    d. 1000 mg

21. Which of the following may increase the likelihood of a prescription error?
    a. Asking another pharmacy technician check your work before having the pharmacist check your work
    b. Having the pharmacist check your work
    c. E-prescribing
    d. Taking a verbal prescription over the phone from a nurse after the prescription was communicated to her verbally by the physician

22. What is the generic name for Avapro?
    a. Candesartan
    b. Irbesartan
    c. Losartan
    d. Valsartan

23. What should be done in preparing a prescription for etoposide?
    a. Flush the remaining contents down a sink or toilet.
    b. Wear protective clothing if you are allergic to etoposide.
    c. Place labels on the container so that it has a professional appearance.
    d. Prepare it in a biologic safety cabinet.

24. To which organization would an individual report a medication error?
    a. DEA
    b. FDA
    c. MedWatch
    d. State board of pharmacy

25. According to TJC, which of the following must be addressed by an institution in its infection control policy?
    a. Infection surveillance, prevention, and control for the pharmacy
    b. Microbial monitoring of laminar flow hoods
    c. Proper use of laminar flow hoods
    d. All of the above

26. A drug in which schedule of medication may be purchased as an "exempt narcotic"?
    a. Schedule II
    b. Schedule III
    c. Schedule IV
    d. Schedule V

27. Which of the following tasks do computers perform?
    a. Communication
    b. Input and output
    c. Processing and storage
    d. All of the above

28. How often does a certified pharmacy technician need to renew his or her certification?
    a. Every 6 months
    b. Yearly
    c. Every 2 years
    d. Pharmacy technicians do not need to renew their certifications

29. What is a medication order called when it is presented to a community pharmacy?
    a. Inscription
    b. MAR
    c. Patient profile
    d. Prescription

30. What is the generic name for Prevacid?
    a. Esomeprazole
    b. Lansoprazole
    c. Omeprazole
    d. Pantoprazole

31. Which law is being violated if a pharmacist prepares a medication under unsanitary conditions?
    a. Dietary Supplement Health Education Act of 1994
    b. Food, Drug, and Cosmetic Act (FDCA) of 1938
    c. OBRA-90
    d. Health Insurance Portability and Accounting Act (HIPAA)

32. What would be the infusion rate for a 50-mg/mL magnesium sulfate solution to provide 1.2 g/hr?
    a. 0.4 mL/hr
    b. 2.5 mL/hr
    c. 20 mL/hr
    d. 24 mL/hr

33. New OTC drugs are required to go through necessary phases. Which phase occurs when a final review is done on the ingredients of the agent in question and the public is able to give feedback?
    a. Phase I
    b. Phase II
    c. Phase III
    d. Phase IV

34. Which of the following organizations may discipline a pharmacy technician for egregious behavior?
    a. ASHP
    b. BOP
    c. NABP
    d. PTEC

35. What part of the laminar flow hood is responsible for removing contaminants?
    a. The blower
    b. The HEPA filter
    c. The recovery vent
    d. The side walls

36. Which of the following is NOT a reason for a third-party claim to be rejected by an insurance carrier?
    a. Drug not covered
    b. Invalid identification number
    c. Generic drug dispensed
    d. Refill too soon

37. If 1 g of dextrose provides 3.4 kcal, how many kilocalories will 200 mL of a 25% dextrose solution provide?
    a. 17 kcal
    b. 170 kcal
    c. 340 kcal
    d. 680 kcal

38. What term describes directions to a pharmacist on a prescription?
    a. DAW indicator
    b. Inscription
    c. Subscription
    d. Signa

39. Which of the following terms is a set amount of money that must be paid by the patient before the insurer will cover additional expenses?
    a. Coinsurance
    b. Copayment
    c. Deductible
    d. Maximum allowable cost

40. What is the correct meaning for the signa in the following prescription?
    Timoptic 0.25% 15 mL
    i gtt ou bid
    a. Instill 1 drop in each ear twice per day.
    b. Instill 1 drop in each eye twice per day.
    c. Instill 1 drop in left eye twice per day.
    d. Instill 1 drop in left ear twice per day.

41. Which schedules of controlled substances are monitored through prescription monitoring programs?
    a. Schedule II
    b. Schedule III
    c. Schedule IV
    d. All of the above

42. What is the unit of measurement for insulin?
    a. USP units
    b. Milliequivalents
    c. Milliliters
    d. Milliosmoles

43. Which organization establishes standards for pharmacy continuing education?
    a. ACPE
    b. APHA
    c. ASHP
    d. PTEC

44. What is the percentage of a 1:25 (w/v) solution?
    a. 0.04%
    b. 0.4%
    c. 4.0%
    d. 40.0%

45. Which of the following medications may NOT be used to treat osteoporosis?
    a. Actonel
    b. Boniva
    c. Cordarone
    d. Fosamax

46. What is the meaning of NPI?
    a. National Pharmaceutical Institute
    b. National Pharmacopeia Index
    c. National Provider Identifier
    d. No provider identified

47. Which of the following would be considered a wrong drug preparation error?
    a. Adding NOT enough water to reconstitute an Augmentin suspension prescription
    b. Using the wrong base to compound an ointment
    c. Using the wrong diluent in compounding a sterile preparation
    d. All of the above

48. What type of unit-dose system is referred to as *punch cards, bingo cards,* or *blister packs*?
    a. Blended unit-dose system
    b. Modified unit-dose system
    c. Modular cassette
    d. Multiple medication packages

49. Which dosage form may either be oil-in-water or water-in-oil?
    a. Emulsion
    b. Solution
    c. Suspension
    d. Syrup

50. How much of a 10% and 60% dextrose solution should be mixed to prepare 1 L of a 40% dextrose solution?
    a. 10%: 600 mL; 60%: 400 mL
    b. 10%: 500 mL; 60%: 500 mL
    c. 10%: 400 mL; 60%: 600 mL
    d. 10%: 300 mL; 60%: 700 mL

51. Which of the following have drug manufacturers done to reduce medication errors?
    a. Change the proprietary medication name.
    b. Use lettering that matches the color of the medication.
    c. Use "tall man" letters.
    d. All of the above

52. Which of the following is NOT required for authorization to release patient information?
    a. A handwritten copy
    b. A list of the patient's prescription and over-the-counter medications
    c. A reason for the release
    d. Patient's signature

53. How often are drug formularies updated?
    a. 4 to 6 months
    b. 12 to 18 months
    c. 2 years
    d. 4 years

54. What is the proper dose for a 6-year-old child if the adult dose is 10 mg?
    a. 33 mcg
    b. 3.3 mg
    c. 33 mg
    d. 333 mg

55. Which of the following is NOT true regarding pharmacy automation?
    a. Automation can change both the pharmacist and pharmacy technician's responsibilities.
    b. Automation can improve the quality of work in the pharmacy.
    c. Automation increases the possibility of medication errors.
    d. Automation requires informed individuals.

56. To which schedule do anabolic steroids belong?
    a. Schedule II
    b. Schedule III
    c. Schedule IV
    d. Schedule V

57. Prescriptions for drugs in which of the following controlled substance schedules may be faxed to a pharmacy?
    a. Schedule III
    b. Schedule IV
    c. Schedule V
    d. All of the above

58. Which of the following units of measure for weight is the smallest?
    a. Gram
    b. Kilogram
    c. Microgram
    d. Milligram

59. What is the meaning of the pharmacy abbreviation "dtd"?
    a. Daylight time doses
    b. Do not take daily
    c. Give of such doses
    d. Of each

60. Which of the following routes of administration is administration into a vein?
    a. IA
    b. IM
    c. IV
    d. SL

61. Which of the following analgesic medications requires a physician to have a DEA number?
    a. Daypro
    b. Motrin
    c. Naprosyn
    d. Vicoprofen

62. What type of medication error occurs when a patient does NOT take his or her medication as directed by the physician?
    a. Compliance error
    b. Improper storage error
    c. Monitoring drug error
    d. Wrong administration

63. Which form is used to document medication being administered to a patient?
    a. MAR
    b. MDR
    c. POS
    d. TAR

64. A 44-lb child is to receive 4 mg of phenytoin per kilogram of body weight daily as an anticonvulsant. How many milliliters of pediatric phenytoin suspension containing 30 mg/5 mL should the child receive?
    a. 13.3 mL
    b. 50 mL
    c. 80 mL
    d. 176 mL

65. Which of the following dosage forms could a patient with diabetes receive?
    a. Elixir
    b. Emulsion
    c. Spirits
    d. Syrups

66. Which of the following is the generic name for Percocet?
    a. Acetaminophen + codeine
    b. Acetaminophen + hydrocodone
    c. Acetaminophen + oxycodone
    d. Acetaminophen + propoxyphene

67. All of the following are disadvantages of a centrally automated dispensing system using robotics except which one?
    a. An individual is required to act as a packager.
    b. Expired medications must be manually removed from the system.
    c. Special medication cassettes are required.
    d. Special packages are required.

68. What is another term for a "crash cart"?
    a. Code blue cart
    b. Code orange cart
    c. Code red cart
    d. Code yellow cart

69. What is the brand name for lorazepam?
    a. Ativan
    b. Dalmane
    c. Klonopin
    d. Valium

70. Which of the following is used as an incentive to take a particular medication or to assist in patients who meet specific income restrictions?
    a. Drug Coupon Card
    b. Drug Discount Card
    c. Medicaid
    d. Worker's compensation

71. Which of the following statements is true regarding the role of pharmacy technicians and pharmacy information systems?
    a. Only the pharmacist can gather data for quality assurance purposes and use the computer to enter this data.
    b. Pharmacy technicians can collect data only.
    c. Pharmacy technicians can gather data for quality assurance activities and can use the computer to organize and input the data.
    d. Pharmacy technicians can't gather or input data because it is judgmental activity assigned only to pharmacists.

72. Which of the following does Bloodborne Pathogen Standard require?
    a. Requires an employer to provide all employees to receive a hepatitis B injection
    b. Requires an employer to provide yearly training for all employees who may be exposed to bloodborne pathogens
    c. Requires latex gloves be provided to all employees who may be exposed to bloodborne pathogens
    d. Requires that management evaluate and determine what safety equipment will be used to prevent exposure to blood borne pathogens

73. What does ASHP mean?
    a. American Schools of Health Practices
    b. American Society of Health-System Pharmacists
    c. American Society of Hospital Pharmacists
    d. Association of Specialty Health Practitioners

74. Which of the following is NOT a management function of a pharmacy information system?
    a. Collect narcotic use data
    b. Compile workload data
    c. Generate labels
    d. Maintain billing information

75. How many milliliters are in 1 pint?
    a. 120 mL
    b. 240 mL
    c. 480 mL
    d. 960 mL

76. Which of the following drugs would be administered to a patient if he or she had received an overdose of heparin?
    a. Aspirin
    b. Phytonadione
    c. Protamine sulfate
    d. Warfarin

77. Which of the following is a way to inform the pharmacy staff about prescription errors?
    a. Newsletters
    b. Provide staff with materials provided by ISMP
    c. Yearly staff in-services addressing medication errors
    d. All of the above

78. Which reference book is included in *USP DI* Volume III and contains the FDA's approved drug products?
    a. *American Drug Index*
    b. *Blue Book*
    c. *Orange Book*
    d. *Red Book*

79. Which of the following side effects may be attributed to an overdosage of salicylates?
    a. GI upset
    b. Platelet changes
    c. Tinnitus
    d. All of the above

80. How many milliliters of water should be mixed with 1200 mL of 65% (v/v) to make a 45% (v/v) solution?
    a. 533 mL
    b. 667 mL
    c. 830 mL
    d. 1733 mL

81. Which of the following is a potassium-sparing diuretic?
    a. Chlorthalidone
    b. Furosemide
    c. Hydrochlorothiazide
    d. Spironolactone

82. What is the basic unit of measurement of weight in the metric system?
    a. Gram
    b. Kilogram
    c. Microgram
    d. Milligram

83. Which of the following online clinical monitoring can be performed because of automation?
    a. Drug–disease, drug–drug, drug–food, and drug–laboratory test interactions
    b. IV incompatibilities
    c. Therapeutic duplication
    d. All of the above

84. Which of the following managed care organizations provides patients with the most options and therefore have higher out-of-pocket expenses?
    a. HMO
    b. Medicare
    c. Medicaid
    d. PPO

85. Which DEA Form is used to request official order form, DEA Form 222?
    a. DEA Form 41
    b. DEA Form 106
    c. DEA Form 224
    d. DEA Form 363

86. Which document permits items to be purchased from a vendor?
    a. Invoice
    b. Packing slip
    c. Purchase order
    d. Statement

87. When does a "code blue" occur?
    a. When a patient is having a heart attack
    b. When a patient stops breathing
    c. A and B
    d. None of the above

88. Which of the following pharmacy abbreviations can be mistaken with "ou"?
    a. od
    b. os
    c. u
    d. Both a and b

89. Which of the following is NOT required on a patient's medication profile?
    a. Medication name and strength
    b. Patient's demographics
    c. Route of administration for each medication the patient is receiving
    d. Start date of the medication

90. Which of the following would be an example of biometrics being used in the pharmacy?
    a. Assigning an personal id to access the computer system
    b. Assigning a key to the pharmacy
    c. Scanning an individual's hand to access the pharmacy
    d. All of the above

91. Which of the following medications is limited to a 30-day supply with no refills?
    a. Isotretinoin
    b. Imitrex
    c. Insulin
    d. Viagra

92. Which gland influences water balance, body temperature, appetite, and emotions?
    a. Hypothalamus
    b. Pancreas
    c. Thymus
    d. Thyroid

93. Which of the following is the proper order of garbing in the anteroom?
    a. Shoes or shoe covers, head and facial hair coverings, fingernail cleansing, hand and forearm washing and drying, nonshedding gown, and face mask
    b. Shoes or shoe covers, head and facial hair coverings, face mask, fingernail cleansing, hand and forearm washing and drying, and nonshedding gown
    c. Shoes or shoe covers, head and facial hair coverings, fingernail cleansing, face mask, hand and forearm washing and drying, and nonshedding gown
    d. There is no particular order.

94. Which of the following is a cause for a medication error?
    a. Asking the pharmacist if you a have a question while filling a prescription
    b. Checking the prescription label with the medication bottle
    c. Failure to follow standard operating procedures for the pharmacy
    d. Verifying the patient's information with the patient

95. What is the purpose of a group purchasing organization?
    a. Negotiates prices for hospital pharmacies
    b. Purchases medications for hospital pharmacies
    c. Purchases medications for community pharmacies
    d. Purchases medications for managed care pharmacies

96. Which of the following is an Internet-accessible database that hospitals and health care systems can use to report medication errors?
    a. ISMP
    b. MEDMARX
    c. MedWatch
    d. NCC MERP

97. Which of the following is NOT an antiviral agent?
    a. Acyclovir
    b. Clotrimazole
    c. Didanosine
    d. Zidovudine

98. How much 1% boric acid solution and 5% boric acid solution are needed to make 30 mL of 3% boric acid solution?
    a. 5%:20 mL; 1%:10 mL
    b. 5%:5 mL; 1%:15 mL
    c. 5%:10 mL; 1%:20 mL
    d. 5%:5 mL; 1%:25 mL

99. What does the word root *cardio* mean?
    a. Heart
    b. Lungs
    c. Skin
    d. Stomach

100. Under the Bloodborne Pathogen Standard, how often should safety equipment be evaluated?
    a. Annually
    b. Every 6 months
    c. Every 5 years
    d. Does NOT state

PRACTICE EXAMINATION VI

1. What part of Medicare reimburses a retail pharmacy for prescription medications?
    a. Part A
    b. Part B
    c. Part C
    d. Part D

2. What type of interaction occurs when a patient takes tetracycline with milk?
    a. Adverse effect
    b. Drug–drug
    c. Drug–food
    d. Synergistic

3. At what standard time would a patient receive a medication if the military time was 1800 hours?
    a. Midnight
    b. 8 AM
    c. 6 PM
    d. 8 PM

4. Which of the following is NOT used to treat gastrointestinal problems?
    a. Antacids
    b. H_2 receptor agonists
    c. H_2 receptor antagonists
    d. Proton pump inhibitors

5. How many minutes should a pharmacy be allowed to deliver a "stat" order?
    a. 5 to 15 minutes
    b. 5 to 30 minutes
    c. 30 to 45 minutes
    d. 45 to 60 minutes

6. An IV order calls for the addition of 45 mEq of $CaCO_3$ (calcium carbonate). You have a 25-mL vial of calcium carbonate 4.4 mEq/mL. How many milliliters of this concentration do you need to add to this IV solution?
    a. 5.6 mL
    b. 8.4 mL
    c. 10.2 mL
    d. 12.8 mL

7. In whose name is an insurance policy is held?
    a. Beneficiary
    b. Dependent
    c. Subscriber
    d. Patient

8. The medications Diovan HCT, Dyazide, Hyzaar, and Zestoretic are combination products used in the treatment of cardiovascular disease. Which medication is found in all of them?
    a. Hydrochlorothiazide
    b. Lisinopril
    c. Triamterene
    d. Valsartan

9. Which of the following pieces of information is required on a medication order for a patient in a hospital but NOT for a prescription being filled at a retail pharmacy?
   a. Medical record number
   b. Patient's name
   c. Physician's name
   d. Name and strength of medication

10. What does MDI mean?
   a. Medical diagnosis included
   b. Medical doctor under investigation
   c. Metered-dose inhaler
   d. Multidose inhaler

11. Who licenses pharmacists in each state?
   a. DEA
   b. FDA
   c. Federal government
   d. State board of pharmacy

12. A pharmacy wants to mark up a product by 30%. How much would an item with this markup cost if its original cost was $4.50?
   a. $5.85
   b. $6.23
   c. $6.40
   d. $7.10

13. What piece of equipment reduces the risk of contamination when IV admixtures are prepared?
   a. Foot pedal sinks
   b. Humidifiers
   c. Laminar flow hoods
   d. Ultraviolet lighting

14. What type of dosage form is prepared using the "punch method"?
   a. Capsules
   b. Emulsions
   c. Suppositories
   d. Tablets

15. How many 2-tsp doses can be prepared from 1 L of a solution?
   a. 50
   b. 100
   c. 500
   d. 1000

16. What is the role of the DEA?
   a. Accepting NDAs from manufacturers
   b. Enforcing the Controlled Substances Act of 1970
   c. Licensing pharmacists
   d. Overseeing the MedWatch program

17. Which of the following drugs is NOT a macrolide?
   a. Azithromycin
   b. Clarithromycin
   c. Doxycycline
   d. Erythromycin–sulfisoxazole

18. Which term on a prescription is an instruction to the pharmacist?
   a. Inscription
   b. Rx
   c. Signa
   d. Subscription

19. What type of formulary is a limited list of drugs?
   a. Closed formulary
   b. Open formulary
   c. Restricted formulary
   d. None of the above

20. Which method of administration is used to provide medication to an unconscious patient?
   a. Inunction
   b. Inhalation
   c. Parenteral
   d. Peroral

21. A patient has been ordered Phenobarbital ½ gr; how many 15-mg tablets should the patient receive?
   a. 1
   b. 2
   c. 3
   d. 4

22. Who may accept new prescriptions phoned in from a physician's office according to federal law?
   a. Pharmacists
   b. Pharmacy aides
   c. Pharmacy clerks
   d. Pharmacy technicians

23. Why are amber vials used to package medications?
   a. To clearly identify oral products from topical products
   b. To prevent an individual from identifying a medication
   c. To prevent moisture from getting inside the container
   d. To protect the medication from ultraviolet light and possible degradation

24. Which law is being violated if an employer discriminates against a potential employee because of medical reasons that would NOT prevent him or her from properly performing the job?
    a. ADA
    b. Any Willing Provider
    c. OSHA
    d. Prescription Drug Equity Act

25. What is the generic name for Depakote?
    a. Divalproex
    b. Gabapentin
    c. Primidone
    d. Valproic acid

26. What is the minimum weighable quantity for a class A balance?
    a. 120 mg
    b. 150 mg
    c. 250 mg
    d. 500 mg

27. Which formula for calculating a child's dose is the most accurate?
    a. Body surface area
    b. Clark's rule
    c. Fried's rule
    d. Young's rule

28. What type of copayment is a different dollar amount based on the type of drug being dispensed?
    a. Fixed copayment
    b. Percentage copayment
    c. Variable copayment
    d. None of the above

29. Which of the following provides regulations for compounding sterile preparations?
    a. Pure Food and Drug Act
    b. Food, Drug, and Cosmetic Act
    c. MSDS
    d. USP 797

30. Which of the following is required to appear on a repackaged drug label?
    a. Drug strength
    b. Expiration date assigned at time of repackaging
    c. Manufacturer's name
    d. All of the above

31. Which of the following would be appropriate directions for Ambien?
    a. i tab PO q am
    b. i tab PO q hs
    c. i tab sl q hs
    d. i tab PO tid prn anxiety

32. What does the computer insurance error message "patient not found" or "invalid ID number" indicate?
    a. The customer is not a legitimate patient.
    b. The medication is not covered under the plan.
    c. The patient does not appear to be enrolled in the insurance program.
    d. The patient's condition is not covered under the prescription plan.

33. Which of the following medications should be prepared in a biologic safety cabinet?
    a. Etoposide
    b. IV solution containing insulin
    c. IV solution of gentamicin
    d. Skin cream

34. What is the maximum number of tablets that can be taken in 1 day with the directions "1–2 tabs PO q4-6h prn pain"?
    a. 4 tablets
    b. 6 tablets
    c. 8 tablets
    d. 12 tablets

35. Which of the following is NOT required on a prescription label?
    a. Name and address of the pharmacy
    b. Name of the prescriber
    c. Serial number of the prescription
    d. Telephone number of the patient

36. Which of the following is an indication of Zofran?
    a. Constipation
    b. Diarrhea
    c. Migraine headache
    d. Nausea and vomiting

37. Which of the following suffixes designates that a drug is a calcium channel blocker?
    a. -dipine
    b. -mycin
    c. -olone
    d. -pril

38. What is the infusion rate in milliliters per hour if a total of 500 mL is infused over 4 hours?
    a. 100 mL/hr
    b. 125 mL/hr
    c. 500 mL/hr
    d. 2000 mL/hr

39. Which of the following statements is false regarding the Isotretinoin Safety and Risk Management Act of 2004?
    a. Women are required to have monthly pregnancy tests.
    b. Patients are required to undergo monthly education regarding the medication.
    c. Prescriptions can be written for a 90-day supply.
    d. Prescriptions cannot be telephoned to the pharmacy from the physician's office.

40. A 180-lb man is to receive 1.75 mg of tobramycin per kilogram per day. The pharmacy technician is to prepare the tobramycin in 100 mL of D5W, and it is to be given three times per day. The drug is available in a 40-mg/mL vial and is to be administered over 30 min. How much medication will the patient receive each day?
    a. 48 mg
    b. 96 mg
    c. 143 mg
    d. 315 mg

41. Which of the following terms does NOT mean a "proprietary" drug?
    a. Brand
    b. Generic
    c. Patented
    d. Trade

42. How many days will the following prescription last?
    Ampicillin 250 mg #40
    1 cap PO qid
    Ref × ii
    a. 4
    b. 10
    c. 20
    d. 30

43. What does the term "pc" mean?
    a. After meals
    b. As needed
    c. Before meals
    d. By mouth

44. Where would meperidine be stored in the pharmacy?
    a. In the refrigerator
    b. In the pharmacy safe
    c. With the "fast movers"
    d. With the pills and tablets

45. Convert 10° Celsius to degrees Fahrenheit.
    a. −12° F
    b. 32° F
    c. 42° F
    d. 50° F

46. In this formula, how much talc is needed to fill 120 g of the compound?

Nupercainal ointment	4%
Zinc oxide	20%
Talc	2%

    a. 1200 mg
    b. 1500 mg
    c. 2400 mg
    d. 120 g

47. What type of documentation does OSHA require for pharmacies that handle hazardous chemicals?
    a. Manufacturer Safety Documentation Sheets
    b. Manufacturer Sheets for Documentation of Safety
    c. Safety Data Sheet (SDS)
    d. Mixture Safety Documentation Sheets

48. What is the meaning of "qid" on a prescription?
    a. Once a day
    b. Twice a day
    c. Three times a day
    d. Four times a day

49. Which of the following is an antidote for an overdose of heparin?
    a. Coumadin
    b. Enoxaparin
    c. Phytonadione
    d. Protamine sulfate

50. Where should a patient store a prescription of liquid amoxicillin suspension?
    a. In a bathroom vanity
    b. In a kitchen cupboard
    c. In the refrigerator
    d. Does not matter where it is stored

51. What components would be found in total nutrient admixture?
    a. Amino acids, dextrose, and lipids
    b. Amino acids, dextrose, and proteins
    c. Amino acids, dextrose, and vitamins
    d. Amino acids, dextrose, minerals, and vitamins

52. Who develops the formulary for a hospital?
    a. Board of directors of the hospital
    b. FDA
    c. GPO
    d. P&T committee

53. What does "qsad" mean on a prescription?
    a. A sufficient quantity
    b. A sufficient quantity for the right ear
    c. A sufficient quantity to make
    d. To make for the right ear

54. How long must controlled substance records be retained according to federal law?
    a. 6 months
    b. 1 year
    c. 2 years
    d. 7 years

55. How much gentian violet is in 100 mL of a 1:10,000 solution?
    a. 0.01 mg
    b. 10 mg
    c. 0.01 g
    d. 10 g

56. What type of drug classification ends in *-pril*?
    a. ACE inhibitors
    b. Benzodiazepines
    c. Corticosteroids
    d. H_2 antagonists

57. Which pharmacy law clearly defined adulteration and misbranding?
    a. Pure Drug Act of 1906
    b. Food, Drug, and Cosmetic Act of 1938
    c. Durham-Humphrey Amendment
    d. Poison Control Act of 1970

58. A manufacturer's invoice totals $500.00 with the terms 3% net. How much should be remitted to the manufacturer if it is paid in 30 days?
    a. $15.00
    b. $150.00
    c. $485.00
    d. $500.00

59. What is the maximum day's supply a pharmacy benefit manager will reimburse a retail pharmacy?
    a. 15-day supply
    b. 30-day supply
    c. 60-day supply
    d. 90-day supply

60. What is the meaning of the word root *osteo*?
    a. Artery
    b. Bone
    c. Cell
    d. Muscle

61. Where should one place medication with the shortest expiration date?
    a. Behind the other stock
    b. In front of the other stock
    c. Return it to the drug manufacturer
    d. Any of the above

62. Which liquid form is a dispersion in which one liquid is dispersed in another immiscible liquid?
    a. Emulsion
    b. Lotion
    c. Ointment
    d. Suspension

63. Which of the following is NOT a characteristic of touch-screen technology?
    a. A stylus or pen can be used to touch the screen.
    b. Light pen systems are more accurate than finger systems.
    c. The technology senses the location of a finger as it nears or touches the screen.
    d. Touch-screen technology has high resolution.

64. What size container would you use in dispensing 240 mL of a liquid medication?
    a. 2 oz
    b. 4 oz
    c. 6 oz
    d. 8 oz

65. Which of the following is NOT found on a Master Formula Sheet used in compounding?
    a. Amount of ingredient needed
    b. Color of ingredient
    c. Manufacturer's lot number and expiration date
    d. Name of individual who weighed or measured ingredient

66. Which reference book is the official compendium of pharmaceutical products in the United States?
    a. *Facts and Comparisons*
    b. *Physicians' Desk Reference*
    c. *Remington's Pharmaceutical Sciences*
    d. *USP-NF*

67. Which of the following is NOT a disadvantage of an oral dosage form?
    a. Delayed onset of action
    b. Ease of administration
    c. First-pass metabolism
    d. Taste of medication

68. Which of the following would be the appropriate action to be taken by a pharmacy technician when a filling label indicates a prescription error?
    a. Check the label against the original prescription or medication order to determine if an error was made.
    b. Contact the physician to verify the order.
    c. Correct the error.
    d. Inform the pharmacist of the possible error.

69. In which of the following environments should a sterile product be compounded?
    a. Class 25 environment
    b. Class 50 environment
    c. Class 75 environment
    d. Class 100 environment

70. What term refers to where a list of drugs, devices, or supplies that need to be reordered are written down?
    a. Formulary
    b. *Orange Book*
    c. *Red Book*
    d. Want book

71. Which of the following limits access to a computer system?
    a. CPU
    b. Hardware
    c. Password
    d. Software

72. Which of the following statements about pharmacy automation is false?
    a. Automation can change the scope of a pharmacy technician's responsibilities.
    b. Automation can improve the quality of work.
    c. Automation increases the potential for errors.
    d. Automation requires informed, educated operators.

73. An IV solution is to be infused over a 12-hour period. The total exact volume is 800 mL. What would be the infusion rate?
    a. 0.56 mL/min
    b. 1.11 mL/min
    c. 2.7 mL/min
    d. None of the above

74. What is the route of administration for heparin?
    a. IA
    b. IM
    c. IV
    d. Oral

75. What is the purpose of quality assurance programs?
    a. Document causes of errors and implement programs to reduce them
    b. Punish individuals for making errors
    c. Provide a service to customers
    d. Provide additional responsibilities for pharmacy technicians

76. Which organization developed the following initiatives: leadership process and accountability, competent and capable workforce, safe environment for staff and patients, clinical care of patients, and improving quality and safety?
    a. FDA
    b. ISMP
    c. OSHA
    d. TJC

77. Which of the following contributes to the highest percentage of medication errors?
    a. Communication
    b. Computer entry
    c. Documentation
    d. Performance deficit

78. What advice should NOT be given to a patient taking penicillin products?
    a. Do NOT take with juices or colas
    b. May cause drowsiness
    c. Take on an empty stomach
    d. Take with water

79. Which of the following is required by OBRA-90?
    a. Patient confidentiality
    b. Patient profiles
    c. Prescriptions from a veterinarian for animals
    d. Prohibiting the dispensing of professional samples from a pharmacy

80. What does the word root *derm* mean?
    a. Brain
    b. Skin
    c. Skull
    d. Tooth

81. Which of the following is/are a false statement(s) regarding continuous quality improvement (CQI)?
    a. CQI focuses on people.
    b. CQI permits decisions to be made on the basis of objective data.
    c. CQI is a scientific/systemic approach to quality.
    d. Both b and c are false.

82. Which of the following are examples of protected health information?
    a. Patient's diagnosis
    b. Patient's medical record number
    c. Patient's name
    d. All of the above

83. An intravenous solution containing 20,000 units of heparin in 500 mL of a 0.45% sodium chloride solution is to be infused at a rate of 1000 units/hr. How many drops per minute should be infused to deliver the desired dose if the intravenous set is calibrated at a rate of 15 gtt/mL?
    a. 0.42 gtt/min
    b. 6 gtt/min
    c. 16 gtt/min
    d. 32 gtt/min

84. Which classification of drugs has interactions with many foods and OTC products?
    a. MAOIs
    b. MOAs
    c. SSRIs
    d. TCAs

85. Which device transfers information from one computer to another through telephone lines?
    a. Bar code
    b. CPU
    c. Modem
    d. Scanner

86. Which of the following are the two major means for pharmacy reimbursement for prescriptions?
    a. Capitation and copayments
    b. Capitation and fee for service
    c. Copayments and deductibles
    d. Copayments and POS

87. Which of the following automation devices is/are used to prepare hyperalimentation solutions?
    a. MicroMix
    b. Robot Rx
    c. SureMed
    d. All of the above

88. Which of the following may result in unexpected medication shortages in the pharmacy?
    a. Changes in prescribing habits of physicians
    b. Drug manufacturer shortages
    c. Increased need for seasonal medications
    d. All of the above

89. Which of the following situations would require a HEPA filter to be recertified?
    a. Dusted
    b. Dry
    c. Wet
    d. All of the above

90. What type of medication requires a Safety Data Sheets (SDS) be provided to the purchaser?
    a. Hazardous chemicals and drugs
    b. Investigational drugs
    c. Intravenous drugs
    d. All of the above

91. Which organization reviews Investigational New Drug Applications?
    a. FDA
    b. ISMP
    c. TJC
    d. USP

92. Which federal law requires that all controlled substances bear the following legend: "Warning: may be habit forming"?
    a. Comprehensive Drug Abuse Prevention and Control Act
    b. Food, Drug and Cosmetic Act
    c. Harrison Narcotics Act
    d. Combat Methamphetamine Epidemic Act

93. What is the correct dosage for a 25-lb child if the adult dose is 100 mg?
    a. 7.6 mg
    b. 17 mg
    c. 68 mg
    d. 113 mg

94. What term refers to the failure to provide a reasonable amount of care to prevent injury?
    a. Abuse
    b. Dependence
    c. Malpractice
    d. Negligence

95. What type of mortar and pestle should be used in mixing liquid compounds?
    a. Glass
    b. Latex
    c. Porcelain
    d. Wedgwood

96. Which of the following automated dispensing devices would be found in a nursing unit?
    a. Baker cells
    b. Omni Link Rx
    c. Pyxis Medstation
    d. Safety Pak

97. Which of the following are included in the "administrative simplification" provision of the Health Insurance Portability and Accountability Act (HIPAA)?
    a. Electronic Health Transaction Standards
    b. Insurance premium standards
    c. Privacy and Confidentiality Standards
    d. Both a and c

98. Which organization requires that unit-dose be dispensed in a hospital?
    a. APHA
    b. ASHP
    c. FDA
    d. TJC

99 Which of the following products should NOT be chewed?
    a. Azatadine
    b. Azelastine
    c. Benzonatate
    d. Fexofenadine

100. What should a patient take for a headache if he or she is taking warfarin?
    a. APAP
    b. ASA
    c. Narcotic analgesics
    d. NSAIDs

PRACTICE EXAMINATION VII

1. How many teaspoon doses are in a pint of elixir?
    a. 24
    b. 48
    c. 72
    d. 96

2. Which organ would be affected if the root word *nephro* was indicated?
    a. Ear
    b. Heart
    c. Kidney
    d. Liver

3. How is insulin administered?
    a. ID
    b. IM
    c. PO
    d. SC

4. What is the correct interpretation of the following prescription: "1 tsp PCN 250 mg PO qid for 10 days"?
    a. Take one tablespoonful of penicillin 250 mg by mouth four times a day for 10 days.
    b. Take one teaspoonful of penicillin 250 mg by mouth every other day for 10 days.
    c. Take one teaspoonful of penicillin G 250 mg by mouth four times a day for 10 days.
    d. Take one teaspoonful of penicillin 250 mg by mouth four times a day for 10 days.

5. Which of the following drugs does NOT require blood work from a patient?
    a. Lithium
    b. Phenytoin
    c. Sulfasalazine
    d. Warfarin

6. Which reference book is a compilation of package inserts?
    a. *Drug Topics Red Book*
    b. *Facts and Comparisons*
    c. *Physicians' Desk Reference*
    d. *USP DI*

7. How much codeine is contained in one tablet of Tylenol #3?
    a. ¼ gr
    b. ½ gr
    c. ¾ gr
    d. 1 gr

8. What is the most common route of administration?
   a. Inhalation
   b. Inunction
   c. Oral
   d. Rectal

9. Which term encompasses the absorption, distribution, metabolism, and elimination of a drug?
   a. Pharmacokinetics
   b. Pharmacognosy
   c. Pharmacology
   d. Pharmacopeia

10. A pharmacy technician receives a medication order that requires him to add 40 units of insulin to an intravenous solution. How many milliliters will he need?
    a. 0.3 mL
    b. 0.4 mL
    c. 0.5 mL
    d. 0.6 mL

11. What is the meaning of URI?
    a. Upper respiratory infection
    b. Urethral and rectal infection
    c. Urine receptacle infection
    d. Upper respiratory influenza

12. Which of the following is the strongest dose?
    a. NTG 1/100 gr
    b. NTG 1/150 gr
    c. NTG 1/200 gr
    d. NTG 1/400 gr

13. How many days would 40 capsules of a medication last if the directions were "i cap qid ac and hs"?
    a. 4 days
    b. 8 days
    c. 10 days
    d. None of the above

14. Which of the following drugs will produce an adverse effect if alcohol is consumed during the course of therapy?
    a. Disulfiram
    b. Guaifenesin
    c. Hydrochlorothiazide
    d. Triamcinolone

15. Which of the following drugs is NOT a quinolone medication?
    a. Ciprofloxacin
    b. Norflex
    c. Norfloxacin
    d. Floxin

16. How many milliliters of a 1:50 (w/v) stock solution can be prepared from 1 pint of a 5% stock solution?
    a. 96 mL
    b. 192 mL
    c. 720 mL
    d. 1200 mL

17. Which of the following drugs would use "pulse dosing"?
    a. Clotrimazole
    b. Fluconazole
    c. Itraconazole
    d. Ketoconazole

18. What is the meaning of the abbreviation BS?
    a. Blood sugar
    b. Blood in stools
    c. Body surface
    d. Bowel syndrome

19. Which of the following is true about generically equivalent drugs?
    a. Chemically different but are expected to produce the same therapeutic outcome and toxicity
    b. Chemically identical in strength, concentration, dosage form, and route of administration
    c. Contain different active ingredients
    d. Priced exactly the same as brand name drugs

20. Which of the following dosage forms bypasses the digestive system?
    a. Capsule
    b. Enteric-coated tablet
    c. Oral tablet
    d. Sublingual tablet

21. How many units of heparin are in 50 mL of 100,000 units/L?
    a. 50 units
    b. 500 units
    c. 5000 units
    d. 50,000 units

22. What is hypoglycemia?
    a. High blood pressure
    b. High blood sugar
    c. Low blood pressure
    d. Low blood sugar

23. Which of the following medications could be used as a prophylactic for migraines?
    a. Imitrex
    b. Inderal
    c. Ergotamine
    d. Stadol

24. How would a patient take a medication if the directions read "prn"?
    a. As directed
    b. As needed
    c. By mouth
    d. By rectum

25. Which pharmacy reference book contains drug costs?
    a. *Blue Book*
    b. *Orange Book*
    c. *Red Book*
    d. *White Book*

26. Which organization enforces the Poison Prevention Act?
    a. Centers for Medicare and Medicaid Services
    b. Consumer Products Safety Commission
    c. Drug Enforcement Administration
    d. Food and Drug Administration

27. Which of the following conditions would have symptoms of excessive fluid resulting in swollen legs and ankles?
    a. Congestive heart failure
    b. Coronary artery disease
    c. Dysrhythmia
    d. Hyperlipidemia

28. What disease may result in the formation of a goiter?
    a. Cancer
    b. Hypertension
    c. Hypoglycemia
    d. Hyperthyroidism

29. Which of the following is a disadvantage of a robotic cart filling system?
    a. Bar coding aids in identifying the patient
    b. Improved inventory control
    c. Removal of expired medications before they have expired
    d. Special packaging and equipment

30. How many pairs of gloves should be worn when handling antineoplastic agents?
    a. Gloves do not need to be worn by either pharmacists or pharmacy technicians
    b. One pair of gloves
    c. Pharmacy technicians are not permitted to handle antineoplastic agents
    d. Two pair of gloves

31. What is the meaning of the prefix *intra-*?
    a. Below
    b. Between
    c. Equal
    d. Within

32. Which of the following is NOT a goal for security of protected health information?
    a. Ensuring the integrity of the information
    b. Ensuring the availability of the information to the correct in a timely manner
    c. Maintaining patient confidentiality
    d. Protecting the informational privacy of patient-related data

33. What is the automatic stop date for antibiotics?
    a. One week
    b. Two weeks
    c. Three weeks
    d. Four weeks

34. A mother is waiting for an antibiotic prescription of amoxicillin suspension for her child and asks the pharmacy technician what she should give her child for a fever. What should the pharmacy technician do?
    a. Inform the pharmacist of the parent's question.
    b. Offer to call the physician for a prescription to reduce a child's fever.
    c. Recommend children's aspirin to the mother.
    d. Tell the mother to apply cold compresses to the child's forehead.

35. What is the meaning of the suffix *-ism*?
    a. Condition
    b. Process
    c. Specialist
    d. tumor

36. What is the minimum age to purchase pseudoephedrine?
    a. 12 years of age
    b. 14 years of age
    c. 16 years of age
    d. 18 years of age

37. What is an ongoing, systematic process for monitoring, evaluating, and improving the quality of pharmacy services?
    a. Peer review
    b. Pharmacy certification
    c. Process validation
    d. Quality assurance

38. Which of the following medications is NOT a bisphosphonate used to treat osteoporosis?
    a. Actonel
    b. Boniva
    c. Fosamax
    d. Miacalcin

39. Which type of fire extinguisher would be used to extinguish a fire caused by ordinary combustibles such as wood, cloth, and paper?
    a. Class A
    b. Class B
    c. Class C
    d. Class D

40. Which of the following drug classifications requires that a package insert be provided to the patient?
    a. Cephalosporin
    b. Estrogen
    c. Nonsteroidal antiinflammatory drug
    d. Proton pump inhibitor

41. Which piece of legislation requires that Safety Data Sheet (SDS) documents be provided to the purchaser for hazardous materials?
    a. Controlled Substance Act
    b. Pure Food and Drug Act
    c. Occupational Safety and Health Act
    d. Poison Prevention Act

42. Which of the following pieces of information is useful to verify that the correct medication has been selected from the shelf to fill a prescription?
    a. Brand or generic name on the stock bottle
    b. Drug name on the prescription
    c. NDC number
    d. All of the above

43. What term is used to define the desired action of a drug?
    a. Adverse effect
    b. Physiological effect
    c. Psychological effect
    d. Therapeutic effect

44. Which of the following is true about a flexible spending account?
    a. The employee is required to pay a copay for provider services.
    b. An employee is able to set aside tax-deductible pay that may be used for medical expenses in a calendar year.
    c. The patient is required to pay for out-of-pocket services and submit documentation for reimbursement.
    d. The patient is required to pay an annual fee to participate in the program.

45. What part of the computer connects the computer to a remote network via telephone lines?
    a. CPU
    b. Modem
    c. RAM
    d. ROM

46. Which of the following pieces of legislation required that patient profiles be maintained for all patients?
    a. Food, Drug and Cosmetic Act
    b. OBRA '87
    c. OBRA '90
    d. Pure Food Act

47. What is the generic name for Glucophage?
    a. Glimepiride
    b. Glipizide
    c. Glyburide
    d. Metformin

48. What is a procedure?
    a. An established way of performing a task
    b. Options of doing something
    c. Rules of an organization
    d. All of the above

49. What type of a machine is a Pyxis?
    a. Automated dispensing machine
    b. Automated compounder
    c. Laminar flow workbench
    d. Prepares TPNs

50. Which piece of legislation requires that a medication be proven effective to the FDA before it may be marketed?
    a. Durham-Humphrey Amendment
    b. Kefauver-Harris Amendment
    c. Poison Prevention Act
    d. Omnibus Budget Reconciliation Act

51. Which of the following medications should be dispensed in its regular container to the patient?
    a. Crixivan
    b. Diflucan
    c. Epitol
    d. Singular

52. The dispensing fee for a prescription is $6.50. How much should the patient be charged for 50 tablets of a drug when the cost is $12.43 for 100 tablets?
    a. $6.22
    b. $7.12
    c. $9.47
    d. $12.72

53. Why would a pharmacy technician check the temperature of the refrigerator?
    a. To ensure medication is being stored at the correct temperature to avoid having unsaleable inventory
    b. State Board of Pharmacy Regulation
    c. USP 795 requirement
    d. USP 797 requirement

54. Which of the following should be checked when receiving an order from a wholesaler?
    a. Expiration date of drug product
    b. Name of drug product
    c. Drug product strength
    d. Drug cost

55. Which of the following is required by the body to produce thyroid hormone?
    a. Calcium
    b. Iodine
    c. Magnesium
    d. Sodium

56. What is the markup rate for a prescription that costs $35.00 and retails for $50.00?
    a. 30%
    b. 43%
    c. 57%
    d. 70%

57. What does a red C indicate on a prescription?
    a. The prescription has been canceled by the physician.
    b. The prescription has been copied and transferred to another pharmacy.
    c. The prescription has been processed by the pharmacy and has been picked up by the patient.
    d. The prescription is a controlled substance.

58. What does Syrup USP contain?
    a. Alcohol in water
    b. Oleaginous fluid in water
    c. PEG in water
    d. Sucrose in water

59. What type of company administers prescription drug benefits for covered individuals from many different insurance companies?
    a. Health maintenance organization
    b. Pharmacy benefit manager
    c. Point of service
    d. Preferred provider organization

60. Which of the following routes of administration produces its effect slowest?
    a. IM
    b. IV
    c. PO
    d. SL

61. What is the inventory turnover rate if a pharmacy purchases $500,000 of inventory a year and has an average inventory of $125,000?
    a. 0.25
    b. 0.33
    c. 3
    d. 4

62. Which of the following is NOT contained in a patient product insert?
    a. Drug indication
    b. Drug contraindication
    c. Drug precautions
    d. Drug cost

63. Which of the following is NOT an advantage of an inventory control systems?
    a. Calculates personnel expenditures
    b. Computes inventory costs
    c. Maintains records of purchases
    d. Tracks medication usage

64. What term refers to the price a pharmacy pays for a drug after all discounts and shipping costs have been applied?
    a. Actual acquisition cost (AAC)
    b. Average wholesale price (AWP)
    c. Discounted price
    d. First in, first out

65. Which of the following is NOT a benefit of paperless charting?
    a. Bedside terminals allow the nurse to be with the patient
    b. Beneficial for gathering data for audits
    c. Decreases the amount of time available for patient care
    d. Online availability of patients' medical record

66. What is the intent of the Orphan Drug Act?
    a. Ensures that all medications are pure, safe, and effective
    b. Establishes the usage of NDC numbers for all medications
    c. Establishes drug schedules for medication based upon an approved medical use in the United States and the potential for abuse
    d. Permits drug manufacturers to bypass lengthy testing to treat individuals with rare medical diseases

67. What term refers to appropriate standards of conduct within a profession?
    a. Ethics
    b. Morals
    c. Regulations
    d. Torts

68. What type of medication error occurs when a prescriber is not licensed in the state?
    a. Compliance drug error
    b. Monitoring drug error
    c. Prescribing error
    d. Unauthorized drug error

69. What type of medication error occurs but did not reach the patient?
    a. No error
    b. Error, no harm
    c. Error, harm
    d. Error, death

70. Which type of insulin can be added to an IV solution?
    a. Extended insulin zinc
    b. Isophane insulin
    c. NPH insulin
    d. Regular insulin

71. Which of the following is a source for medication?
    a. Animal
    b. Plant
    c. Synthetic
    d. All of the above

72. Which of the following should be done when a medication that has been ordered for a prescription is dispensed before the order has been checked?
    a. Always provide sufficient time for an order to be checked before providing the patient the time the prescription will be ready.
    b. Assume all medication has been delivered and remove the needed medication from the order.
    c. Have the patient wait until the order has been checked.
    d. Make a note the medication has been removed from the order and reconcile it when the order has been checked.

73. Who controls the electronic personal health record?
    a. Patient
    b. Physician
    c. Pharmacist
    d. Point of care

74. Which of the following is NOT an administration error?
    a. Ear medication placed in the eye
    b. Intravenous medication injected intramuscularly
    c. Patient forgot to take their medication
    d. Total parenteral nutrition administered intravenously

75. What type of solution is a total parenteral solution?
    a. Dialysis solution
    b. Hypotonic solution
    c. Hypertonic solution
    d. Isotonic solution

76. What factors should be considered when dealing with elderly patients?
    a. Auditory issues
    b. Chronic conditions
    c. Multiple medications
    d. All of the above

77. Which organization developed the terminology associated with storage temperatures?
    a. FDA
    b. ISMP
    c. USP
    d. TJC

78. Which of the following work lists could be generated by a pharmacy computer?
    a. Cart fill
    b. Cart fill pick
    c. IV fill
    d. All of the above

79. How often should a patient change his or her Catapres TTS patch?
    a. Once per day
    b. Every other day
    c. Weekly
    d. Monthly

80. Which of the following organizations certifies pharmacy technicians?
    a. ASHP
    b. NABP
    c. PTCB
    d. State board of pharmacy

81. What is the nonproprietary name for Deltasone?
    a. Lithium
    b. Methylprednisolone
    c. Prednisolone
    d. Prednisone

82. What is the purpose of an auxiliary label?
    a. To comply with OBRA-90
    b. To provide additional drug information to the patient
    c. To save time by NOT having the pharmacist counsel the patient
    d. To scare the patient

83. Which of the following is an advantage of an intravenous drug?
    a. They can be used by patients who are unable to take medication by mouth.
    b. They bypass the digestive tract.
    c. They produce a quick therapeutic effect.
    d. All of the above

84. Which piece of legislation established the National Drug Code (NDC)?
    a. Durham-Humphrey Amendment
    b. Drug Listing Act
    c. Food, Drug and Cosmetic Act
    d. OBRA '90

85. Which of the following is NOT an example of a patient-caused medication error?
    a. The patient did NOT receive the full quantity of medicine from the pharmacy.
    b. The patient forgot to take her medication last night.
    c. The patient took a medication 1 hour before a meal, and the label said to take it with food.
    d. The patient took antibiotics that were left over from an infection 6 months ago.

86. Which document must be signed when dispensing an Investigational New Drug?
    a. CSAR
    b. DAR
    c. MAR
    d. TAR

87. What do the last two numbers of a National Drug Code (NDC) number indicate?
    a. Drug manufacturer
    b. Drug product
    c. Drug package
    d. Drug quantity

88. What term is used to identify the area between the HEPA filter and the sterile product being compounded?
    a. Class I area
    b. Critical area
    c. Critical site
    d. Laminar area workbench

89. What term refers to the document describing a purchase made by the pharmacy and the amount due to the vendor?
    a. Invoice
    b. Packing slip
    c. Prime vendor agreement
    d. Purchase order

90. Which of the following is NOT true regarding hospital automation?
    a. Both centralized and decentralized automation make dispensing efficient.
    b. Dispensing automation may be centralized in the pharmacy or decentralized at the point of care.
    c. Decentralized automation is preferred over centralized automation.
    d. Some institutions use both centralized and decentralized automation to use the advantages of each.

91. How often must a pharmacy scale be certified?
    a. Every 6 months
    b. Every 12 months
    c. Every 18 months
    d. Every 24 months

92. Which of the following pieces of information is required on the label of intravenous admixture?
    a. Name and strength of medication
    b. Patient's name
    c. Prescriber's name
    d. All of the above

93. Which of the following information is not required for an institutional pharmacy?
    a. Medication files
    b. Payer and insurance information
    c. Physician information
    d. Prescriber information

94. According to the USP, how many CSP Microbial Contamination Risk Levels exist?
    a. Two
    b. Three
    c. Four
    d. Five

95. What is the duration of action for Humulin N insulin?
    a. 3 to 4 hours
    b. 4 to 6 hours
    c. 14 to 20 hours
    d. Up to 36 hours

96. What is the primary concern when compounding a sterile product?
    a. Cost
    b. Efficiency
    c. Product availability
    d. Safety

97. A solution of haloperidol contains 2 mg/mL of active ingredient. How many grams are in 1 pint of this solution?
    a. 0.0096 g
    b. 0.096 g
    c. 0.96 g
    d. 9.6 g

98. Which of the following drug classifications lowers blood pressure?
    a. Antihypertensive
    b. Antimanics
    c. Antipyretic
    d. Antitussive

99. Which of the following is an electrolyte that could be used in preparing a total parenteral nutrition product?
    a. Amino acids
    b. Dextrose
    c. Lipids
    d. Potassium chloride

100. Deficiency of which vitamin may result in scurvy?
    a. Vitamin A
    b. Vitamin B_1
    c. Vitamin C
    d. Vitamin D

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Appendix A

Pharmacy Technician Certification Examination Information

Certification is the process by which a nongovernmental association or agency grants recognition to an individual who has met certain predetermined qualifications specified by that association or agency. The goal of the certification program of the Pharmacy Technician Certification Board (PTCB) is to enable pharmacy technicians to work more effectively with pharmacists to offer greater patient care and service. The PTCB is responsible for the development and implementation of policies related to national certification for pharmacy technicians.

ELIGIBILITY

To achieve PTCB Certification, candidates must satisfy the following eligibility requirements:

- High school diploma or equivalent educational diploma (e.g., a GED or foreign diploma)
- Full disclosure of all criminal and state board of pharmacy (BOP) registration or licensure actions
- Compliance with all applicable PTCB Certification policies
- Passing score on the Pharmacy Technician Certification Exam (PTCE)

A candidate may be disqualified for PTCB Certification upon the disclosure or discovery of:

- Criminal conduct involving the candidate
- State BOP registration or licensure action involving the candidate
- Violation of a PTCB Certification policy, including but not limited to the Code of Conduct

PTCB reserves the right to investigate criminal background, verify candidate eligibility, and deny certification to any individual.

After being certified, certified pharmacy technicians (CPhTs) must report any felony conviction, drug- or pharmacy-related violations, or state BOP action taken against their licenses or registrations at the occurrence and at the time of recertification to the PTCB for review. Disqualification determinations are made on a case-by-case basis.

CERTIFICATION

There are two parts to being a CPhT. First, pharmacy technicians must sit for and pass the national PTCE. After a pharmacy technician has passed the examination, he or she may use the designation "CPhT." Second, to continue to hold certification, a CPhT is required to obtain 20 hours of continuing education (CE) for recertification within 2 years of original certification or previous recertification. For more information regarding certification, visit the PTCB's website (www.ptcb.org).

SPECIAL ACCOMMODATIONS

Candidates who require testing accommodations must request special accommodations during the application process. Accommodations that are reasonable and consistent with the Americans with Disabilities Act (ADA) will be provided by the PTCB at no additional cost to candidates. Candidates who need to bring medical equipment into the testing room need to request an accommodation if the item is not on the list of allowed items.

NONDISCRIMINATION

The PTCB does not discriminate against any individual because of race, gender, age, religion, sexual orientation, disability, veteran status, or national origin in administering its certification policies. The PTCB endorses the principles of equal opportunity.

COST OF THE EXAMINATION

The cost of the PTCB Examination is $129.

PASSING SCORE

The passing score and all candidate results are reported as scaled scores. The passing scaled score for the PTCE is 650. The range of possible PTCE scores is 300 to 900.

SCALED SCORES AND EQUATING

The use of scaled scores is necessary because different forms of the PTCE are administered every year, and these forms may fluctuate slightly in difficulty. The PTCB uses multiple forms containing different items to minimize item exposure and ensure the continuing relevance of test items. To ensure that the results of candidates taking two different forms are equivalent, the PTCB uses a process known as statistical equating. Statistical equating is a process by which scores on different forms of the PTCE are calibrated onto a common scale. Equating ensures that candidates of comparable proficiency will be likely to obtain approximately the same scaled scores regardless of fluctuations in the overall difficulty level from one examination form to another.

SCHEDULE THE EXAM

AUTHORIZATION PERIOD

After an application is approved, candidates will be authorized to schedule and take the PTCE. The authorization to schedule lasts for 90 days. A candidate who is unable to take the exam during this period must withdraw his or her application to avoid forfeiting the application fee.

SCHEDULING

Candidates may schedule exam appointments online or call Pearson VUE at 866-902-0593. The PTCE is administered at more than 235 Pearson VUE test centers nationwide and DANTES military test centers.* After you have scheduled an appointment, an e-mail confirmation will be sent to you within approximately 24 hours. Candidates with approved testing accommodations must call 800-466-0450 to schedule exam appointments.

CANCELING AND RESCHEDULING

There is no charge to cancel or reschedule an exam appointment. However, appointments must be canceled or rescheduled at least one business day (24 hours) before the scheduled appointment. For example, if an appointment is scheduled for 11:00 AM on Monday, it must be canceled or rescheduled by 11:00 AM the previous Friday. Candidates who fail to appear for their scheduled exam appointment will forfeit all fees. Canceling and rescheduling are handled directly with Pearson VUE.

MISSED APPOINTMENTS

Candidates who fail to appear for their scheduled exam appointment, arrive more than 30 minutes late, or do not present valid ID will forfeit all fees. If this occurs, candidates must reapply and pay the applicable fees.

WITHDRAWING AN APPLICATION

Candidates who are unable to test within the 90-day authorization period or simply wish to withdraw may do so from within their PTCB Account. Candidates with scheduled exam appointments must first cancel their appointments with Pearson VUE. Candidates who withdraw will receive a refund, less an administrative fee.

EMERGENCY WITHDRAWALS

Candidates who miss their exam appointments because of an emergency may submit a withdrawal request to PTCB. Examples of what PTCB considers an emergency include serious illness, injury, or unexpected hospitalization; death in the immediate family; serious accident; and court appearance. Please see the Candidate Guidebook for more information about emergency withdrawals.

CHANGES IN THE PTCB EXAMINATION IN 2013

The PTCB's most recent Job Analysis Study was completed in February 2012, with more than 25,000 pharmacy technicians from across the United States participating in the survey. The PTCB's Certification Council and Board of Governors reviewed the 2012 Job Analysis Study and approved a new blueprint for the PTCE. An exact date for implementing the new blueprint has not been established, but it is anticipated that the PTCE will reflect the new blueprint starting in the latter half of 2013. Note that no changes are planned to the length of the PTCE

*For military personnel and qualifying dependents.

(90 items across 1 hour and 50 minutes) or type of questions (multiple choice).

PTCE BLUEPRINT

The most noticeable change in the new blueprint is the way in which content is organized. The current blueprint distributes exam content into three functional areas, giving it a task focus, as shown in the following table. Each functional area has a series of knowledge statements associated with it.

CURRENT PTCE BLUEPRINT FUNCTIONAL AREAS

FUNCTIONAL AREAS	FUNCTIONAL AREA DESCRIPTION	% OF PTCE CONTENT	KNOWLEDGE STATEMENTS
I	Assisting the Pharmacist in Serving Patients	66	84
II	Maintaining Medication and Inventory Control Systems	22	26
III	Participating in the Administration and Management of Pharmacy Practice	12	38

The new blueprint organizes content into nine knowledge domains, called "knowledge areas" in the table below, each with a number of subdomains. This organization gives the new blueprint a knowledge focus and conveys more information about the type and relative amount of content in the exam.

NEW PTCE BLUEPRINT DOMAINS

KNOWLEDGE DOMAINS	DOMAIN DESCRIPTION	% OF PTCE CONTENT	KNOWLEDGE AREAS
1	Pharmacology for Technicians	13.75	6
2	Pharmacy Law and Regulations	12.50	15
3	Sterile and Non-sterile Compounding	8.75	7
4	Medication Safety	12.50	6
5	Pharmacy Quality Assurance	7.50	5
6	Medication Order Entry and Fill Process	17.50	7
7	Pharmacy Inventory Management	8.75	5
8	Pharmacy Billing and Reimbursement	8.75	5
9	Pharmacy Information Systems Usage and Application	10.00	2

The vast majority of knowledge statements in the current blueprint are covered by one or more of the knowledge areas in the new blueprint. By extension, this means that the new PTCE content will be very similar to what is covered in the current exam.

PREPARING FOR THE EXAMINATION

The national PTCE applies to all practice settings. In preparing for the national PTCE, familiarity with the material contained in any basic pharmacy technician training manuals or books may be helpful. Your supervising pharmacist may also be helpful in designing a study plan. The PTCB does not endorse, recommend, or sponsor any review course, manuals, or books for the PTCB examination.

The PTCB encourages pharmacy technicians to visit the "Exam Information" portion of the PTCB's website (www.ptcb.org). Candidates are able to access a full-length practice test, a list of texts used to assist in writing questions for the examination, and a "Useful Numbers" section that provides the contact numbers for publishers of examination study materials.

RECERTIFICATION

WHEN

CPhTs can apply for recertification beginning 100 days before the certification expiration date. Applications should be submitted at least 30 days before the expiration date (the "renew by" date) to ensure adequate time for processing. Example: If your certification expires on July 31, 2013, the earliest you can submit your recertification application is April 22, 2013. To allow adequate time for processing, the latest you should submit your application is July 1, 2013.

CPhTs are required to complete 20 hours of pharmacy-related CE (1 hour must be in medication safety) during each 2-year certification period. For more information regarding the recertification process, download a copy of *PTCB's Recertification Requirements and Guidelines.*

A maximum of 10 hours may be earned by completing in-service projects.

Pharmacy-related subject matter includes the following topics:

- Medication distribution
- Inventory control systems
- Mathematics
- Biology
- Pharmaceutical sciences
- Pharmacy law

- Pharmacology and drug therapy
- Roles and duties of pharmacy technicians

CPhTs must complete all CE hours within the 2-year recertification cycle (on or before the expiration date). No CE hours completed before certification is granted may be used to satisfy recertification requirements. CE hours can only be applied to the recertification cycle in which they are completed and cannot be carried over and applied to future cycles.

EXAMPLE CE PROVIDERS

- American Pharmacists Association
- American Society of Health-System Pharmacists
- Illinois Council of Health-System Pharmacists
- Michigan Pharmacists Association
- National Pharmacy Technician Association
- Pharmacy Technician's Letter
- Pharmacy Times
- Power-Pak C.E.
- RxSchool
- U.S. Pharmacist

CE DOCUMENTATION

CPhTs must maintain their own records of CE hours earned during each recertification period and are responsible for maintaining these records for at least 1 year after the certification cycle ends. Acceptable documentation of participation in a college course may be either a transcript or a grade report. For in-service projects or other CEs for which a certificate of participation is not available, the supervising pharmacist or instructor must complete the Universal CE Form.

NATIONAL HEALTHCAREER ASSOCIATION PHARMACY TECHNICIAN CERTIFICATION

The Pharmacy Technician Certification Program is accredited by the National Commission for Certifying Agencies (NCCA). Technicians who pass the (ExCPT) Pharmacy Exam are granted the title of CPhT. The program was established by the Institute for the Certification of Pharmacy Technicians (ICPT), which is now a part of the National Healthcareer Association (NHA). All content previously found on www.NationalTechExam.org is now available on www.nhanow.com.

REGISTERING FOR THE EXAMINATION

An individual who does not have a certification from the NHA must create a profile at www.nhanow.com/pharmacy-technician. The cost of the examination is $105.

TEST INFORMATION

EXAMINATION CONTENT

REGULATIONS AND TECHNICIAN DUTIES (25% OF EXAM)

1.1 Overview of technician duties and general information
- 1.1.1 The role of pharmacists and pharmacy technicians
- 1.1.2 Functions that a technician may and may not perform
- 1.1.3 Prescription department layout and workflow
- 1.1.4 Pharmacy security
- 1.1.5 Inventory control
- 1.1.6 Stocking medications
- 1.1.7 Identifying expired products

1.2 Controlled substances
- 1.2.1 Difference among the controlled substances schedules
- 1.2.2 Refills, partial refills, filing, and prescription transfers
- 1.2.3 Correct procedures for handling Schedule V sales
- 1.2.4 Controlled Substance Act
- 1.2.5 DEA numbers

1.3 Other laws and regulations
- 1.3.1 Federal privacy act
- 1.3.2 Generic substitution (including brand vs. generic products)
- 1.3.3 Professionals with prescribing authority (and acronyms)
- 1.3.4 Child-resistant packaging
- 1.3.5 Role of government agencies (e.g., BOP, DEA, FDA)
- 1.3.6 Manufacturer drug package labeling
- 1.3.7 Over-the-counter (OTC) package labeling

2.1 Drug classification (23% of exam)
- 2.1.1 Major drug classes (e.g., analgesics, anesthetics, antibiotics)
- 2.1.2 Dosage forms (types, characteristics, and uses)
- 2.1.3 OTC products
- 2.1.4 National Drug Code number

2.2 Most frequently prescribed medications
- 2.2.1 Brand and generic names
- 2.2.2 Basic mechanism of action (pharmacology) and drug classification
- 2.2.3 Primary indications
- 2.2.4 Common adverse drug reactions, interactions, and contraindications

3.1 Prescription information (52% of exam)
- 3.1.1 Information required on a valid prescription form
- 3.1.2 Telephoned and faxed prescriptions
- 3.1.3 Refill requirements

- 3.1.4 Patient information (e.g., age, gender)
- 3.1.5 Interpreting prescribers' directions for prescription labels
- 3.1.6 Recognizing and using common prescription abbreviations

3.2 Preparing and dispensing prescriptions
- 3.2.1 Avoiding errors (e.g., sound-alike, look-alike names)
- 3.2.2 Systems for checking prescriptions
- 3.2.3 Automated dispensing systems (including quality control)
- 3.2.4 Procedures for preparing prescriptions and data entry
- 3.2.5 Labeling prescriptions properly
- 3.2.6 The purpose and use of patient records
- 3.2.7 Proper packaging and storage
- 3.2.8 Managed care prescriptions

3.3 Calculations
- 3.3.1 Conversions and systems of measurement used in pharmacy
- 3.3.2 Calculating the amounts of prescription ingredients
- 3.3.3 Calculating quantity or days supply to be dispensed
- 3.3.4 Calculating individual and daily doses
- 3.3.5 Calculations used in compounding
- 3.3.6 Calculating dosages and administration rates for intravenous lines
- 3.3.7 Business calculations (pricing, markup, inventory control)

3.4 Sterile products, unit dose and repackaging
- 3.4.1 Drug distribution systems used in hospitals and nursing homes
- 3.4.2 Procedures for repackaging medications
- 3.4.3 Prescription compliance aids
- 3.4.4 Aseptic technique and the use of laminar flow hoods
- 3.4.5 Special procedures for chemotherapy
- 3.4.6 Routes of administration for parenteral products
- 3.4.7 Types of sterile products
- 3.4.8 Correct procedures for maintaining the sterile product environment
- 3.4.9 Accurate compounding and labeling of sterile product prescriptions

TEST PREPARATION

Candidates are strongly encouraged to prepare for the exam in advance.

TAKING THE EXAMINATION

The ExCPT is a secure, computer-based exam offered during business hours and some evenings and weekends at one of the PSI/LaserGrade Testing Centers located throughout the United States. Candidates may register by completing preregistration on the website followed by calling PSI/LaserGrade's toll-free number (800-733-9267) to arrange a date, time, and location. Candidate identification is verified at the PSI/LaserGrade Testing Center at the time of the test.

Candidates have 2 hours to answer 110 multiple-choice questions. Each question has four choices. One question is presented on the screen at a time. Candidates may mark the answers or they can skip questions and come back later. Final answers are submitted when the candidate indicates that he or she is finished.

The exam is graded by the PSI/LaserGrade computer system, and the candidate is given results immediately.

TESTING CENTERS

PSI/LaserGrade is a computer-based public testing network with headquarters in Burbank, California, and Vancouver, Washington, and can be found on the Internet at http://candidate.psiexams.com. The PSI network consists of secure and supervised testing centers located throughout North America and overseas at colleges, training schools, and certification-related locations.

IDENTIFICATION REQUIRED

To take the exam at a PSI/LaserGrade Testing Center, candidates are required to present government-issued photo identification, such as a valid passport, driver's license, U.S. Armed Forces photo identification or a nondriver's identification issued by a state department of motor vehicles. The identification must be clear and legible. The name on the photo identification must be the same as on the original registration. If the names are different, then a certified or notarized copy of a marriage license, divorce decree, adoption papers, or other legal documentation of name change should be provided. If the address on the government-issued photo identification is different from that supplied at the time of registration, the candidate must show proof of address, such as a current utility bill.

SCORING EXAMS AND REPORTING RESULTS

The exam is scored immediately, and successful candidates are given an official report by PSI/LaserGrade indicating that they passed the ExCPT immediately upon completion. Candidates may use this report to

provide evidence to employers or regulatory boards that they passed.

CPhT RECERTIFICATION

The purpose of recertification is to promote high standards of practice for pharmacy technicians and to encourage their participation in CE to promote safe and effective patient care. Recertification also provides a means for recognizing pharmacy technicians who continue to demonstrate their qualifications by complying with CE requirements and adhering to high professional standards.

RECERTIFICATION REQUIREMENTS

During the 2-year period before recertification, CPhTs must participate in at least 20 hours of (CE, including at least 1 hour of pharmacy law). Additional CE credits earned cannot be carried over to the next recertification period.

Acceptable topics include but are not limited to:

- Drug distribution
- Managed health care
- Therapeutic issues
- Communications
- Pharmacy operations
- Calculations
- Drug repackaging
- Inventory control
- Drug products
- Patient interaction
- Interpersonal skills
- Prescription compounding
- Pharmacy law (at least 1 hour required)

The NHA reserves the right to reject credits not deemed applicable to pharmacy technician practice.

Certified technicians may recertify up to 90 days after expiration of their certification, but are not allowed to include CE credit earned during this grace period. After this 90-day grace period, technicians will lose their certification status. Certified technicians who fail to recertify on time may be able to have their certification reinstated within 12 months of their expiration date.

Appendix B

Drug Nomenclature: Stems Used by the U.S. Adopted Names Council

STEM EXAMPLE	DEFINITION
-ac	Antiinflammatory
-actide	Synthetic corticotropin
-adol or -adol-	Analgesic
-adox	Quinolone antibacterial
-aj-	Antiarrhythmic
-aldrate	Antacid aluminum salt
-alol	Combined alpha- and beta-blocker
-amivir	Neuraminidase inhibitor
-andr-	Androgen
-anserin	Serotonin 5-HT receptor antagonist
-antel	Antihelmintic
-arabine	Antineoplastic
-aril, -aril-	Antiviral
-arit	Antirheumatic
-arol	Anticoagulant
-arot-	Arotinoid
arte-	Antimalarial
-ase	Enzyme
-ast	Antiasthmatic
-astine	Antihistamine
-atadine	Tricyclic antiasthmatic
-azenil	Benzodiazepine receptor agonist or antagonist
-azepam	Antianxiety
-azepide	Cholecystokinin
-azocine	Narcotic antagonist
-azoline	Antihistamine or local vasoconstrictor
-azosin	Antihypertensive
-bactam	β-Lactamase inhibitor
-bamate	Tranquilizer
-barb or -barb-	Barbituric acid derivative
-bendazole	Antihelmintic
bol- or -bol-	Anabolic steroid
-butazone	Antiinflammatory
-caine	Local anesthetic
calci- or -calci-	Vitamin D analog
-camsule	Camphor sulfonic acid derivative
-carbef	Carbacephem antibiotic
cef-	Cephalosporin
-cept	Receptor

Continued

STEM EXAMPLE	DEFINITION
-cic	Hepatoprotective
-cidin	Natural antibiotic
-cillin	Penicillin
-citabrine	Nucleoside antiviral or antineoplastic
-clidine	Muscarinic agonist
-clone	Hypnotic tranquilizer
-cog	Blood coagulation factor
-conazole	Systemic antifungal
-cort-	Cortisone derivative
-crinat	Diuretic
-crine	Acridine derivative
-cromil	Antiallergic
-curium	Neuromuscular blocking agent
-cycline	Tetracycline antibiotic
-dan	Positive isotropic agent
-dapsone	Antimicrobacterial
-dar	Multidrug inhibitor
-dil, dil-, or -dil-	Vasodilator
-dipine	Phenylpyridine
-dismase	Superoxide dismutase activity
-ditan	Antimigraine 5-HT receptor agonist
-dopa	Dopamine receptor agonist
-dralazine	Antihypertensive
-dronate	Calcium metabolism receptor
-ectin	Antiparasitic
-entan	Endothelin receptor antagonist
-erg-	Ergot alkaloid derivative
-eridine	Analgesic
-ermin	Growth factor
estr- or -estr-	Estrogen
-etanide	Diuretic
-ezolid	Oxazolidinone antibacterial
-fenamate	Fenamic acid ester or salt
-fenin	Diagnostic aid
-fenine	Analgesic
-fentanil	Narcotic analgesic
-fiban	Fibrinogen receptor antagonist
-fibrate	Clofibrate-type compound
-filcon	Hydrophilic contact lens material
-fingol	Sphingosine
-flapon	5-Lipoxygenase activating protein inhibitor
-flurane	General inhalation anesthetic
-focon	Hydrophobic contact lens material
-formin	Oral hypoglycemic agent
-fradil	Calcium channel blocker
-fungin	Antifungal antibiotic
-fylline or -phylline	Theophylline derivative
-gab-	γ-Aminobutyric acid (GABA) mimetic
-gado-	Gadolinium derivative
-ganan	Antibacterial
-gest	Progestin
-giline	Monoamine oxidase inhibitor
-gillin	Antibiotic
gli-	Oral hypoglycemic agent
-glitazone	Antidiabetic
-gramostim	Granulocyte macrophage colony-stimulating factor
-grastim	Granulocyte colony-stimulating factor
-grel- or -grel	Platelet antiaggregant
guan-	Antihypertensive
-icam	Antiinflammatory
-ifen	Antiestrogens
-ilide	Class III antiarrhythmic
-imex	Immunostimulant
-imib	Acyl-CoA : cholesterol acetyltransferase inhibitor

STEM EXAMPLE	DEFINITION
-imode	Immunomodulator
-imus	Immunosuppressive
io-	Iodide-containing contrast medium
-irudinem	Anticoagulant
-isomide	Antiarrhythmic
-iurn	Quaternary ammonium derivative
-kacin	Antibiotic
-kalant	Potassium channel agonist
-kef- or -keph-	Encephalin agonist
-kin	Interleukin-type substance
-kinra	Interleukin receptor antagonist
-kiren	Renin inhibitor
-iazad	Lipid peroxidation inhibitor
-leukin	Interleukin-2–type compound
-lubant	Leukotriene antagonist
-lukast	Leukotriene receptor antagonist
-lutamide	Antiandrogen
-mab	Monoclonal antibody
-mantadine or -mantine-	Adamantine derivative
-mastat	Antineoplastic
-meline	Cholinergic agonist
-mer	Polymer
-mesine	Sigma receptor ligand
-mestane	Antineoplastic
-metacin	Antiinflammatory
-micin	Aminoglycoside antibiotic
-monam	Monobactam antibiotic
-mostim	Monocyte macrophage colony-stimulating factor
-motine	Antiviral
-moxin	Monoamine oxidase inhibitor
-mustine	Antineoplastic
-mycin	Macrolide antibiotic
-nab or -nab-	Cannabinol derivative
nal-	Narcotic agonist or antagonist
-navir	Human immunodeficiency virus protease inhibitor
-nidap	Nonsteroidal antiinflammatory
-nidazole	Antiprotozoal
nifur-	5-Nitrofuran derivative
-nixin	Antiinflammatory
-olol	Beta-blocker
-olone	Steroid
-onoid	Topical steroid
-orex	Anorexiant
-orphan	Morphinan derivative
-oxacin	Quinolone antibiotic
-oxan	α-Adrenoreceptor antagonist
-oxanide	Antiparasitic
-oxef	Antibiotic
-oxetine	Antidepressant
-pafant	Platelet-activating factor antagonist
-pamide	Diuretic
-pamil	Coronary vasodilator
-pamine	Dopaminergic
-parcil	Antithrombotic
-parcin	Glycopeptide antibiotic
-parin	Heparin derivative
-paroid	Heparinoid-type substance
-penem	Antibiotic
perfl(u)-	Perfluorochemical
-peridol	Antipsychotic
-pirox	Antimycotic pyridine derivative
-plact	Platelet factor 4 analog
-planin	Antibacterial

Continued

STEM EXAMPLE	DEFINITION
-platin	Antineoplastic
-plon	Nonbenzodiazepine anxiolytic
-poetin	Erythropoietin
-porfin	Benzoporphyrin
-pramine	Imipramine-type antidepressant
-prazole	Antiulcer
pred-, -pred-, or -pred	Prednisone derivative
-pressin	Vasoconstrictor
-priode	Antipsychotic
-pril	Antihypertensive
-prilat	Antihypertensive
-prim	Antibacterial
-profen	Antiinflammatory
-prost or -prost-	Prostaglandin derivative
-queside	Cholesterol sequestrant
-ractam	Nootrope substance
-relin	Prehormone
-relix	Hormone release–inhibiting agent
-renone	Aldosterone antagonist
-restat- or -restat	Aldose reductase inhibitor
-retin	Retinol derivative
-ribine	Ribofuranil
rifa-	Antibiotic
-rinone	Cardiotonic
-rozole	Aromatase inhibitor
-rubicin	Antineoplastic antibiotic
-sal, -sal-, or sal-	Salicylic acid derivative
-sartan	Angiotensin II receptor antagonist
-semide	Diuretic
-serpine	Derivatives of Rauwolfia alkaloid
-setron	Serotonin (5-HT_3) antagonist
-sidomine	Antianginal
som-	Growth hormone derivative
som-, -bove	Bovine somatotropin derivative
som-, por-	Porcine somatotropin derivative
-spirone	Anxiolytic
-sporin	Immunosuppressant
-stat or -stat-	Enzyme inhibitor
-ster-	Steroid (androgen, anabolic)
-steride	Testosterone reductase inhibitor
-stigmine	Anticholinesterase
-stinmel	*N*-methyl D-aspartate receptor antagonist
sulfa-	Sulfonamide antibacterial
-sulfan	Antineoplastic alkylating agent
-tant	Tachykinin receptor antagonist
-tecan	Antineoplastic
-tepa	Antineoplastic
-teplase	Tissue-type plasminogen activator
-terol	Bronchodilator
-tesinol	Thymidylate synthetase inhibitor
-thiazide	Diuretic
-tiapine	Antipsychotic
-tiazem	Calcium channel blocker
-tibant	Antiasthmatic
-tide	Peptide
-tidine	H_2-receptor antagonist
-tocin	Oxytocin derivative
-toin	Antiepileptic
-trexate	Folic acid analog
-trexed	Antineoplastic
-tricin	Antibiotic
-triptan	Antidepressant
-triptyline	Antidepressant
-troban	Antithrombotic

STEM EXAMPLE	DEFINITION
-trodast	Thromboxane A receptor antagonist
-troline	Antipsychotic
trop- or -trop-	Atropine derivative
-udine	Antineoplastic
-uplase	Urokinase-type plasminogen activator
-uracil	Uracil derivative used as thyroid antagonist or as antineoplastic
-uridine	Uridine derivative used as antiviral agent or as antineoplastic
-vastatin	Antihyperlipidemic
-verine	Spasmolytic
vin- or -vin-	Vinca alkaloid
-vir-, -vir, or vir-	Antiviral
-virsen	Antisense
-vudine	Antineoplastic or antiviral
-xanox	Antiallergic respiratory tract drug
-zolamide	Carbonic anhydrase inhibitor
-zolast	Benzoxazole antiasthmatic

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Appendix C

Top 200 Prescription Drugs

RANK	BRAND NAME	GENERIC NAME	DRUG CLASSIFICATION*	INDICATION OR USE
1	Abilify	aripiprazole	Antipsychotic	Schizophrenia
2	Aciphex	rabeprazole	PPI	GERD
3	Actoplus Met	pioglitazone–metformin	Biguanide/thiazolidinedione	Diabetes mellitus type 2
4	Actos	pioglitazone	Thiazolidinedione	Diabetes mellitus type 2
5	Adderall XR	dextroamphetamine–amphetamine	Amphetamine	ADHD
6	Advair Diskus	fluticasone–salmeterol	β_2-Agonist–corticosteroid	Asthma, COPD
7	Aggrenox	aspirin–dipyridamole	Antiplatelet	Thrombotic stroke prevention
8	Alphagan P	brimonidine tartrate	α-Agonist	Glaucoma
9	Altace	ramipril	ACE inhibitor	Hypertension
10	Ambien	zolpidem	Gamma-aminobutyric acid-ergic agionist	Insomnia
11	Amoxil	amoxicillin	Penicillin antibiotic	Bacterial infection
12	Androgel	testosterone topical	Androgen	Hypogonadism
13	Aricept	donepezil	Alzheimer disease; dementia	Alzheimer disease
14	Arimidex	anastrozole	Hormonal oncologic	Cancer
15	Armour Thyroid	thyroid	Thyroid	Hypothyroidism
16	Asacol	mesalamine	Inflammatory bowel disease	Ulcerative colitis
17	Asmanex Twisthaler	mometasone	Corticosteroid	Asthma
18	Astelin	azelastine	Histamine-1 receptor inhibitor	Respiratory allergies
19	Atacand	candesartan cilexetil	ARB	Hypertension
20	Ativan	lorazepam	Benzodiazepine	Anxiety
21	Augmentin	amoxicillin–clavulanate	Penicillin combination antibiotic	Bacterial infection
22	Avalide	irbesartan–hydrochorothiazide	ARB–thiazide combination	Hypertension
23	Avelox	moxifloxacin	Quinolone antibiotic	Bacterial infection
24	Avapro	irbesartan	ARB	Hypertension
25	Avodart	dutasteride	5-alpha reductase inhibitor	BPH
26	Bactrim or Septra	trimethoprim–sulfamethoxazole	Sulfa antibiotic	Bacterial infection
27	Bactroban	mupirocin	Topical antibacterial	Skin infection
28	Beconase AQ	beclomethasone	Corticosteroid	Allergic rhinitis
29	Benicar	olmesartan	ARB	Hypertension
30	Benicar HCT	olmesartan–hydrochlorothiazide	ARB–thiazide combination	Hypertension
31	BenzaClin	clindamycin–benzoyl peroxide	Topical antibiotic	Acne
32	Boniva	ibandronate	Bisphosphonate	Osteoporosis
33	Byetta	exenatide	GLP-1 receptor agonist	Diabetes mellitus type 2
34	Bystolic	nebivolol	Beta-blocker	Hypertension
35	Caduet	amlodipine–atorvastatin	CCB–HMG CoA reductase inhibitor combination	Hypertension and hyperlipidemia
36	Catapress-TTS	clonidine	Alpha-blocker	Hypertension
37	Celebrex	celecoxib	COX-2 inhibitor	Inflammation
38	Celexa	citalopram	SSRI	Depression

Continued

RANK	BRAND NAME	GENERIC NAME	DRUG CLASSIFICATION	INDICATION OR USE
39	Chantix	varenicline	Partial cholinergic nicotinic agonist	Smoking cessation
40	Cheratussin AC	codeine–guaifenesin	Antitussive and expectorant combination	Expectorant and cough suppressant
41	Cialis	tadalafil	PDE5 inhibitor	Erectile dysfunction
42	Cipro	ciprofloxacin	Quinolone antibiotic	Bacterial infection
43	Ciprodex Otic	ciprofloxacin–dexamethasone	Quinolone–corticosteroid	Bacterial external ear infection
44	Cleocin	clindamycin	Antibacterial	Bacterial infection
45	Combivent	ipratropium–albuterol	Anticholinergic–β_2-agonist	Asthma
46	Concerta	methylphenidate	Central nervous system stimulant	ADHD
47	Coreg	carvedilol	Beta-blocker	Hypertension
48	Cosopt	dorzolamide–timolol	Beta-blocker–carbonic anhydrase inhibitor	Glaucoma
49	Coumadin	warfarin	Vitamin K antagonist	Anticoagulation
50	Cozaar	losartan	ARB	Hypertension
51	Crestor	rosuvastatin	HMG-CoA reductase inhibitor	Hyperlipidemia
52	Cymbalta	duloxetine	SNRI	Depression
53	Deltasone	prednisone	Corticosteroid	Inflammation
54	Depakote ER	divalproex sodium	Neurologic	Bipolar disorder; migraine headache: seizure disorder
55	Desyrel	trazodone	Serotonin reuptake inhibitor	Insomnia, depression
56	Detrol LA	tolterodine	GU antispasmodic	Incontinence
57	Differin	adapalene	Retinoid	Acne vulgaris
58	Diflucan	fluconazole	Antifungal	Fungal infection
59	Dilantin	phenytoin	Hydantoin	Status epilepticus
60	Diovan	valsartan	ARB	Hypertension
61	Diovan HCT	valsartan–hydrochlorothiazide	ARB–thiazide combination	Hypertension
62	Dyazide	triamterene–hydrochlorothiazide	Potassium sparing–thiazide combination	Hypertension
63	Effexor	venlafaxine	SNRI	Depression
64	Elavil	amitriptyline	TCA	Depression
65	Enablex	darifenacin	GU antispasmodics	Overactive bladder
66	EpiPen	epinephrine	Catecholamine	Anaphylaxis
67	Esidrix	hydrochlorothiazide	Thiazide diuretic	Hypertension
68	Evista	raloxifene	SERM	Osteoporosis
69	Flexeril	cyclobenzaprine	Muscle relaxant	Skeletal muscle relaxant
70	Flomax	tamsulosin	Alpha-blocker	BPH
71	Flonase	fluticasone	Corticosteroid	Allergic rhinitis
72	Flovent HFA	fluticasone	Corticosteroid	Asthma
73	Fluzone	influenza vaccine	Influenza vaccine	Influenza
74	Focalin XR	dexmethylphenidate	Central nervous system stimulant	ADHD
75	Folic acid	vitamin B_9	Vitamin	Dietary supplement
76	Fosamax	alendronate	Biphosphonate	Osteoporosis
77	Fosamax Plus D	alendronate with vitamin D	Biphosphonate	Osteoporosis
78	Geodon	ziprasidone	Antipsychotic	Schizophrenia
79	Gianvi	drospirenone–ethinyl estradiol	Monophasic oral contraceptive	Oral contraceptive
80	Glucophage	metformin	Biguanide	Diabetes mellitus type 2
81	Glucotrol	glipizide	Sulfonylurea	Diabetes mellitus type 2
82	GlycoLax	polyethylene glycol 3350	Osmotic laxative	Constipation
83	Humalog	insulin lispro	Insulin	Diabetes mellitus
84	Humulin N	insulin NPH	Insulin	Diabetes mellitus
85	Hyzaar	losartan–hydrochlorothiazide	ARB–thiazide combination	Hypertension
86	Imitrex	sumatriptan	Serotonin 5-HT_1 receptor	Migraine headache
87	Januvia	sitagliptin	DPP-4 inhibitor	Diabetes mellitus type 2
88	K-Dur, Klor-Con, Klor-Con M, or Micro K	potassium chloride	Electrolyte	Potassium supplement
89	Kariva	desogestrel–ethinyl estradiol	Monophasic oral contraceptive	Oral contraceptive
90	Keflex	cephalexin	Cephalosporin antibiotic	Bacterial infection
91	Keppra	levetiracetam	Antiepileptic	Seizure
92	Klonopin	clonazepam	Benzodiazepine	Seizure
93	Lamictal	lamotrigine	Antiepileptic	Bipolar disorder

RANK	BRAND NAME	GENERIC NAME	DRUG CLASSIFICATION	INDICATION OR USE
94	Lanoxin	digoxin	Cardiac glycoside	Arrhythmia; myocardial infarction
95	Lantus	insulin glargine	Insulin	Diabetes mellitus
96	Lasix	furosemide	Loop diuretic	Hypertension
97	Lescol XL	fluvastatin	HMG-CoA reductase inhibitor	Hyperlipidemia
98	Levaquin	levofloxacin	Quinolone antibiotic	Bacterial infection
99	Levitra	vardenafil	PDE5 inhibitor	PDE5 inhibitor
100	Lexapro	escitalopram	SSRI	Depression
101	Lidoderm	lidocaine	Analgesic	Neuralgia
102	Lipitor	atorvastatin	HMG-CoA reductase inhibitor	Hyperlipidemia
103	Loestrin Fe24	norethindrone–ethinyl estradiol	Monophasic oral contraceptive	Oral contraceptive
104	Lopressor	metoprolol tartrate	Beta-blocker	Hypertension
105	Lovaza	omega-3-acid ethyl esters	Estrified fish oils	Hypertriglyceridemia
106	Lovenox	enoxaparin	Low-molecular heparin	DVT prophylaxis
107	Lumigan	bimatoprost	Prostaglandin analogs	Glaucoma
108	Lunesta	eszopiclone	Nonbenzodiazepine hypnotic	Insomnia
109	Lyrica	pregabalin	Neurologic	Neuropathic pain
110	Maxzide	triamterene–hydrochorothiazide	Potassium sparring–thiazide diuretic	Hypertension
111	Medrol	methylprednisolone	Corticosteroid	Inflammation
112	Mevacor	lovastatin	HMG-CoA reductase inhibitor	Hyperlipidemia
113	Micardis	telmisartan	ARB	Hypertension
114	Micardis HCT	telmisartan–hydrochlorothiazide	ARB–thiazide combination	Hypertension
115	Micronase or DiaBeta	glyburide	Sulfonylurea	Diabetes mellitus type 2
116	Mirapex	pramipexole	Dopamine agonist	Parkinson disease
117	Mobic	meloxicam	NSAID	Osteoarthritis
118	Motrin†	ibuprofen	NSAID	Inflammation
119	Namenda	memantine	NMDA receptor agonist	Alzheimer disease
120	Naprosyn	naproxen	NSAID	Inflammation
121	Nasacort AQ	triamcinolone	Corticosteroid	Allergic rhinitis
122	Nasonex	mometasone furoate	Corticosteroid	Allergic rhinitis
123	Neurontin	gabapentin	Neurologic	Seizure
124	Nexium†	esomeprazole	PPI	GERD
125	Niaspan	niacin	Nicotinic acid	Hyperlipidemia
126	Norvasc	amlodipine besylate	CCB	Hypertension
127	NuvaRing	etonogestrel–ethinyl estradiol	Estrogen: progestin	Contraceptive
128	Omnicef	cefdinir	Cephalosporin antibiotic	Bacterial infection
129	Ortho-Tri-Cyclen Lo	ethinyl estradiol–norgestimate	Triphasic oral contraceptive	Oral contraceptive
130	OxyContin	oxycodone	Opioid	Analgesic
131	Patanol	olopatadine	Allergy	Allergic conjunctivitis
132	Paxil	paroxetine	SSRI	Depression
133	Penicillin VK	penicillin	Penicillin antibiotic	Bacterial infection
134	Pepcid†	famotidine	H2 blocker	GERD
135	Phenergan	promethazine	Antihistamine	Antiemetic
136	Plavix	clopidogrel	Antiplatelet	Thrombotic event prevention
137	Pravachol	pravastatin	HMG-CoA reductase inhibitor	Hyperlipidemia
138	Premarin	conjugated estrogens	Estrogen	Vasomotor symptoms
139	Prevacid†	lansoprazole	PPI	GERD
140	Prilosec†	omeprazole	PPI	GERD
141	ProAir HFA, Proventil HFA, Ventolin HFA	albuterol	Bronchodilator	Asthma
142	Prometrium	progesterone	Progestin	Amenorrhea
143	Propecia	finasteride	5-α-reductase inhibitor	Male pattern baldness
144	Protonix	pantoprazole	PPI	GERD
145	Provigil	modafinil	Sympathomimetic-like amine	Narcolepsy
146	Prozac	fluoxetine	SSRI	Depression
147	Pulmicort Respules	budesonide	Corticosteroid	Asthma
148	Relpax	eletriptan	5HT receptor agonist	Migraine headache
149	Requip	ropinirole	Dopamine agonist	Parkinson disease
150	Restasis	cyclosporine	Calcineunin inhibitor immunosuppressant	Ocular dryness

Continued

RANK	BRAND NAME	GENERIC NAME	DRUG CLASSIFICATION	INDICATION OR USE
151	Rhinocort AQ	budesonide	Corticosteroid	Asthma
152	Risperdal	risperidone	Antipsychotic	Schizophrenia
153	Seroquel	quetiapine fumarate	Antipsychotic	Schizophrenia
154	Singulair	montelukast	Leukotriene receptor antagonist	Asthma
155	Skelaxin	metaxalone	Muscle relaxant	Musculoskeletal pain
156	Soma	carisoprodol	Muscle relaxant	Skeletal muscle relaxant
157	Spiriva Handihaler	tiotropium	Anticholinergic	COPD
158	Strattera	atomoxetine	Norepinephrine reuptake inhibitor	ADHD
159	Suboxone	buprenorphine–naloxone	Opioid agonist/antagonist	Opioid maintenance
160	Sular	nisoldipine	CCB	Hypertension
161	Symbicort	budesonide–formoterol	Corticosteroid/β_2-Agonist	Asthma
162	Synthroid	levothyroxine sodium	Thyroid	Hypothyroidism
163	Tenormin	atenolol	Beta-blocker	Hypertension
164	Tessalon Perles	benzonatate	Antitussive	Cough
165	Topamax	topiramate	Antiepileptic	Seizure
166	Toprol XL	metoprolol succinate	Beta-blocker	Hypertension
167	Travatan	travoprost	Prostaglandin analog	Glaucoma
168	Tricor	fenofibrate	Fibrate	Hyperlipidemia
169	Triesence or Trivaris	triamcinolone	Corticosteroid	Ocular inflammation
170	Trileptal	oxcarbazepine	Antiepileptic	Partial seizure
171	TriNessa	norgestimate–ethinyl estradiol	Triphasic oral contraceptive	Oral contraceptive
172	Tri-Sprintec	norgestimate–ethinyl estradiol	Triphasic oral contraceptive	Oral contraceptive
173	Tussionex	chlorpheniramine–hydrocodone	Antihistamine–antitussive combination	Upper respiratory symptoms
174	Tylenol with codeine	acetaminophen with codeine	Opioid combination	Analgesic
175	Ultram	tramadol	Opioid	Analgesic
176	Uroxatral	alfuzosin	Alpha-blocker	BPH
177	Vagifem	estradiol	Estrogen	Vulvovaginal atrophy
178	Valium	diazepam	Benzodiazepine	Anxiety
179	Vasotec	enalapril	ACE inhibitor	Hypertension
180	VESIcare	solifenacin	Antispasmodic	Overactive bladder
181	Viagra	sildenafil	PDE5 inhibitor	Erectile dysfunction
182	Vibramycin	doxycycline hyclate	Tetracycline antibiotic	Bacterial infection
183	Vicodin	hydrocodone and acetaminophen	Opioid combination	Analgesic
184	Vigamox	moxifloxacin	Quinolone antibiotic	Bacterial conjunctivitis
185	Vitamin D†	ergocalciferol	Vitamin	Vitamin D deficiency
186	Vytorin	ezetimibe–simvastatin	HMG CoA reductase combination	Hypercholesterolemia
187	Vyvanse	lisdexamfetamine	Central nervous system stimulant	ADHD
188	Wellbutrin XL	bupropion	Quinolone antibiotic	Depression
189	Xalatan	latanoprost	Prostaglandin analog	Glaucoma
190	Xanax	alprazolam	Benzodiazepine	Anxiety
191	Xopenex HFA	levalbuterol	β_2-Agonists	Bronchospasm
192	Zantac†	ranitidine	H_2 blocker	GERD
193	Zestoretic	lisinopril and hydrochlorothiazide	ACE inhibitor–thiazide combination	Hypertension
194	Zestril or Prinivil	lisinopril	ACE inhibitor	Hypertension
195	Zetia	ezetimibe	Cholesterol absorption inhibitor	Hyperlipidemia
196	Zithromax	azithromycin	Macrolide antibiotic	Bacterial infection
197	Zocor	simvastatin	HMG-CoA reductase inhibitor	Hyperlipidemia
198	Zoloft	sertraline	SSRI	Depression
199	Zyloprim	allopurinal	Xanthine oxidase inhibitor	Gout
200	Zyprexa	olanzapine	Antipsychotic	Schizophrenia, bipolar disease

*According to Epocrates.
†Prescription.
ACE, Angiotensin-converting; *ADHD*, attention deficit hyperactivity disorder; *ARB*, angiotensin II receptor blocker; *BPH*, benign prostatic hypertrophy; *CCB*, calcium channel blocker; *COPD*, chronic obstructive pulmonary disease; *COX*, cyclooxygenase; *DVT*, deep vein thrombosis; *GERD*, gastroesophageal reflux disease; *GU*, genitourinary; *NSAID*, nonsteroidal antiinflammatory drug; *PPI*, proton pump inhibitor; *SSRI*, selective serotonin reuptake inhibitor; *TCA*, tricyclic antidepressant.

Appendix D

Vitamins

VITAMIN	NAME	USE
A	Retinol	Retinal function and bone growth
B_1	Thiamine	Carbohydrate metabolism
B_2	Riboflavin	Macronutrient metabolism
B_3	Niacin	Lipid metabolism
B_6	Pyridoxine	Amino acid metabolism
B_9	Folic acid	Red blood cell formation
B_{12}	Cyanocobalamin	Red blood cell formation
C	Ascorbic acid	Collagen formation and tissue repair
D_2	Ergocalciferol	Absorption and use of calcium and phosphate
D_3	Cholecalciferol	Absorption and use of calcium and phosphate
E	Alpha-tocopherol	Antioxidant
K_1	Phytonadione	Blood clotting
K_3	Menadione	Blood clotting

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Appendix E

Common Over-the-Counter Products

BRAND NAME	GENERIC NAME	CLASSIFICATION
Actifed Cold and Allergy	chlorpheniramine–phenylephrine	Decongestant
Advil	ibuprofen	Analgesic, antipyretic
Afrin	oxymetazoline	Decongestant
Aleve	naproxen sodium	Analgesic
Anbesol	benzocaine and phenol	Topical anesthetic
Aspercreme	trolamine salicylate	Topical analgesic
Bayer Aspirin	aspirin	Analgesic, antipyretic, antiinflammatory
Benadryl	diphenhydramine	Antihistamine
Benylin	diphenhydramine	Antihistamine
Bonine	meclizine	Antiemetic
Bufferin	aspirin	Analgesic, antipyretic, antiinflammatory
Caladryl	pramoxine–calamine	Topical protectant
Chlor-Trimeton	chlorpheniramine	Antihistamine
Chloraseptic Sore Throat Spray	phenol	Topical anesthetic
Citrucel	methylcellulose	Laxative
Claritin	loratadine	Antihistamine
Colace	docusate sodium	Stool softener
Compound W	salicylic acid	Keratolytic
Cortaid	hydrocortisone	Topical allergic reactions
Delsym	dextromethorphan	Antitussive
Children's Dimetapp Cold & Allergy	brompheniramine–phenylephrine	Antihistamine
Doxidan	docusate calcium	Stool softener
Dramamine	dimenhydrinate	Antiemetic
Dulcolax	bisacodyl	Laxative
DuoFilm	salicylic acid	Keratolytic
Ecotrin	aspirin	Analgesic, antipyretic, antiinflammatory
Emetrol	dextrose, fructose, and phosphoric acid	Antiemetic
Excedrin Migraine	acetaminophen, aspirin, and caffeine	Analgesic
FiberCon	polycarbophil	Laxative
Gas-X	simethicone	Antiflatulent
Gaviscon	aluminum hydroxide and magnesium carbonate	Antacid
Gly-Oxide	carbamide peroxide	Topical anesthetic
Gyne-Lotrimin	clotrimazole	Antifungal
Imodium AD	loperamide	Antidiarrheal
Kaopectate	bismuth subsalicylate	Antidiarrheal
Lotrimin AF	clotrimazole	Antifungal
Maalox	aluminum hydroxide and magnesium hydroxide	Antacid
Metamucil	psyllium	Laxative
Micatin	miconazole	Antifungal
Monistat	miconazole	Antifungal

Continued

BRAND NAME	GENERIC NAME	CLASSIFICATION
Motrin IB	ibuprofen	Analgesic
Mylanta Regular Strength	aluminum hydroxide, magnesium hydroxide, and simethicone	Antacid
Mylanta Gas	simethicone	Antiflatulent
Mylicon Infant Drops	simethicone	Antiflatulent
Naphcon A	pheniramine and naphazoline	Ophthalmic decongestant
NasalCrom	cromolyn sodium	Antihistamine
Neo-Synephrine	phenylephrine	Decongestant
Neosporin	polymyxin B sulfate, neomycin, and bacitracin	Topical antibiotic
Nicoderm	nicotine transdermal	Smoking cessation
Nicorette	nicotine polacrilex	Smoking cessation
Nicotrol	nicotine transdermal	Smoking cessation
Nix	permethrin	Pediculus infestation
NoDoz	caffeine	Central nervous system stimulant
Ocean	normal saline	Nasal moisturizer
Orabase	benzocaine	Oral anesthetic
Orajel Cold Sore Swabs	benzocaine	Oral anesthetic
Pepcid AC	famotidine	Antiulcer
Pepto-Bismol	bismuth subsalicylate	Gastrointestinal distress
Percogesic	acetaminophen–diphenhydramine	Analgesic
Peri-Colace	docusate sodium–sennosides	Stool softener and laxative
Phazyme	simethicone	Antiflatulent
Phillips Milk of Magnesia	magnesium hydroxide	Laxative
RID	pyrethrin	Pediculus infestation
Robitussin Peak Cold Cough + Chest Congestion DM	guaifenesin–dextromethorphan	Expectorant and cough suppressant
Rogaine	minoxidil	Hair replacement
Senokot	sennosides	Laxative
Sominex	diphenhydramine	Sleep
Sucrets	hexylresorcinol and dyclonine	Oral anesthetic
Sudafed 12 Hour	pseudoephedrine	Decongestant
Tagamet HB 200	cimetidine	Antiulcer
Tavist Allergy	clemastine fumarate	Antihistamine
Tinactin	tolnaftate	Antifungal
Tums	calcium carbonate	Antacid
Tylenol	acetaminophen	Analgesic, antiinflammatory
Zantac 75	ranitidine	Antiulcer
Zilactin-B	benzocaine	Cold sores
Zostrix	capsaicin	Topical analgesic

Appendix F

Institute for Safe Medication Practices List of Error-Prone Abbreviations, Symbols, and Dose Designations

ABBREVIATION	INTENDED MEANING	MISINTERPRETATION	CORRECTION
µg	Microgram	Mistaken as "mg"	Use "mcg"
AD, AS, AU	Right ear, left ear, each ear	Mistaken as OD, OS, OU (right eye, left eye, each eye)	Use "right ear," "left ear," or "each ear"
OD, OS, OU	Right eye, left eye, each eye	Mistaken as AD, AS, AU (right ear, left ear, each ear)	Use "right eye," "left eye," or "each eye"
BT	Bedtime	Mistaken as BID (twice daily)	Use "bedtime"
cc	Cubic centimeter	Mistaken as "u" (units)	Use "mL"
D/C	Discharge or discontinue	Premature discontinuation of medications if D/C (intended to mean discharge) has been misinterpreted as "discontinued" when followed by a list of discharge medications	Use "discharge" and "discontinue"
IJ	Injection	Mistaken as IV or intrajugular	Use "injection"
IN	Intranasal	Mistaken as IM or IV	Use "intranasal"
HS	Half-strength	Mistaken as bedtime	Use "half-strength"
hs	At bedtime, hour of sleep	Mistaken as half-strength	Use "bedtime"
IU*	International unit	Mistaken as IV (intravenous) or 10 (ten)	Use "units"
o.d. or OD	Once daily	Mistaken as "right eye" (OD, oculus dexter), leading to oral liquid medications administered in the eye	Use "daily"
OJ	Orange juice	Mistaken as OD or OS (right or left eye); drugs meant to be diluted in orange juice may be given in the eye	Use "orange juice"
Per os	By mouth; orally	The "os" can be mistaken as "left eye" (OS, oculus sinister)	Use "PO," "by mouth," or "orally"
q.d. or QD*	Every day	Mistaken as "qid," especially if the period after the "q" or the tail of the "q" is misunderstood as an "i"	Use "daily"

Continued

ABBREVIATION	INTENDED MEANING	MISINTERPRETATION	CORRECTION
qhs	Nightly at bedtime	Mistaken as "qhr" or every hour)	Use "nightly"
qn	Nightly at bedtime	Mistaken as "qh" (every hour)	Use "nightly" or "at bedtime"
q.o.d. or QOD*	Every other day	Mistaken as "q.d." (daily) or "q.i.d." (four times daily) if the "o" is poorly written	Use "every other day"
q1d	Daily	Mistaken as q.i.d. (four times daily)	Use "daily"
q6PM, etc.	Every evening at 6 PM	Mistaken as every 6 hours	Use "daily at 6 PM" or "6 PM daily"
SC, SQ, sub q	Subcutaneous	SC mistaken as SL (sublingual); SQ mistaken as "5 every;" the "q" in "sub q" has been mistaken as "every" (e.g., a heparin dose ordered "sub q 2 hours before surgery" misunderstood as every 2 hours before surgery)	Use "subcut" or "subcutaneously"
ss	Sliding scale (insulin) or ½ (apothecary)	Mistaken as "55"	Spell out "sliding scale;" use "one-half" or "1/2"
SSRI	Sliding scale regular insulin	Mistaken as selective-serotonin reuptake inhibitor	Spell out "sliding scale (insulin)"
SSI	Sliding scale insulin	Mistaken as strong solution of iodine (Lugol's)	Spell out "sliding scale (insulin)"
i/d	One daily	Mistaken as "tid"	Use "1 daily"
TIW or tiw	3 times a week	Mistaken as "3 times a day" or "twice in a week"	Use "3 times weekly"
U or u*	Unit	Mistaken as the number 0 or 4, causing a 10-fold overdose or greater (e.g., 4U seen as "40" or 4u seen as "44"); mistaken as "cc" so dose given in volume instead of units (e.g., 4u seen as 4 cc)	Use "unit"
UD	As directed ("ut dictum")	Mistaken as unit dose (e.g., diltiazem 125 mg IV infusion "UD" misinterpreted as meaning to give the entire infusion as a unit [bolus] dose)	Use "as directed"

DOSE DESIGNATIONS AND OTHER INFORMATION	INTENDED MEANING	MISINTERPRETATION	CORRECTION
Trailing zero after decimal point (e.g., 1.0 mg)*	1 mg	Mistaken as 10 mg if the decimal point is not seen	Do not use trailing zeros for doses expressed in whole numbers
"Naked" decimal point (e.g., .5 mg)*	0.5 mg	Mistaken as 5 mg if the decimal point is not seen	Use zero before a decimal point when the dose is less than a whole unit
Abbreviations such as mg. or mL. with a period following the abbreviation	mg mL	The period is unnecessary and could be mistaken as the number 1 if written poorly	Use mg, mL, etc., without a terminal period
Drug name and dose run together (especially problematic for drug names that end in "l" such as Inderal40 mg; Tegretol300 mg)	Inderal 40 mg Mistaken as Inderal 140 mg	Tegretol 300 mg Mistaken as Tegretol 1300 mg	Place adequate space between the drug name, dose, and unit of measure
Numeric dose and unit of measure run together (e.g., 10mg, 100mL)	10 mg 100 mL	The "m" is sometimes mistaken as a zero or two zeros, risking a 10- to 100-fold overdose	Place adequate space between the dose and unit of measure
Large doses without properly placed commas (e.g., 100000 units or 1000000 units)	100,000 units 1,000,000 units	100000 has been mistaken as 10,000 or 1,000,000; 1000000 has been mistaken as 100,000	Use commas for dosing units at or above 1,000, or use words such as 100 "thousand" or 1 "million" to improve readability

DRUG NAME ABBREVIATIONS	INTENDED MEANING	MISINTERPRETATION	CORRECTION
To avoid confusion, do not abbreviate drug names when communicating medical information. Examples of drug name abbreviations involved in medication errors include:			
APAP	Acetaminophen	Not recognized as acetaminophen	Use complete drug name
ARA A	vidarabine	Mistaken as cytarabine (ARA-C)	Use complete drug name
AZT	zidovudine (Retrovir)	Mistaken as azathioprine or aztreonam	Use complete drug name
CPZ	Compazine (prochlorperazine)	Mistaken as chlorpromazine	Use complete drug name
DPT	Demerol–Phenergan–Thorazine	Mistaken as diphtheria–pertussis–tetanus (vaccine)	Use complete drug name
DTO	Diluted tincture of opium or deodorized tincture of opium (Paregoric)	Mistaken as tincture of opium	Use complete drug name
HCl	hydrochloric acid or hydrochloride	Mistaken as potassium chloride (the "H" is misinterpreted as "K")	Use complete drug name unless expressed as a salt of a drug
HCT	hydrocortisone	Mistaken as hydrochlorothiazide	Use complete drug name
HCTZ	hydrochlorothiazide	Mistaken as hydrocortisone (seen as HCT250 mg)	Use complete drug name
$MgSO_4$*	magnesium sulfate	Mistaken as morphine sulfate	Use complete drug name
MS, MSO_4*	morphine sulfate	Mistaken as magnesium sulfate	Use complete drug name
MTX	methotrexate	Mistaken as mitoxantrone	Use complete drug name
PCA	procainamide	Mistaken as patient-controlled analgesia	Use complete drug name
PTU	propylthiouracil	Mistaken as mercaptopurine	Use complete drug name
T3	Tylenol with codeine no. 3	Mistaken as liothyronine	Use complete drug name
TAC	triamcinolone	Mistaken as tetracaine, Adrenalin, cocaine	Use complete drug name
TNK	TNKase	Mistaken as "TPA"	Use complete drug name
$ZnSo^4$	zinc sulfate	Mistaken as morphine sulfate	Use complete drug name
STEMMED DRUG NAMES	**INTENDED MEANING**	**MISINTERPRETATION**	**CORRECTION**
"Nitro" drip	nitroglycerin infusion	Mistaken as sodium nitroprusside infusion	Use complete drug name
"Norflox"	norfloxacin	Mistaken as Norflex	Use complete drug name
"IV Vanc"	intravenous vancomycin	Mistaken as Invanz	Use complete drug name
SYMBOLS	**INTENDED MEANING**	**MISINTERPRETATION**	**CORRECTION**
ʒ	Dram	Mistaken as "3"	Use the metric system
ɱ	Minim	Mistaken as "mL"	Use the metric system
x3d	For three days	Mistaken as "3 doses"	Use "for three days"
> and <	Greater than or less than	Mistaken as opposite of intended; mistakenly use incorrect symbol; "<10" mistaken as "40"	Use "greater than" or "less than"
/ (slash mark)	Separates two doses or indicates "per"	Mistaken as the number 1 (e.g., "25 units/10 units" misread as 25 units and 110" units)	Use "per" rather than a slash mark to separate doses
@	At	Mistaken as "2"	Use "at"
&	And	Mistaken as "2"	Use "and"
+	Plus or and	Mistaken as "4"	Use "and"
°	Hour	Mistaken as a zero (e.g., q2° seen as q 20)	Use "hr," "h," or "hour"
Φ or ø	zero, null sign	Mistaken as numerals 4, 6, 8, and 9	Use 0 or zero or describe intent using whole words

*These abbreviations are included on The Joint Commission's "minimum list" of dangerous abbreviations, acronyms, and symbols that must be included on an organization's "do not use" list, effective January 1, 2004. Visit www.jointcommission.org for more information about The Joint Commission's requirements.

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Appendix G

Pharmaceutical Abbreviations

ABBREVIATION	MEANING
aa	of each
ad	up to, so as to make
cc	cubic centimeter (mL)
dtd	dispense such doses or give of such doses
eq	equivalent
g	gram
gal	gallon
gr	grain
gtt	drop(s)
h	hour
hr	hour
kg	kilogram
L	liter
lb	pound
mcg	microgram
mEq	milliequivalent
mg	milligram
mg/kg	milligram of drug per kilogram of body weight
mL	milliliter (cc)
mOsm	milliosmole
#	number
pt	pint
qs	a sufficient quantity
qs ad	a sufficient quantity to make up to
qt	quart
ss	one-half
tbsp	tablespoonful
tsp	teaspoonful
U*	unit

*The pharmacy abbreviation appears on the "do not use" list of the Joint Commission (TJC) and Institute for Safe Medication Practices (ISMP). Despite the recommendation of both TJC and the ISMP, pharmacy technicians may continue to see prescriptions or medication orders with these abbreviations.

DOSAGE FORM	MEANING
amp	ampule
cap	capsule
ECT	enteric-coated tablet
elix	elixir
fl	fluid
fl oz	fluid ounce
inj	injection
IV	intravenous
IVP	intravenous push
IVPB	intravenous piggyback
MDI	metered-dose inhaler
oint	ointment
sol	solution
supp	suppository
susp	suspension
syr	syrup
tab	tablet
TDS	transdermal delivery system
TPN	total parenteral nutrition
ung	ointment

SOLUTION	MEANING
D5LR	5% dextrose in lactated Ringer solution
D5NS	5% dextrose in normal saline solution
D5W	5% dextrose in water
D10W	10% dextrose in water
D20W	20% dextrose in water
DW	distilled water
NS	normal saline (0.9% sodium chloride)
1/2 NS	half-strength normal saline (0.45%)
o/w	oil-in-water
RL	Ringer lactate solution
R/L	Ringer lactate solution
SWFI	sterile water for injection
w/o	water-in-oil

SITE OF ADMINISTRATION	MEANING
abd	abdomen
ad*	right ear
as*	left ear
au*	each ear
buc	in the cheek
IA	intraarterial
ID	intradermal
IM	intramuscular
IT	intrathecal
IV	intravenous
NPO	nothing by mouth
od*	right eye
os*	left eye
ou*	each eye
per	by or through
PO	by mouth
PR	by rectum
PV	by vagina
R	rectum
SC, SQ, subq*	subcutaneous (under the skin)
SL	sublingual (under the skin)
top	topical
vag	vaginal

*Appears on the "do not use list" of The Joint Commission and the Institute for Safe Medication Practices.

TIME OF ADMINISTRATION	MEANING
a	before
ac	before meals
ad lib	at pleasure, freely
am	morning, before noon
ATC	around the clock
bid	twice per day
h, hr	hour
hs	at bedtime
noct	at night
p	after
pc	after meals
pm	evening, afternoon
postop	postoperative
pp	after meals
prn	as needed
q	each, every
qd	every day
q4h	every 4 hr
q6h	every 6 hr
q8h	every 8 hr
qh	every hour
qid	four times per day
qod	every other day
tid	three times per day
wk	week

MISCELLANEOUS PHARMACY ABBREVIATION	MEANING
C	Celsius
c	with
DAW	dispense as written
D/C*	discontinue or discharge
dil	dilute, dissolve
disp	dispense
div	divide
F	Fahrenheit
KVO	keep vein open
m ft	mix and make
non rep	do not repeat
NR	no refill
RN	registered nurse
Rx	take
s	without
sig	write on label
T	temperature
ut dict	as directed
ud	as directed

*Abbreviation appears on the "do not use" list of the Joint Commission and the Institute of Safe Medication Practices.

MEDICATION*	MEANING
ABC	abacavir
APAP	acetaminophen (Tylenol)
ASA	aspirin
ATV	atazanavir
AZT	zidovudine (Retrovir)
BCP	birth control pill
CBV	zidovudine and lamivudine
ddC	zalcitabine
ddI	didanosine (Videx)
d4T	stavudine (Zerit)
DES	diethylstilbestrol
DLV	delavirdine
EES	erythromycin ethylsuccinate
EFV	efavirenz
5FU	fluorouracil (Efudex)
FPV	fosamprenavir
FTC	emtricitabine
HC	hydrocortisone
HCTZ	hydrochlorothiazide (Diuril)
HRT	hormone replacement therapy
IDV	indinavir
INH	isoniazid
LPV/r	lopinavir with ritonavir
MOM	Milk of Magnesia
MS	morphine sulfate
MTX	methotrexate
MVI	multiple vitamins
NFV	nelfinavir
NTG	nitroglycerin
NVP	nevirapine
PCN	penicillin
PTU	propylthiouracil
RTV	ritonavir
SMZ/TMP	sulfamethoxazole and trimethoprim
SQV-HGC	saquinavir
SQV-SGC	saquinavir
3TC	lamivudine (Epivir)
T-20	enfuvirtide
TDF	tenofovir DF
TRZ	zidovudine, lamivudine, and abacavir
TVD	emtricitabine
ZnO	zinc oxide

*The Joint Commission and the Institute for Safe Medication Practices discourage the use of medication abbreviations; however, pharmacy technicians may continue to see abbreviations for medications on prescription or medication orders.

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Answers

PRETEST ANSWERS

1. a—DAW code 1 indicates that the physician has indicated on the prescription that a brand name drug must be dispensed. The physician must write in his or her own handwriting: "Brand Name Medically Necessary" or "Dispense as Written." **Domain 8**

2. d—The patient is to receive 20 mL per day for 10 days, which is 200 mL. **Domains 3, 6**

3. c—The patient will need to take 2 capsules per dose three times a day for 10 days; therefore, 60 capsules must be dispensed. **Domains 3, 6**

4. a—CMS is the acronym assigned to the Centers of Medicare and Medicaid Services. **Domains 4, 5**

5. d—The United States Pharmacopoeia establishes standards for all medications dispensed in the United States. **Domain 5**

6. a—Alert fatigue occurs when an individual is continuously being informed of medication alerts and begins to not pay close attention to these alerts. **Domain 9**

7. b—Lorazepam is classified as a Schedule IV medication under the Controlled Substance Act and is permitted to be refilled a maximum of five times within 6 months of the prescription's being written. **Domains 1, 2**

8. c—*Approved Drug Products with Therapeutic Equivalence Evaluation,* also known as the *Drug Topics Orange Book,* provides a rating system comparing all generic medications approved in the United States with the standard established in the *USP*. **Domains 2, 5**

9. b—Paroxetine is the generic name for Paxil, venlafaxine is the generic name for Effexor, fluoxetine is the generic name for Prozac, and sertraline is the generic name for Zoloft. **Domain 1**

10. d—A third-party payment is one that is paid by a pharmacy benefits management (PBM) company for prescriptions provided to a subscriber of the PBM. **Domain 8**

11. a—0.25% means there is 0.25 g in every 100 g. One pound is equal to 454 g. 0.25 g/100 g = X g/454; X = 1.135, which would be rounded to 1.14 g. **Domain 3**

12. a—*ut dict* is a Latin abbreviation meaning "as directed" and may be found on some prescriptions. **Domain 6**

13. d—The root word *-dipsia* means thirst. **Domain 6**

14. b—The Accrediting Council for Pharmacy Education (ACPE) accredits all pharmacy-related education and continuing education. **Domain 5**

15. c—Maxzide can be crushed if necessary. Ambien CR and Augmentin XR should not be crushed because they are the long-acting dosage forms. Tessalon Perles should not be crushed because the liquid in the capsule will numb the throat. **Domains 1, 5**

16. a—The generic name for Augmentin is amoxicillin–clavulanate. Ampicillin–sulbactam is generic for Unasyn, piperacillin–tazobactam is generic for Zosyn, and ticarcillin–clavulanate is generic for Timentin. **Domain 1**

17. c—The *Physician's Desk Reference* (*PDR*) is not a required reference material for pharmacies; however, a pharmacist may select it as part of the pharmacy library. **Domains 2, 5**

18. c—Patients should be tapered off prednisone because of the adverse effects they may experience if they are not tapered of the medication. The other medications may be discontinued without fear of adverse events from developing. **Domain 1**

19. b—Robitussin A-C is an "exempt" narcotic. **Domain 2**

20. d—120 g (≈4 oz) is the maximum weighable amount on a class A (III) balance. **Domain 3**

21. b—Tylenol with codeine (acetaminophen with codeine) is classified as a Schedule III medication by the Drug Enforcement Administration. **Domain 2**

22. d—Acyclovir (Zovirax) is an antiviral agent. **Domain 1**

23. c—The pharmacy abbreviation "tid" means three times a day. **Domain 6**

24. c—Estrace is not a combination drug. Bactrim DS is sulfamethoxazole–trimethoprim, Dyazide is triamterene–hydrochlorothiazide, and Prempro is conjugated estrogens plus medroxyprogesterone. **Domain 1**

25. c—The NCPDP has established standards for e-prescribing. **Domains 5, 6**

26. b—A filter needle prevents glass from entering the final solution when an ampule is drawn from it. Depth filters trap particles as a solution moves through channels, filter straws are used for pulling medication from ampules, and a final filter is used before a solution enters the patient's body. **Domain 3**

27. c—Singulair (montelukast) is a leukotriene inhibitor. **Domain 1**

28. d—A pharmacy technician performs technical duties; anything requiring a decision to be made must be referred to the pharmacist. **Domain 2**

29. b—Rotating medications is an inventory management tool and is done to minimize medication from expiring before it is dispensed or administered. **Domain 7**

30. d—A "STAT" order means that the medication is needed immediately. **Domain 6**

31. d—The Medicaid Tamper-Resistant Prescriptions Act of 2008 requires that all Medicaid prescriptions that are handwritten by prescribers appear on a tamper-resistant prescription pad. **Domain 2**

32. d—A midlevel practitioner such as a physician's assistant or nurse practitioner would have a DEA number beginning with an "M." **Domain 2**

33. d—Remeron (mirtazapine) is not a combination product. Estratest (esterified estrogens and methyl testosterone), Hyzaar (losartan and hydrochlorothiazide), and Lotrel (amlodipine and benazepril) are combination products. **Domain 1**

34. b—Class A balances must have a sensitivity of 6 mg. **Domain 3**

35. c—The Poison Control Act permits Nitrostat (nitroglycerin) to be dispensed in a non–child-resistant container. **Domains 2, 6**

36. d—A pharmacy technician is permitted to accept a written prescription from the patient. **Domains 2, 6**

37. c—The Controlled Substances Act requires that all prescribers and dispensers of controlled substances have a DEA number. The requirement shows the pharmacist that the physician has the authority to prescribe controlled substances. **Domain 2**

38. a—According to the Controlled Substances Act of 1970, meperidine (Demerol) is a Schedule II drug. **Domain 2**

39. c—NACDS stands for the National Association of Chain Drug Stores. **Domains 5, 6**

40. b—Insulin has been classified as a "high-alert" medication by the ISMP because of the large number of medication errors associated with it. **Domain 4**

41. b—Adding the totals of all of the different ingredients gives 2270 mg. Divide 2270 mg/tablet by 1000 mg/g to determine the number of grams. **Domain 3**

42. c—Salmeterol is the generic name for Serevent, albuterol is generic for Proventil or Ventolin, beclomethasone is generic for Vanceril or Vancenase, and triamcinolone is generic for Azmacort. **Domain 1**

43. c—Rx is a Latin abbreviation meaning "take this drug." **Domain 6**

44. c—Nifedipine (Procardia or Adalat) is a calcium channel blocker. **Domain 1**

45. d—PHI is defined under HIPAA as Protected Health Information. **Domain 2**

46. d—The Joint Commission certifies health care organizations. **Domain 5**

47. b—Cubicin is not indicated as a smoking cessation aid. **Domain 1**

48. a—Amantadine (Symmetrel) is used in the prevention of influenza and the treatment of Parkinson disease. **Domain 1**

49. d—The pharmacy and therapeutics committee is responsible for developing, maintaining, and changing an institution's formulary. **Domain 7**

50. d—According to the Controlled Substances Act, a physician has up to 7 calendar days to provide a pharmacy a handwritten prescription for a Schedule II medication if it was called in to the pharmacy. The quantity prescribed should be enough to last only until the patient can see the physician. **Domain 2**

51. c—Investigational drugs are not stocked in an ambulatory pharmacy; they are only available in a hospital. **Domains 1, 2, 5**

52. a—Brand and generic names are as follows: Celexa (citalopram), Nardil (phenelzine), Eldepryl (selegiline), and Parnate (tranylcypromine). **Domain 1**

53. d—HIPAA does not mention any compensatory or punitive damages that may be awarded for HIPAA violations. HIPAA requires that health care providers ensure that patient confidentiality be maintained, establishes conditions on the use and the disclosure of protected health information (PHI), and requires patient notification on how their PHI will be used. Also, through HIPAA, patients are entitled to a complete discussion of health care options from health care providers, and patients may request that confidential communication is made in a manner that they believe is appropriate. Every organization must have a written privacy procedure, and training must be provided for all employees. **Domain 2**

54. c—MERF stands for Medication Error Reporting Form, which informs manufacturers of errors caused by commercial packaging and labeling. USP-ISMP stands for the United States Pharmacopeia–Institute for Safe Medication Practices. MedWatch is the Food and Drug Administration (FDA) Medical Products Reporting Program; there is no such thing as an FDA Form 79. **Domains 4, 5**

55. b—This is a dilution problem that can be solved by using the formula (IS)(IV) = (FS)(FV), where IS is 80%, FS is 1 : 5000 or 0.2%, and FV is 500 mL. Substituting these values into the equation results in 1.25 mL of the 80% solution to be used. **Domain 1**

56. d—Solve using a proportion: 2 mEq/mL = 40 mEq/X mL, where X = 20 mL. **Domain 3**

57. d—Use the following formula: (IS)(IV) = (FS)(FV) or (100%)(X mL) = (2%)(1000 mL). One will need 20 mL of the 100% solution. The amount of diluent needed can be calculated by subtracting the initial volume from the final volume: 1000 mL − 20 mL = 980 mL of diluent. **Domain 3**

58. d—Patient monitoring functions include therapeutic duplication; drug–allergy, drug–drug, drug–food, drug–disease, and drug–laboratory test interactions; and intravenous compatibilities. **Domain 9**

59. c—Normal saline is a 0.9% (w/v) solution; % w/v is the number of grams/100 mL × 100. **Domain 3**

60. a—Januvia has been approved for the treatment of type 2 diabetes, Lunesta is indicated for insomnia, Remeron is used to treat depression, and telithromycin is an antibiotic. **Domain 1**

61. d—Medicare Part D pays for prescriptions for Medicare patients enrolled in the plan. **Domain 8**

62. a—Quinapril (Accupril) is an ACE inhibitor. The suffix *-pril* indicates the medication is an ACE inhibitor. **Domain 1**

63. b—Sales of pseudoephedrine must be recorded in a book that is retained in the pharmacy for a minimum of 2 years. **Domain 2**

64. c—Nitrostat is an example of a sublingual medication used in the treatment of angina. **Domains 1, 3**

65. c—Although the expression "prn" means as needed, a prescription with "prn" refills can only be refilled up to 1 year from the date the medication was prescribed. Any additional refills require the prescriber's approval. **Domains 2, 6**

66. b—Whereas memory (RAM or random access memory) provides the computer with a temporary workspace, read-only memory (ROM) provides a permanent storage place. **Domain 9**

67. a—The Durham Humphrey Amendment defines both prescription and over-the-counter medications. All prescription medications contain the federal legend. **Domain 2**

68. b—The Institute of Safe Medication Practices (ISMP) has developed pharmacy resources to assist in the reduction of medication errors. Examples of these resources include the "do not crush," "error-prone abbreviations," and "sound-a-like, look-a-like drug" lists. **Domain 4**

69. b—A Pyxis machine is an example of an automatic dispensing machine commonly found in hospitals. **Domain 9**

70. c—1 (one) tab (tablet) po (by mouth) bid (twice a day) × (times) 14 d (14 days) for URI (upper respiratory infection). **Domain 6**

71. c—MERP is overseen by the ISMP. **Domains 4, 5**

72. c—The FDA oversees FAERS. **Domain 5**

73. d—The telephone number is not required on the prescription label, but it is required on the prescription. **Domains 2, 6**

74. b—"BS" means blood sugar. **Domains 1, 6**

75. c—Convert the weight in pounds to kg (187 lb/2.2 lb/kg = 85 kg). Multiply the daily dose by the weight of the individual (50 mg/kg/day × 85 kg = 4250 mg/day). Multiply the daily amount by the length of therapy (4250 mg × 10 days = 42,500 mg). Calculate the number of capsules by dividing the total weight by the weight per capsule (42,500 mg/250 mg per capsule = 170 capsules). **Domains 3, 6**

76. d—USP <797> addresses the potential for a pathogen to be introduced into the body by way of an injection. In this chapter of the USP, aseptic technique is one of methods used to prevent the introduction of pathogens when compounding sterile products. **Domains 3, 5**

77. a—The board of pharmacy establishes regulations for the practice of pharmacy within the state. **Domain 2**

78. d—Some of the tasks a pharmacy a computer can perform include detecting drug interactions, maintaining patient profiles, and identifying nonformulary drug usage. **Domain 9**

79. b—A pharmacy technician is not permitted to counsel a patient, which is an example of a judgmental task; pharmacy technicians perform technical duties. **Domain 2**

80. b—With any insurance plan, a formulary will be set up stating which drugs will be covered or excluded under the plan. "NDC not covered" means that the product is not covered by the insurance plan. **Domain 8**

81. a—The acronym AAC means actual acquisition cost, which is the cost that a pharmacy pays for a medication after all discounts and rebates have been applied. AWP means average wholesale price, MAC stands for maximum allowable cost for generic medications per an insurance plan's formulary, and U&C means usual and customary (the cost an individual would pay for a medication if it was not covered under a drug prescription plan). **Domain 8**

82. d—All the information should be collected to ensure the patient profile is accurate and to reduce the possibility of drug interactions and contraindications associated with medications. **Domains 2, 4**

83. a—When measuring a liquid in a conical graduate, one should hold the graduate at eye level and look at the bottom of the meniscus. **Domain 3**

84. b—A prescription may only be transferred one time from one pharmacy to another pharmacy of the number of refills remaining. When the prescription is transferred, the original pharmacy notes on the prescription that it has been transferred and is now void. **Domain 2**

85. c—MAC means "maximum allowable cost" when dispensing generic medications. The pharmacy benefits manager will determine the maximum amount of money that will be reimbursed

to the pharmacy for dispensing a medication. If a pharmacy dispenses a generic version of the drug that costs less than the MAC, it will only receive what was paid for the drug. If the drug costs more than the MAC, the pharmacy will be reimbursed up to the MAC. **Domain 8**

86. a—Inventory refers to all of the drugs available for sale; inventory value refers to the cost of the drugs available for sale. **Domain 7**

87. a—Nurses cannot originate an e-PHR; however, the patient, pharmacist, or physician may create an e-PHR. **Domain 9**

88. a—Carbonated beverages should not be mixed with Sandimmune. Chocolate or regular milk and orange juice may be mixed with Sandimmune at room temperature. **Domain 1**

89. c—The expression "pr" means "per rectum." **Domain 6**

90. d—4 drops/ear three times a day is equal to 24 drops. **Domain 6**

91. b—Parenteral medications possess a rapid onset of action; the remaining three answers are disadvantages of parenteral drugs. **Domain 3**

92. b—A pharmacy technician cannot make decisions during drug utilization evaluation if the information identifies drug–drug interactions, drug–disease contraindications, or drug duplications or if any other type of warning is identified. The pharmacy technician must inform the pharmacist immediately. **Domains 2, 4, 5**

93. c—A prescription should be read at least three times during the prescription filling process to reduce the possibility of a prescription error. **Domains 4, 5, 6**

94. c—PAR means periodic automatic replenishment, which is the point in which medication should be reordered. **Domain 7**

95. c—The printer is an output device, not an input device. **Domain 9**

96. c—According to both the PTCB and NHA, a pharmacy technician must earn 20 hours of continuing education every 2 years (1 of those hours must involve pharmacy law) to remain certified. **Domain 5**

97. a—Health saving accounts permit an employee to take income from his or her yearly salary for an account to be used for medical expenses during the year. This money is tax deductible; any money not used during a calendar year is forfeited. **Domain 8**

98. b—Net profit = Selling price − Acquisition price − Expenses: \$55.00 − \$3.75 − \$45.00 = \$6.25. **Domain 8**

99. a—PO is an abbreviation meaning "per os" (by mouth). **Domains 3, 6**

100. a—CMS refers to the Centers for Medicare and Medicaid Services, which is responsible for all Medicare and Medicaid payments. **Domain 8**

CHAPTER 1 ANSWERS

1. a—A therapeutic equivalent medication must contain the same active ingredient, the same dosage form, and the same strength or concentration and be administered by the same route. Although a medication may be approved to be administered by different routes, an injectable solution administered intravenously is not therapeutically equivalent to the solution administered intramuscularly.

2. d—Vasotec (enalapril) is an ACE inhibitor, amlodipine is a calcium channel blocker, Calan (verapamil) is a calcium channel blocker, and Corgard (nadolol) is a beta–blocker.

3. b—escitalopram (Lexapro) is indicated for depression, alprazolam (Xanax) and lorazepam (Ativan) are used to treat anxiety, and ramelteon (Remeron) treats insomnia.

4. b—Albuterol is generic for Proventil or Ventolin, theophylline is generic for TheoDur, and zileuton is generic for Zyflo.

5. c—Insulin glargine is administered once a day.

6. d—The action of warfarin is affected by the presence or absence of vitamin K.

7. c—Levothyroxine is one the medications that requires periodic blood tests performed.

8. b—The generic name for beta-blockers contain the suffix *-olol*, combination alpha-beta blockers contain the suffix *-alol*, some thiazide diuretics

use the suffix *-pamide*, and ACE inhibitors are designated by the *-pril* suffix.

9. d—Zestril is an ACE inhibitor.

10. a—Although all of the listed medications are antiviral agents, only amantadine is indicated in the treatment of influenza.

11. c—Phenazopyridine will discolor the urine.

12. c—Rabeprazole (Aciphex) is a proton pump inhibitor, cimetidine (Tagamet) and ranitidine (Zantac) are H_2 blockers, and sucralfate (Carafate) is a coating agent.

13. c—Latanoprost (Xalatan) is used to treat glaucoma, ciprofloxacin is antibiotic, dexamethasone is a corticosteroid, and naphazoline is an ophthalmic decongestant.

14. a—Antiviral agents are used in the treatment of herpes; fusion inhibitors, non-nucleoside reverse transcriptase inhibitors, and protease inhibitors are indicated for HIV and AIDS.

15. d—Sumatriptan (Imitrex) is used to abort migraine headaches.

16. b—Potassium supplements are often prescribed for patients taking thiazide diuretics because the body is depleted of potassium. Amiloride, spironolactone, and triamterene are potassium-sparring diuretics.

17. c—Metformin is a biguanide hypoglycemic agent, glyburide and glipizide are sulfonylureas hypoglycemic agents, and repaglinide is classified as an "other" hypoglycemic agent.

18. d—Tetracycline may cause birth defects if taken during pregnancy.

19. b—Lexapro's generic name is escitalopram. Duloxetine is generic for Cymbalta, fluoxetine is generic for Prozac, and paroxetine is generic for Paxil.

20. a—Unlike aspirin, ibuprofen, and naproxen, acetaminophen does not possess any antiinflammatory properties.

21. d—Antibiotics, anticonvulsants, and antifungal agents may reduce the effectiveness of oral contraceptives.

22. a—Clopidogrel is generic for Plavix, enoxaparin is generic for Lovenox, heparin is generic for Heparin, and warfarin is generic for Coumadin.

23. c—Januvia (sitagliptin) is indicated for diabetes.

24. a—Lanoxin (digoxin) is the drug of choice for cardiac arrhythmias, furosemide and triamterene are both diuretics used in cardiovascular disease, and lisinopril is indicated for a variety of cardiovascular diseases but not for arrhythmias.

25. d—Dairy products may be taken by a patient 1 hour before or 2 hours after meals to prevent binding to tetracycline. If taken concurrently, the tetracycline's effectiveness is decreased.

26. d—Valsartan is the generic name for Diovan, irbesartan is generic for Avapro, losartan is generic for Cozaar, and olmesartan is generic for Benicar.

27. c—Kaletra is a protease inhibitor. Combivir, Epivir, and Trizivir are NRTIs.

28. c—Isosorbide dinitrate, isosorbide mononitrate, and nitroglycerin are indicated for angina.

29. a—Combivent is the brand name for ipratropium bromide–albuterol. Lamivudine–zidovudine is generic for Combivir, prochlorperazine is generic for Compazine, and quinupristin–dalfopristin is generic for Synercid.

30. c—Lithium is indicated for bipolar disease, amitriptyline and imipramine are indicated for depression, and pregabalin is indicated for neuropathic pain.

31. c—Nonsteroidal antiinflammatory drugs (NSAIDs) should be taken with food or milk to avoid or reduce stomach distress.

32. d—Sotalol (Betapace) therapy must be initiated in a hospital. The patient must be monitored for the first 48 hours of therapy.

33. c—Patients being prescribed monoamine oxidase inhibitors (MAOIs) should avoid tyramine-containing foods and wines.

34. d—Methimazole (Tapazole) is indicated for hyperthyroidism; levothyroxine, liothyronine, and liotrix are indicated for hypothyroidism.

35. d—Vitamin D_3 is not a water-soluble vitamin; water-soluble vitamins include vitamins B and C.

36. d—Zolpidem (Ambien) is indicated for insomnia. Etodolac and ibuprofen are NSAIDs used to treat pain, inflammation, and fever. Valproic acid is used to prevent seizures.

37. a—Cascara sagrada may be used as a laxative, chondroitin and glucosamine are used to treat osteoarthritis, and cranberry is an antioxidant.

38. d—Tamoxifen is a hormone agent used in chemotherapy, cisplatin is an alkylating agent, etoposide is a mitosis inhibitor, and interferon-α-2a is an interferon.

39. d—Accutane (isotretinoin) is indicated for acne vulgaris; Loprox (ciclopirox) miconazole and tolnaftate are used to treat a variety of l fungal infections.

40. b—Latanoprost (Xalatan) must be refrigerated after it has been opened.

41. d—Tomatoes are a source of vitamin C.

42. c—Meperidine is not an NSAID but rather a narcotic analgesic.

43. d—Enbrel, Humira, and Orencia are all disease-modifying antirheumatic drugs (DMARDs).

44. c—Dovonex (calcipotriene) is used to treat psoriasis, Differin (adapalene) and Azelex (azelaic acid) are indicated for acne vulgaris, and fluorouracil is indicated to treat a variety of cancers.

45. b—Glucovance is a combination product containing glyburide and metformin; the other medications are Metaglip (glipizide–metformin), Actos (pioglitazone), and Prandin (repaglinide).

46. d—Quetiapine is the generic for Seroquel, aripiprazole is generic for Abilify, clozapine is generic for Clozaril, and olanzapine is generic for Zyprexa.

47. a—Benzodiazepines are indicated for anxiety and to induce sleep. Depression can be treated with monoamine oxidase inhibitors (MAOIs), selective serotonin reuptake inhibitors (SSRIs), and tricyclic antidepressants (TCAs).

48. d—Strattera (atomoxetine) is not a controlled substance that is used to treat attention-deficit hyperactivity disorder (ADHD).

49. a—Sildenafil is the generic name for Viagra, selegiline is generic for Eldepryl, tadalafil is generic for Cialis, and vardenafil is generic for Levitra.

50. a—Aluminum hydroxide may cause an individual to experience constipation.

51. d—Fosamax should be taken with 8 oz of water. A patient taking Fosamax should take it first thing in the morning, not lie down for at least 30 minutes after taking the medicine, and wait at 30 minutes before eating.

52. d—Furosemide is a loop diuretic.

53. c—Pregabalin is generic for Lyrica, divalproex is generic for Depakote, gabapentin is generic for Neurontin, and primidone is generic for Mysoline.

54. c—Prednisone should be taken food, latanoprost (Xalatan) and timolol (Timoptic) are ophthalmic agents, and ondansetron (Zofran) is indicated for severe nausea.

55. a—Benadryl is an antihistamine that may cause drowsiness.

56. d—Simvastatin is the generic name for Zocor, rosuvastatin is generic for Crestor, lovastatin is generic for Mevacor, and ezetimibe is generic for Zetia.

57. c—Momentasone is the generic name for Nasonex, fluticasone is generic for Flonase or Flovent, and triamcinolone is generic for Azmacort. Budesonide is a generic drug and does not have a branded name in the United States.

58. b—Hydrochlorothiazide

59. c—Methimazole (Tapazole) is indicated for hyperthyroidism, levothyroxine is used for hypothyroidism, medroxyprogesterone is indicated for amenorrhea, and zolmitriptan is used for migraine headaches.

60. A—Plavix (clopidogrel) is an antiplatelet medication.

61. a—Augmentin is the brand name for amoxicillin trihydrate–potassium clavulanate. Cefuroxime is generic for Ceftin, ciprofloxacin is generic for Cipro, and telithromycin is generic for Ketek.

62. b—Cephalexin is used to treat a bacterial infection, acyclovir is used for viral infections, clotrimazole is used for fungal infections, and stavudine is used for viral infections (HIV or AIDS).

63. a—Guaifenesin is an expectorant, cetirizine and loratadine are respiratory allergy medications, and oxymetazoline is a decongestant.

64. a—Alprazolam is used to treat anxiety, carbamazepine and valproic acid are used to prevent convulsions, and cephalexin is an antibiotic.

65. c—Klor-Con is a potassium supplement used in conjunction with non–potassium-sparing diuretics.

66. c—Actonel is indicated for osteoporosis.

67. a—Acetaminophen is the active ingredient in Tylenol.

68. c—The generic name for Flomax is tamsulosin. Doxazosin is generic for Cardura, dutasteride is generic for Avodart, and terazosin is generic for Hytrin.

69. a—Vitamin A is a fat-soluble vitamin; vitamins B_1, B_2, and C are water-soluble vitamins.

70. a—Medications classified as category A have been determined to be safe to use in pregnant women.

71. d—Tolterodine is the generic name for Detrol LA, prazosin is generic for Minipress, and terazosin is generic for Hytrin. Flutamide is not a branded drug in the United States.

72. a—Carbamazepine (Tegretol) is indicated for both bipolar disease and epilepsy, lithium is used in the treatment of bipolar disease, olanzapine–fluoxetine is indicated for bipolar disease and depression, and risperidone is used to treat schizophrenia.

73. c—Singulair is a leukotriene inhibitor.

74. b—Multaq (dronedarone) is indicated for arrhythmias, Cogentin (benztropine) is used in the treatment of Parkinson disease, Seroquel (quetiapine) is indicated for schizophrenia, and Zerit (stavudine) is used in the treatment of HIV or AIDS.

75. a—The generic name for Aricept is donepezil; the other brands are Namenda (memantine), Exelon (rivastigmine), and Cognex (tacrine).

CHAPTER 2 ANSWERS

1. b—The first five numbers identify the drug manufacturer, the middle four numbers identify the drug product, and the last two numbers identify the packaging.

2. b—The Food, Drug, and Cosmetic Act of 1938 defined adulteration and misbranding. Misbranding involves labeling.

3. b—The Occupational Safety and Health Act of 1970 required that work sites be safe for the employees.

4. d—The Poison Prevention Act of 1970 required that all prescriptions be prepared in child-resistant containers except in five different situations. A patient requesting an easy-open container is one of the situations.

5. b—This is an example of adulteration, which is prohibited under Food, Drug and Cosmetic Act of 1938.

6. c—The Durham-Humphrey Act of 1950 allows a prescription to be telephoned from a physician's office.

7. d—Nitroglycerin is an example of a medications that does not need to be in a child-resistant container according to the Poison Control Act.

8. c—The Durham-Humphrey Act clearly defined legend and OTC medications.

9. c—The Durham-Humphrey Act stated that all legend medications must bear the following: "Federal law prohibits the dispensing of this medication without a prescription."

10. c—The Controlled Substances Act allows a DEA Form 222 to be valid for 60 days after it is signed by the pharmacist in charge or an individual with the power of attorney.

11. c—The Occupational Safety and Health Act of 1970 was written to protect workers from hazards in the workplace. Safety Data Sheets (SDS, formerly known as Material Safety Data Sheets [MSDS]) are required to inform an individual of the hazards of handling a particular product and the appropriate treatment if one comes in contact with the substance.

12. b—The Controlled Substances Act allows for the partial filling of a Schedule II medication prescription, with the remaining medication to be provided to the patient within 72 hours or the quantity becomes void.

13. d—The Controlled Substances Act allows for the partial filling of a Schedule III to V medication on the request of the patient. The remaining balance of medication can be dispensed only if the physician has indicated a refill on the prescription. The total number of units of medication or refills cannot exceed what is indicated on the prescription.

14. a—The first letter of a physician's DEA number will be A, B, F, or M. The second letter is the first letter of the physician's last name at the time he or she applied for the DEA number. DEA numbers are required as a result of the Controlled Substances Act.

15. c—The Controlled Substances Act requires that a pharmacy use DEA Form 222 to purchase Schedule II medications. The DEA Form 222 issued to a pharmacy is specific to that pharmacy for the use of ordering or transferring Schedule II medications. The DEA Form 222 cannot be lent to another pharmacy.

16. c—DEA Form 222 can be used to transfer Schedule II medications, such as Percocet, to another pharmacy.

17. b—On discovery of a theft of controlled substances, the local law enforcement agency must be notified, and DEA Form 106 needs to be submitted.

18. c—HIPAA is concerned with insurance reform, patient confidentiality, and security of computer systems.

19. b—Centers for Medicare and Medicaid Services (CMS) oversees the operation and reimbursement of these two federal programs.

20. d—The Food, Drug, and Cosmetic Act (FDCA 1938) created the FDA, and one of its duties is to review Investigational New Drug Applications.

21. d—The Harrison Narcotic Act required a prescription for opium-containing products.

22. b—Comprehensive Drug Abuse Prevention and Control Act

23. c—The Omnibus Reconciliation Act of 1990 (OBRA '90) requires drug utilization evaluation (formerly known as drug utilization review) on all prescriptions and medication orders and an offer to counsel patients on their prescriptions. Failure to perform these tasks may result in monetary penalties and the loss of Medicaid funds.

24. a—The Durham-Humphrey Act allowed prescriptions to be called to the pharmacy from a physician's office.

25. c—Tax-free saving accounts were created under the Medicare Drug Improvement and Modernization Act of 2003.

26. c—The Omnibus Reconciliation Act of 1987 was concerned with care in long-term care facilities; one of the items it addresses is the use of unnecessary medications.

27. d—The Poison Control Act of 1970 allows nasal inhalers to be dispensed without child-resistant containers.

28. d—The Medicare Drug Improvement and Modernization Act of 2003 lowered the reimbursement rate for durable medical equipment.

29. d—The Prescription Drug Marketing Act prohibits the reimportation of medication into the United States. This law is being reexamined.

30. d—The state boards of pharmacy (BOPs) oversee the practice of pharmacy in their respective states.

31. a—A class I drug recall may cause irreversible injury or possibly death to a patient, a class II drug recall may cause reversible harm to the patient, and a class III drug recall does not cause injury to the patient.

32. d—The Nuclear Regulatory Commission (NRC) is responsible for the dispensing of radiopharmaceuticals

33. c—USP <795> addresses nonsterile compounding, and USP <797> deals with sterile compounding.

34. a—The state BOP is responsible for the practice of pharmacy within a state to include the requirements for dispensing generic medications.

35. b—Under the Combat Methamphetamine Epidemic Act of 2005, the maximum amount of pseudoephedrine that may purchase in a single day is 3.6 g; the maximum amount that may be purchased in a 30-day time period is 9 g.

36. b—The health and safety of the patient is the most important consideration for a pharmacy technician.

37. d—A manufacturer's drug label is required to contain the manufacturer's control (lot) number, expiration date of the medication, and NDC number for the medication. Other pieces of required information include the proprietary name if it is branded drug, the nonproprietary name, the quantity of medication in the package, and manufacturer's name.

38. c—The Controlled Substances Act specifies that a DEA permit is valid for 3 years.

39. a—Beyond-use dates are assigned to both sterile and nonsterile compounded products.

40. d—All of the above may indicate that a prescription has been forged, especially if it is a controlled substance.

CHAPTER 3 ANSWERS

Note: There may be more than one way to do many of these problems.

1. Answer = 50,000 tablets. Convert 30 g to micrograms by multiplying by 1,000,000. Divide 30,000,000 mcg by 600 mcg/tablet.

2. Answer = 200 mcg. Convert mg to micrograms by multiplying 0.2 mg by 1000 mcg/mg.

3. Answer = 25 mg. Multiply 5 mg by 3 days. Multiply 2½ mg by 4 days. Add the sum of these two products.

4. Answer = 50 mcg. Convert 0.05 mg to micrograms. Multiply 0.05 mg by 1000 mcg.

5. Answer = 1.33 mL. This is a proportion problem that uses both Arabic and Roman numerals (V = 5 and VIISS = 7.5). Set the proportion up as 7.5 gr/2 mL = 5 gr/X mL.

6. Answer = 6.25 g. Multiply 250 mcg/tablet by 25,000 tablets. Divide the product 1,000,000 mcg/g.

7. Answer = 0.4 mg. 1 grain is equal 65 mg. Solve by using the following proportion: 65 mg/1 gr = X mg/1/150 gr.

8. Answer = 3.0 g of antipyrine. Use the following formula: Final weight × % (expressed as a decimal) = Amount of active ingredient, where 60 g is the final weight and 5% is equal to 0.05.

9. Answer = 7 mL. This problem can be solved by using the following proportion: 50 mg/5 mL = 70 mg/X mL.

10. Answer = 5000 mcg. Solve using a proportion: 20 mg/2 mL = X mg/0.5 mL, where X = 5 mg. Convert 5 mg to micrograms by multiplying by 1000 mcg/mg.

11. Answer = 187.5 to 375 mg. Convert pounds to kilograms (165 lb × 1 kg/2.2 lb). Multiply the weight in kilograms by 2.5 mg to obtain the lower dose and multiply the weight in kilograms to obtain the upper dose.

12. Answer = 49 capsules. Convert pounds to kilograms (154 lb × 1 kg/2.2 lb). Multiply the weight in kilograms by 25 mg/kg to obtain the dose per day. Multiply the daily dose by 7 days. Divide the total dose by 250 mg per capsule to obtain the number of capsules needed.

13. Answer = 9.54 mL. Convert pounds to kilograms (140 lb × 1 kg/2.2 lb). Multiple the weight in kilograms by 15 mg/kg to obtain the daily dosage required. To calculate volume desired, solve using a proportion: 100 mg/mL = daily dosage/X mL.

14. Answer = 0.6 mL. This can be solved using a proportion: 250 mg/10 mL = 15 mg/X mL. Cross-multiplying and dividing will provide you with the answer.

15. Answer = 12.5 mg. Convert weight in pounds to kilograms (55 lb × 1 kg/2.2 lb). Multiply weight in kilograms by 500 mcg/kg to obtain the correct dose in micrograms. Convert micrograms to milligrams by multiplying micrograms by 1 mg/1000 mcg.

16. Answer = 0.05 mL. The problem can be solved by using two proportions. First, convert 330 mcg to milligrams (1000 mcg/1 mg = 330 mcg/X mg, where X = 0.330 mg). Next, calculate the number of milliliters by using the following formula: 6.6 mg/mL = 0.330 mg/X mL.

17. Answer = 0.58 mL. This can be solved using a proportion: 2.5 mg/2 mL = 0.725 mg/X mL.

18. Answer = 1.2 mL. This can be solved using a proportion: 80 mg/mL = 100 mg/X mL.

19. Answer = 10 g. Convert 20 mg to grams by using the following proportion: 1000 mg/1 g = 20 mg/X g, where X = 0.02 g. Next, determine the number of mL in 0.5 L by using a proportion: 1 L/1000 mL = 0.5 L/X mL, where X = 500 mL. Next, use a proportion to solve for the number of grams: 0.02 g/1 mL = X g/500 mL, where X = 10 g.

20. Answer = 32 doses. One tablespoon is equal to 15 mL, and 1 pint is equal to 480 mL. Solve using a proportion: 15 mL/1 dose = 480 mL/X doses, where X = 32 doses.

21. Answer = 56 tablets. Solve using the following proportion: 75 mg dose/1 tablet = 300 mg dose/X tablets, which is 4 tablets. The abbreviation "bid" means twice per day. Solve for the number of tablets: 4 tablets/dose × 2 doses/day × 7 days = 56 tablets.

22. Answer = 4%. Convert the ratio to a proportion (1 : 25 is equal to 1/25). Next, multiply 1/25 by 100 to obtain the answer of 4%.

23. Answer = 0.5%. Convert the ratio to a proportion (1 : 200 is equal to 1/200). Next, multiply 1/200 by 100 to obtain the answer of 0.5%.

24. Answer = 77° F. Solve by using the formula 9C = 5F − 160, where you replace the C with 25: (9)(25) = (5)(F) −160, and perform the necessary operations.

25. Answer = 18.33° C. Solve by using the formula 9C = 5F − 160, where you replace the F with 65: (9)(C) = (5)(65) − 160, and perform the necessary operations.

26. Answer = 104° F. Solve by using the formula 9C = 5F − 60, where you replace the C with 40: (9)(40) = (5)(F) −160 and perform the necessary operations.

27. Answer = 7° C. Solve by using the formula 9C = 5F − 160, where you replace the F with 45: (9)(C) = (5)(F) − 160 and perform the necessary operations.

28. Answer = 0.48 mL. This can be solved as a proportion using international units: 500,000 units/1.2 mL = 200,000 units/X mL.

29. Answer = 1.0 mL. This is a proportion problem. 50 units/2 mL = 25 units/X mL, where X = 1.0 mL.

30. Answer = 3.5 mL. This is a proportion problem. 50,000 units/1 mL = 175,000 units/X mL, where X = 3.5 mL.

31. Answer = 3 packets. This is a proportion problem using mEq: 20 mEq/1 packet = 60 mEq/X packets, where X = 3 packets.

32. Answer = 7.5 mL. Solve this problem using the following proportion: 40 mEq/tbsp = 20 mEq/X mL, where X = 7.5 mL.

33. Answer = 800 doses. Convert 0.120 g to micrograms (1,000,000 mcg/1 g = X mcg/0.120 g, where X = 120,000 mcg). Calculate the number of doses using a proportion: 150 mcg/1 dose = 120,000 mcg/X doses, where X = 800 doses.

34. Answer = 200 mL. The patient is to take 250 mg four times per day for 10 days. 250 mg is contained in a 1-tsp (5-mL) dose: (5 mL/dose)(4 doses/day)(10 days) = 200 mL.

35. Answer = 7.5 mL. Convert 25 lb to kilograms using the following proportion: 2.2 lb/1 kg = 25 lb/X kg, where X = 11.36 kg. Multiply patient's weight (kg) by the dose (4 mg/kg) or (4 mg/kg)(11.36 kg) = 45.45 mg. Calculate the number of milliliters needed: 30 mg/5 mL = 45.45 mg/X mL, where X = 7.5 mL.

36. Answer = 108 mg/kg. Convert the weight of the child in pounds to kilograms by dividing 33 lb by 2.2 lb/kg, which equals 15 kg. Calculate the amount of aspirin the child consumed by multiplying 20 tablets by 81 mg/tablet, which equals 1620 mg. Solve using a proportion: 1620 mg/15 kg = X mg/1 kg, which equals 108 mg/kg.

37. Answer = 166.67 mg/kg. Calculate the weight in kilograms by dividing 44 lb by 2.2 lb/kg, which equals 20 kg. Calculate the number of milligrams per day by multiplying 25 mg/kg/day by 20 kg, which equals 500 mg. The patient is to receive three equal doses. Divide the total amount of medication by three doses (500 mg/3 doses = 166.67 mg/dose).

38. Answer = 25 mg. Solve using Young's rule. Young's rule = {Age (in years)/[Age (in years) + 12]} × Adult dose. In this problem, the child is

4 years old, and the adult dose is 100 mg. Substituting into the equation will result in the following: [4/(4 +12)] × 100 mg = 25 mg.

39. Answer = 50 mg. Solve by using Young's rule. 36 months/12 months/year = 3 years. [(3)/(3 + 12)] × 250 mg = 50 mg.

40. Answer = 17 mg. Solve using Young's rule: [2.5/(2.5 + 12)] × 100 mg = 17 mg.

41. Answer = 15 mg. Solve using Clark's rule. Clark's rule = (Weight [lb]/150) × Adult dose = Amount of dose (45/150) × 50 mg = 15 mg.

42. Answer = 5 mL. Solve using Clark's rule: (50/150) × 15 mL = 5 mL.

43. Answer = 200 mg. Solve using Clark's rule: (60/150) × 500 mg = 200 mg.

44. Answer = 16.5 mg. Solve using Clark's rule. First convert kilograms to pounds: 1 kg/2.2 lb = 15 kg/X lb, where X equals 33 lb. Substitute into the equation: (33/150) × 75 mg = 16.5 mg.

45. Answer = 0.76. Specific gravity (SG) = Weight of a substance/Weight of an equal volume of water, where 1 mL of water weighs 1 g. You have been given the weight (95 g) and volume of the substance (125 mL = 125 g). SG = 95/125 or 0.76.

46. Answer = 76 mL. Specific gravity = 1.05 and weight is 80 g. Substituting into the equation for specific gravity: 1.05 = 80/X, where X = 76 mL.

47. Answer = 125 g. Specific gravity is 1.25 and equal volume of liquid is 100 mL. Substituting into the equation for specific gravity: 1.25 = X/100, where X = 125 g.

48. Answer = 0.8. Weight of substance is 60 g, and it occupies a volume of 75 mL. Substituting into the equation for specific gravity: SG = 60/75, where the SG = 0.8.

49. Answer = 2.5 g. 1 L = 1000 mL. Convert percent to a decimal (%/100 or 0.25%/100 = 0.0025). Solve using the following equation: Final volume (FV) × % (expressed as a decimal) = Amount of active ingredient (AI). 1000 mL × 0.0025 = 2.5 g of silver nitrate. In this situation, because it is a solution (w/v), the AI will be expressed in grams.

50. Answer = 22.7 g. 1 lb = 454 g. Convert the % (5%) to a decimal (0.05). Solve using the following equation: FW × % (decimal) = Amount of AI (g) or 454 g × 0.05 = 22.7 g. The AI is expressed in grams because it is a w/w problem.

51. Answer = 1.125 g. Convert % (0.45%) to a decimal (0.0045). Solve using the following equation: FV × % (decimal) = Amount of AI (g) or 250 mL × 0.0045 = 1.125 g. The answer must be expressed in grams because it is a w/v problem.

52. Answer = 5 g. 1 : 200 is a ratio. 1 L = 1000 mL. Convert ratio (1 : 200) to a fraction (1/200) and express the answer as a decimal (0.05). This is a w/v problem and can be solved using the following: FV (1000 mL) × Percent as a decimal (0.005) = Amount of AI (5 g).

53. Answer = 10,000 mcg. Convert ratio (1 : 100) to a fraction (1/100) to a decimal (0.01). In this problem, the FV (1.0 mL) × % as a decimal (0.01) = 0.01 g. One is asked to answer the problem in micrograms, which can be converted by (0.01 g)(1000 mg/1 g)(1000 mcg/1 mg) = 10,000 mcg.

54. Answer = 4.88%. This is a dilution problem and can be solved using the following equation: Initial strength (IS) × Initial weight (IW) = Final strength (FS) × Final weight (FW). IS = 5%, IW = 120 g, FS (unknown), FW = 123 g. (5%)(120 g) = (X%)(123 g), where X = 4.88%.

55. Answer = 60 tablets. 8 oz of ointment is approximately 240 g. The problem can be solved using the following equation: FW × % (decimal) = Amount of AI (g) or 240 g × 0.15 = 36 g or 3600 mg (36 g × 1000 mg/g) of active ingredient. To calculate the number of tablets needed, divide the total amount of AI by the weight of one tablet, which is 36,000 mg/600 mg/tablet = 60 tablets.

56. Answer = 30 mL. This is a dilution problem and can be solved using (IS)(IV) = (FS)(FV), where IS (3%), IV (unknown), FS (1 : 200), and FV (6 oz). One needs to make sure that both the strengths and volumes are in common terms. Convert the ratio (1 : 200) to a fraction (1/200) to a decimal (0.005) to a percent (0.005 × 100 = 0.5%). Next, convert ounces (6 oz) to milliliters: (6 oz)(30 mL/oz) = 180 mL. Substitute into the following equation: (IS)(IV) = (FS)(FV) or (IV)(3%) = (0.5%)(180 mL), where IV is 30 mL.

57. Answer = 64%. This is a dilution problem and can be solved using the following: (IS)(IV) = (FS)(FV), where IS = unknown, IV = 2 oz, FS = 4%, and FV = 32 oz (4 bottles × 8 oz/bottle). (IS)(2 oz) = (4%)(32 oz), where IS = 64%.

58. Answer = 6.67 mL. This is a dilution problem and can be solved using (IS)(IV) = (FS)(FV), where IS = 75%, IV = unknown, FS = 4%, and FV = 125 mL: (75%)(IV) = (4%)(125 mL), where IV = 6.67 mL.

59. Answer = 2.5%. 1 L = 1000 mL. This is a dilution problem, where IS = 25%, IV = 100 mL, FS = unknown, and FV = 1000 mL: (25%)(100 mL) = (FS)(1000 mL), where FV = 2.5%.

60. Answer = 76.8 mL. This is a dilution problem, where IS = 75%, IV = unknown, FS = 72%, and FV = 80 mL: (75%)(IV) = (72%)(80 mL), where IV = 76.8 mL.

61. Answer = 476 mL. 1 gallon = 3840 mL. This is a dilution problem, where IS = 10%, IV = unknown, FS = 1.24%, and FV = 3840 mL: (10%)(IV) = (1.24%)(3840 mL), where IV = 476 mL.

62. Answer = 51 g. One ounce (wt) is approximately 30 g. This is a dilution problem, where IS = 10%, IW = 120 g (4 oz × 30 g/oz), FS = 7%, and FW = unknown: (10%)(120 g) = (75%)(FW) where FW = 171 g. The problem is asking for the amount of diluent to be added. FW − IW = Amount of diluents, or 171 g −120 g = 51 g of diluent.

63. Answer = 10 mL. This is a dilution problem where the concentrations are expressed as ratios, but it can be solved in the same way. IS = 1 : 20, IV = unknown, FS = 1 : 100, and FV = 50 mL: (1 : 20)(IV) = (1 : 100)(50 mL), where IV = 10 mL.

64. Answer = 91.94 mL. This is a dilution problem using ratios as concentrations. IS = 1 : 6, IV = unknown, FS = 1 : 8, and FV = 125 mL: (1 : 6)(IV) = (1 : 8)(125 mL), where IV = 91.94 mL.

65. Answer = 33 mL. This is a dilution problem using ratios as concentrations. IS = 1 : 2, IV = unknown, FS = 1 : 3, and FV = 50 mL: (1 : 2)(IV) = (1 : 3)(50 mL), where IV = 33 mL.

66. Answer = 25 mL. 2 L = 2000 mL (2 L × 1000 mL/L). This is a dilution problem using ratios as concentrations. IS = 1 : 50, IV = unknown, FS = 1 : 4000, and FV = 2000 mL, where IV = 25 mL.

67. Answer = 750 mL. This is a dilution problem using ratios as concentrations. IS = 1 : 2000, IV = 500 mL, FS = 1 : 5000, and FV = unknown: (1 : 2000)(500 mL) = (1 : 5000)(FS), where FS = 1250 mL. The problem is asking for the amount of diluent to be added and can be calculated by subtracting the initial volume from the final volume. 1250 mL − 500 mL = 750 mL of diluent.

68. Answer = 2400 mL. 1 quart = 960 mL. This is a dilution problem asking for the amount of diluent (water) to be added in preparing this compound. IS = 70%, IV = 960 mL, FS = 20%, and FV = unknown: (70%)(960 mL) = (20%)(FV), where FV = 3360 mL. FV − IV = amount of diluent to be added or 3360 mL − 960 mL = 2400 mL.

69. Answer = 1 mL. This is a dilution problem using concentration expressed as milligrams per milliliter but can be solved the same way. IS = 5 mg/mL, IV = unknown, FS = 0.5 mg/mL, and FV = 10 mL: (5 mg/mL)(IV) = (0.5 mg/mL)(10 mL), where IV = 1 mL.

70. Answer = 3.75 mL of cefazolin; 11.25 mL of diluent. This is a dilution problem that can be solved using the following formula: (IS)(IV) = (FS)(FV), where the IS = 1 g/5 mL or (1000 mg/5 mL), IV is unknown, the FS is 50 mg/mL, and the FV is 15 mL. (1000 mg/5 mL)(IV) = (50 mg/mL)(15 mL), where the IV = 3.75 of cefazolin. The problem asks for the amount of diluent that is needed and can be solved using (FV) − (IV) =Amount of diluent: (15 mL) − (3.75 mL) = 11.25 mL of diluent.

71. Answer = 3 mL of vitamin B_{12} and 27 mL of diluent. This is a dilution problem that can be solved using the following formula: (IS)(IV) = (FS)(FV), where the IS = 1 mg/mL or 1000 mcg/mL, IV is unknown, FS = 100 mcg/mL, and FV = 30 mL: (1000 mcg/mL)(IV) = (100 mcg/mL)(30 mL), where IV = 3 mL. The amount of diluent = FV − IV or 30 mL − 3 mL = 27 mL.

72. Answer = 30 mL. This is a dilution problem where concentrations are expressed as a concentration and a percentage. The concentrations need to be expressed in the same terms. Convert the ratio (1 : 4) to a percent (25%). This is a dilution problem that can be solved using the following formula: (IS)(IV) = (FS)(FV), where IS = 30%, IV is unknown, FS = 25%, and FV = 36 mL: (30%)(IV) = (25%)(36 mL), where IV = 30 mL.

73. Answer = 0.35 mL. This is a dilution in which concentrations are expressed as both percentages and in grams per milliliter; therefore, the concentrations must be expressed in the same terms; 28% means that that 28 g is in 100 mL of solution or 0.28 g/mL. IS = 42 g/mL, IV is unknown, FS = 0.28 g/mL, and FV = 52 mL: (42 g/mL)(IV) = (0.28 g/mL)(52 mL), where X = 0.35 mL.

74. Answer = 1 mL. This is a dilution problem with concentrations expressed as both percentages and a ratio. Convert 1 : 100,000 to a percent (0.001%); IS = 0.5%, IV is unknown, FS = 1/100,000, and FV = 500 mL: (0.5%)(IV) = (0.001%)(500 mL), where IV = 1 mL.

75. Answer = 0.96 mL. This is a dilution problem with strengths being expressed as both percentages and in milligrams per liter. w/v% is the number of grams per 100 mL of solution. Convert 100 mg/1000 mL to a percent, which is 0.01%.

76. Answer = 379 mL. This is a dilution problem with concentrations expressed in percentages. IS = 95%, IV is unknown, FS = 75%, and the FV is 1 pint (480 mL): (95%) × (IV) = (75%) × (480 mL), where X = 379 mL.

77. Answer = 95%—5 : 9; 50%—4 : 9. This is an alligation problem. Draw a tic-tac-toe table, placing the highest concentration (95%) in the upper left corner, the desired concentration (75%) in the middle, and the lowest concentration (50%) in the bottom left corner. Subtract the concentrations in a diagonal manner and place the number opposite the remaining concentration. 95% − 75% = 20 parts of 50%. 75% − 50% = 25 parts of 95%. Total all of the parts (45); 95% will require 25/45 (5 : 9), and 50% will require 20/45 (4 : 9).

78. Answer = 7.5%—55.6 mL; 1 : 2000—64.4 mL. This is an alligation problem. Convert 1 : 2000 to a percent (0.5%). Draw a tic-tac-toe table, placing the highest concentration (7.5%) in the upper left corner, the desired concentration (3.5%) in the middle, and the lowest concentration in the bottom left corner (0.5%). Subtract the concentrations in a diagonal manner and place the number opposite the remaining concentration. Calculate the proportions of each needed and multiply by the quantity to be prepared. 7.5%: (3 parts/7 parts) × 120 mL = 55.6 mL; 0.5%: (4 parts/7 parts) × 120 mL = 64.4 mL.

79. Answer = 2.5%—109 mL; 0.9%—391 mL. This is an alligation problem. Draw a tic-tac-toe table, placing the highest concentration (2.5) in the upper left corner, the desired concentration (1.25) in the middle, and the lowest concentration (0.9%) in the bottom left corner. Subtract the concentrations in a diagonal manner and place the number opposite the remaining concentration. Calculate the proportions of each needed and multiply by the quantity to be prepared. 2.5%: (0.4 parts/1.65 parts) × 500 mL = 109 mL; 0.9%: (1.25 parts/1.65 parts) × 500 mL = 391 mL.

80. Answer = 20%—250 mL; 10%—750 mL. This is an alligation problem. Draw a tic-tac-toe table, placing the highest concentration (20%) in the upper left corner, the desired concentration (12.5%) in the middle, and the lowest concentration (10%) in the bottom left corner. Subtract the concentrations in a diagonal manner and place the number opposite the remaining concentration. Calculate the proportions of each needed and multiply by the quantity to be prepared (1 L = 1000 mL). 20%: (2.5 parts/10 parts) × 1000 mL = 250 mL; 10%: (7.5 parts/10 parts) × 1000 mL = 750 mL.

81. Answer = 5%—1.5 parts; 1%—2.5 parts. This is an alligation problem. Draw a tic-tac-toe table, placing the highest concentration (5%) in the upper left corner, the desired concentration (2.5%) in the middle, and the lowest concentration (1%) in the bottom left corner. Subtract the concentrations in a diagonal manner and place the number opposite the remaining concentration. Calculate the proportions of each needed. 5%: 1.5 : 4 and 1%: 2.5 : 4.

82. Answer = 20%—112.5 mL; SWFI—187.5 mL. This is an alligation problem using IV solutions. Draw a tic-tac-toe table, placing the highest concentration (20%) in the upper left corner, the desired concentration (7.5%) in the middle, and the lowest concentration (0%) in the bottom left corner. Subtract the concentrations in a diagonal manner and place the number opposite the remaining concentration. SWFI is sterile water for injection and has a concentration of 0%, and D20W means 20% dextrose in water. Calculate the proportions of each needed and multiply by the quantity to be prepared. 20%: (7.5 parts/20 parts) × 300 mL = 112.5 mL; SWFI: (12.5 parts/20 parts) × 300 mL = 187.5 mL.

83. Answer = 20% and 5%—250 mL; 20%—125 mL, 10%—375 mL. This problem can be prepared using two different combinations (20% and 5%; 20% and 10%) to prepare 500 mL of D12.5. In both situations one must have a concentration above the desired concentration and one concentration below the desired concentration. Draw a tic-tac-toe table, placing the highest concentration (20%) in the upper left corner, the desired concentration (12.5%) in the middle, and the lowest concentration (5%) in the bottom left corner. Subtract the concentrations in a diagonal manner and place the number opposite the remaining concentration. Subtract the concentrations in a diagonal manner and place the number opposite the remaining concentration. Calculate the proportions of each needed and multiply by the quantity to be prepared. 20%: (7.5 parts/15 parts) × 500 mL = 250 mL; 5%: (7.5 parts/15 parts) = 500 mL. Draw a tic-tac-toe table, placing the highest concentration (20%) in the upper left corner, the desired concentration (12.5%) in the middle, and the lowest concentration (10%) in the bottom left corner. Subtract the concentrations in a diagonal manner and place the number opposite the remaining concentration. Subtract the concentrations in a diagonal manner and place the number opposite the remaining concentration. Calculate the proportions of each needed and multiply by the quantity to be prepared. 20%: (2.5 parts/10 parts) × 500 mL = 125 mL; 10%: (7.5 parts/10 parts) × 500 mL = 375 mL.

84. Answer = 120 g. This is an alligation problem to prepare an ointment. Draw a tic-tac-toe table, placing the highest concentration (2.5%) in the upper left corner, the desired concentration (1%) in the middle, and the lowest concentration (0.25%) in the bottom left corner. Subtract the concentrations in a diagonal manner and place the number opposite the remaining concentration. Calculate the proportions of each needed. Set up a proportion to calculate the total weight of the preparation by using the 240 g of 0.25% ointment: 1.5 parts/2.25 parts = 240 g/X, where X = 360 g. To calculate the amount of 2.5% needed, subtract the amount of the 0.25% from the total weight of the compound: 360 g (total weight) − 240 g (weight of 0.25%) = 120 g (weight of 2.5%).

85. Answer = 600 mL. This problem can be solved by multiplying the rate (25 mL/hr) by the amount of time (24 hr): (25 mL/hr) × (24 hr) = 600 mL.

86. Answer = 12.5 mL/hr. Rate = Volume/Time (hr), or 1000 mL/8 hr = 125 mL/hr.

87. Answer = a. 41 mL/hr. Rate = Volume/Time, or 1000 mL/24 hr = 41 hr. A number less than a whole is rounded down in flow rates. b. 10 gtt/min. The problem can be solved by the following formula: Rate × Drop factor × Conversion factor = gtt/min: (41 mL/hr) × (15 gtt/mL) × (1 hr/60 min) = 10 gtt/min.

88. Answer = 0500 hr on the next day. Calculate the amount of time the IV will last (Time = Volume/Time) or 1500 mL/75 mL/hr = 20 hr. The first bag was hung at 0900 hours and will last 20 hours: 0900 hr + 2000 hr − 2400 hr/day = 0500 hr on the next day.

89. Answer = 62.5 mL/hr. Rate = Volume/Time or 250 mL/4 hr = 62.5 mL/hr. Amount of drug/Time. 250 mg/4 hr = 62.5 mg/hr.

90. Answer = 420 mL. Volume = Rate × Time or 120 mL/hr × 3 1/2 hr = 420 mL.

91. Answer = 31 gtt/min. Solve by using: Rate × Drop factor × Conversion factor = gtt/min: (1000 mL/8 hr) × (15 gtt/mL) × (1 hr/60 min) = 31 gtt/min.

92. Answer = 80 mL/hr. Solve by using: Rate = (gtt/min)/(Drop factor) × (Conversion factor): (20 gtt/min)/(15 gtt/mL) × (1 hr/60 min) = 80 mL/hr.

93. Answer = 5 mL/min. Calculate the amount of time 0.1 g (100 mg) would be infused into the body if the patient is receiving 1 mg/min by using a proportion: 1 mg/min = 100 mg/X min, which is 100 min. 100 mg is contained in 500 mL, which will take 100 min to infuse. The flow rate = Volume (500 mL)/Time (100 minutes) = 5 mL/min.

94. Answer = 3.82 mL. Convert the patient's weight from pounds to kilograms (280 lb × 1 kg/2.2 lb = 127.27 kg). Calculate the dose needed: (127.27 kg) × (150 units/kg) = 19,095 units. Solve using a proportion: 5000 units/mL = 19,095 units/X mL, where X = 3.82 mL.

95. Answer = 16 gtt/min. Calculate the rate: (100 mL/1.5 hr) = 66 mL/hr. Calculate drops per minute by multiplying the rate by the drop factor by the conversion factor: (66 mL/hr) × (15 gtt/mL) × (1 hr/60 min) = 16 gtt/min.

96. Answer = 25 gtt/min. Calculate the rate (150 mL/2 hr = 75 mL/hr). Calculate drops per minute by multiplying the rate by the drop factor by the conversion factor: (75 mL/hr) × (20 gtt/mL) × (1 hr/60 min) = 25 gtt/min.

97. Answer = 12 gtt/min. Calculate drops per minute by multiplying the rate by the drop factor by the conversion factor: (50 mL/hr) × (15 gtt/mL) × (1 hr/60 min) = 12 gtt/min.

98. Answer = 62 gtt/min. Rate = 125 mL/hr; drop factor (DF) = 30 gtt/mL and 1 hour/60 min (conversion factor [CF]). Solve using the following formula: Rate × DF × CF = gtt/min: (125 mL/hr) × (30 gtt/mL) × (1 hr/60 min) = 62 gtt/min. Remember drops per minute are always rounded downward when one has a fraction of a drop.

99. Answer = a. 8.33 mg/capsule. You have been given a formula that will yield 24 capsules. Divide the amount of hydrocodone bitartrate (0.2 g) by the number of capsules one is to prepare: 0.2 g/24 capsules = 0.00833 g/capsule. Convert 0.00833 g to milligrams by multiplying 0.0833 g × 1000 mg/g = 8.33 mg/capsule. b. 430 mg per capsule. Add up the total weight of all of the ingredients (10.4 g) and divide by 24 capsules. Each capsule will weigh 0.43 g. Convert grams to milligrams: 0.43 g × 1000 mg/g = 430 mg. c. 75 mg. 0.6 g of caffeine/24 capsules = 0.025 g of caffeine/capsule. Convert grams to milligrams. 0.025 g × 1000 mg/1 g = 25 mg. The directions state that the patient is to take one capsule three times per day. 25 mg of caffeine/capsule × 3 capsules = 75 mg.

100. Answer = 10 1-g Carafate tablets. Calculate the amount of Carafate needed for the compound; this can be done through the use of a proportion: 400 mg/5 mL = X mg/125 mL, where 10,000 mg of Carafate is the entire quantity. One can calculate the number of grams needed by using a proportion: 1 g/1000 mg = X g/10,000 mg, where X = 10 1-g tablets of Carafate.

101. Answer = 43.2 g of iodine; 51.84 g of sodium iodide. You have been asked to prepare 12 dozen 15-mL bottles, which is equal to (12)(12 bottles/1 dozen bottles)(15 mL) = 2160 mL of solution. The formula will make 1000 mL of solution. Calculate the amount needed of each ingredient by using the following formula: (Total quantity needed of compound [TQN]/Quantity required for original formula [QRF]) × Amount of ingredient in original formula: (2160 mL/1000 mL) × 20 g of iodide = 43.2 g of iodide and (2160 mL/1000 mL) × 24 g of sodium iodide = 51.84 g of sodium iodide.

102.

Answer = Benzoyl benzoate	30 mL
Triethanolamine	0.6 mL
Oleic acid	2.4 mL
Purified water to make 500 mL	120 mL

This problem requires a smaller quantity to be made than is called for in the original formula. Use the following formula: (TQN/QRF) × Amount of each ingredient. (120 mL/500 mL) × 125 mL = 30 mL of benzoate; (120 mL/500 mL) × 2.5 mL = 0.6 mL of triethanolamine; (125 mL/500 mL) × 10 mL = 2.4 mL of oleic acid.

103.

Answer = Dextromethorphan	5760 mg (5.76 g)
Guaifenesin	76,800 mg (76.8 g)
Flavored syrup to make 5.0 mL	3840 mL

This problem is enlarged from the original formula and can be calculated using the following formula: (TQN/QRF) × Amount of each ingredient. (3840 mL/5 mL) × 7.5 mg = 5760 mg (5.76 g) of dextromethorphan; (3840 mL/5 mL) × 100 mg = 76,800 mg (76.8 g) of guaifenesin.

104.

Answer = Coal tar	9.08 g
Precipitated sulfur	13.62 g
Salicylic acid	4.54 g
Lidex ointment	108.96 g
Aquabase	317.80 g

This formula is going to be enlarged. One pound is equal to 454 g. This problem is not qs (or brought) to a final weight; therefore, one must add up all the ingredients to determine the weight in the original formula, which is 100 g. The following formula can be used: (TQN/QRF) × Amount of each ingredient. (454 g/100 g) × Amount of each ingredient × 2.0 g = 9.08 g of coal tar; (454 g/100 g) × 3.0 g = 13.62 g of precipitated sulfur; (454 g/100 g) × 1.0 g = 4.54 g of salicylic acid; (454 g/100 g) × 24 g = 108.96 g of Lidex ointment; and (454 g/100 g) × 70 g = 317.8 g of Aquabase.

105.

Answer = Estriol	5 g
Estrone	0.625 g
Estradiol	0.625 g
Polyethylene glycol 1450	14,500.5 kg
Polyethylene glycol 3350	33,500.5 kg

This formula is being enlarged. The following formula can be used: (TQN/QRF) × Amount of each ingredient. (2500 capsules/100 capsules) × 200 mg = 5 g of estriol; (2500 capsules/100 capsules) × 25 mg = 0.625 g of estrone; (2500 capsules/100 capsules) × 25 mg of estradiol; (2500 capsules/100 capsules) × 20 g = 0.5 kg of PEG 1450; and (2500 capsules/100 capsules) × 20 g = 0.5 kg of PEG 3350.

CHAPTER 3 REVIEW QUESTIONS ANSWERS

1. d—USP <797> requires that used syringes be placed in a sharps container.

2. c—USP <797> prohibits that jewelry be worn when compounding sterile products.

3. c—*Reconstitution* is the process of mixing a liquid and powder together to form a suspension. *Geometric dilution* is a technique used in mixing two ingredients of unequal quantities, in which one begins with the smallest quantity and adds an equal quantity of the ingredient having the larger amount; the process continues until all of the ingredients are used. *Blending* is an act of combining two substances together. *Levigation* is trituration of a powder drug with a solvent, in which the drug is insoluble with the solvent. *Trituration* is a process of rubbing, grinding, or pulverizing a powder to create fine particles.

4. c—Characteristics of an absorption base include being anhydrous, difficult to spread after being applied to the area, and nonwashable. Absorption bases are greasy rather than nongreasy.

5. b—Emulsions can be compounded by using the "dry gum," "wet gum," or "beaker" method.

6. b—USP <797> requires that 70% isopropyl alcohol be used to clean a laminar flow hood.

7. b—*Geometric dilution* is a technique used in mixing two ingredients of unequal quantities, in which one begins with the smallest quantity and adds an equal quantity of the ingredient having the larger amount; the process continues until all of the ingredients are used. *Blending* is an act of combining two substances together. *Levigation* is trituration of a powder drug with a solvent, in which the drug is insoluble with the solvent. *Spatulation* is mixing powders using a spatula in a mortar, an ointment slab, or a plastic bag; it is a process used when ingredients may liquefy on mixing; there is no reduction in particle size.

8. d—A *thickening agent* makes a suspension viscous or thicker. An *emulsifier stabilizes* an emulsion. A *flocculating agent* prevents the clumping together of particles. A *mucilage* is a glue-like substance.

9. a—Aquaphor is classified as an absorption ointment base.

10. a—An oleaginous base is anhydrous; the only other anhydrous base is an absorption base. Water–oil emulsion base, oil–water base, and water–miscible bases are hydrous.

11. c—The USP has classified containers as follows: a *single-dose container* is a single-unit container intended for parenteral use, a *tight container* protects the product from contamination, a *single-unit container* is designed to hold a quantity of drug product intended for administration as a single dose after the container is opened, and a *unit-dose container* is a single container intended for administration other than by the parenteral route as a single drug directly from the container.

12. b—An emulsion may be compounded by one of three methods, the dry gum (continental), the wet gum, or the beaker method.

13. c—A syrup may be made either using heat or without heat. It will be prepared quicker with heat, but it must be at a constant temperature.

14. b—Suppositories may be compounded by either using a compression or fusion mold.

15. b—White petrolatum is classified as an oleaginous ointment base.

16. d—Used needles should be placed in a sharps container; gloves, gowns, and masks should be placed in a biohazard bag.

17. c—A total parenteral nutrition product consists of 50% dextrose, 20% fat, and 10% amino acid.

18. b—An oral solid dosage form takes longer to be absorbed into the body than other oral dosage forms.

19. a—A capsule is a dosage form in which the drug is contained in a shell of gelatin (either soft or hard) that dissolves in 10 to 20 minutes. The drug may be in either a solid or a liquid form with the shape being either spherical or ovoid.

20. d—A tablet is prepared either by compressing or by molding. The dosage form is accurate, compact, portable, and easy to administer.

21. a—Effervescent salts are granules or powders; when dissolved in water, they effervesce and release carbon dioxide.

22. b—An advantage of a liquid is that they are easier to swallow than a solid dosage form for many patients.

23. b—An *elixir* is a clear, sweetened, flavored hydroalcoholic solution containing water and alcohol that may or may not be medicated. An *aromatic water* is a solution of water-containing oils that have a smell and are volatile. A *suspension* is a two-phase system in which solid particles are dispersed in a liquid vehicle, which may be oral, topical, or injectable. A *syrup* is an aqueous solution containing sucrose or sucrose substitutes.

24. a—An *emulsion* is a dispersion that may be either water-in-oil or oil-in-water. A *gel* is a two-phase system containing an extremely fine solid particle that, when mixed, it is difficult to distinguish between the two phases, and it is considered a semisolid form. *Lotions* are a liquid for topical application that contains insoluble solids or liquids, and an *ointment* is a homogeneous, viscous, semisolid preparation, most commonly a greasy, thick oil (oil 80% and water 20%) with a high viscosity that is intended for external application to the skin or mucous membranes.

25. c—A *syrup* is an aqueous solution containing sucrose or sucrose substitutes. An *elixir* is a clear, sweetened, flavored hydroalcoholic solution containing water and alcohol that may or may not be medicated. A *spirit* is an alcoholic or hydroalcoholic solution containing volatile aromatic ingredients. A *tincture* is an alcoholic or hydroalcoholic solution of pure chemicals or extracts.

26. b—A *liniment* is a solution that may be an emulsion, alcoholic, or oleaginous solutions that is applied through rubbing. A *gel* is a two-phase system containing an extremely fine solid particle that, when mixed, it is difficult to distinguish between the two phases, and it is considered a semisolid form. A *lotion* is a liquid for topical application that contains insoluble solids or liquids. A *suspension* is a two-phase system in which solid particles are dispersed in a liquid vehicle, which may be oral, topical, or injectable.

27. b—A *solution* contains a solute that is dissolved in a solvent that may be aqueous, alcoholic, or hydroalcoholic. An emulsion is a dispersion that is a solute dispersed through a dispersing vehicle.

28. c—A *pastille,* also known as a *lozenge* or a *troche,* is a solid dosage forms with flavoring that dissolve in the mouth. A pastille is not a sustained-released dosage form.

29. a—A *collodion* is a topical dosage form that contains pyroxylin and is dissolved in alcohol and ether. An *extract* is the process by which active ingredients are removed from their source through the application of solvents. A *liniment* may be an emulsion, alcoholic, or oleaginous solution that is applied through rubbing. A *spirit* is an alcoholic or hydroalcoholic solutions containing volatile aromatic ingredients.

30. a—A suspension has two phases.

31. b—A gel is a two-phase system containing an extremely fine solid particle that, when mixed, it is difficult to distinguish between the two phases, and it is considered a semisolid form.

32. b—Ophthalmic products are required to be isotonic. An isotonic solution should have tonicity equal to that of sodium chloride 0.9%.

33. c—A *solution* contains a solute that is dissolved in a solvent, which may be aqueous, alcoholic, or hydroalcoholic. A *dispersion* contains a solute dispersed through a dispersing vehicle. Examples of dispersions include suspensions, emulsions, gels, lotions, ointments, and creams.

34. c—A sublingual tablet is not a delayed-release dosage form. Sublingual tablets are taken so that the therapeutic effect will occur quickly.

35. d—Pills, tablets, and suppositories are all considered solid dosage forms.

36. d—OSHA oversees hazardous waste and materials and has developed the Hazard Communication Standard, which states that all employees are entitled to be aware of the hazards associated with a specific product that they may come in contact with during their employment.

37. b—Repackaged medications can be assigned a beyond-use date that does not exceed ¼ of the time remaining before the drug expires or a maximum of 6 months.

38. a—The packaging date is not required on the package label. The following information is required on the package label: generic name of the drug, strength, dosage form, manufacturer's name and lot number, and expiration date after repackaging.

39. d—The medication's color does not have to be recorded on the repackaging log. Information required on the repackaging log includes the date of repackaging, drug name, dosage form, drug manufacturer, manufacturer's expiration date and lot number, pharmacy lot number, expiration date assigned by the pharmacy, quantity of drug repackaged, and pharmacy technician's initials (if a pharmacy technician participated in the repackaging). The pharmacist must sign off on the repackaging log.

40. b—A piggyback must be placed higher than the primary intravenous (IV) line so that the fluid flows into the primary IV line.

41. b—There are three possible methods of preparing a 3-1 solution: In method 1, amino acids and dextrose are mixed first. Fat emulsion is added next followed by the additives. In method 2, amino acids are added to the fat emulsion. Dextrose is added next followed by the additives. In method 3, dextrose, amino acids, and fat emulsion are added simultaneously while swirling and mixing. Additives are incorporated last.

42. b—USP <797> states that HEPA filters must be certified every 6 months unless they become wet or damaged and therefore need to certified at the time of the incident.

43. d—USP <797> requires that laminar flow hoods be certified every 6 months.

44. d—Examples of additives that may be added to a TPN include potassium chloride (KCl), potassium phosphate (KPO_3), calcium gluconate (Ca gluconate), magnesium sulfate ($MgSO_4$), sodium phosphate ($NaPO_4$), sodium chloride (NaCl), multivitamin (MVI), multiple trace elements (MTEs), and zinc (Zn).

45. b—A class A balance must have a minimum sensitivity of 6 mg.

46. b—A rubber spatula should be used to in measuring corrosive materials; a steel or plastic spatula may react with the material.

47. a—USP <797> states that 70% isopropyl alcohol be used to clean a laminar flow hood; rubbing alcohol will leave a film on the laminar flow hood.

48. c—The lumen is the opening of a needle. The bevel is the angled tip of the needle where the lumen is found. The hilt of the needle attaches to the hub of the barrel of the syringe. The shaft is the length of the needle.

49. a—Laminar flow hoods should be in a class 100 area, where there are no more than 100 particles that are 0.5 micron or larger per cubic foot of air. The number indicates the number of particles 0.5 micron or larger per cubic foot of air.

50. c—A pipette is used to measure volumes less than 1.5 mL.

51. d—The Direct Compounding Area is the critical area within the ISO class 5 primary engineering control where critical sites are exposed to unidirectional HEPA-filtered air. The buffer area is an area where the preparation and staging of components and supplies used when compounding. The critical area is an ISO class 5 environment, and the critical site is a location that includes any component or fluid pathway surfaces.

52. c—*Sterile water for injection USP* has been sterilized but has no antimicrobial agents and can be used in parenteral solutions. *Purified water USP* is not intended for parenteral administration and is used in the reconstitution of oral products. *Water for injection USP* is not sterile and cannot be used in aseptic compounding of sterile products. *Sterile water for irrigation USP* has been sterilized but contains no antimicrobial agents; it is used as an irrigating solution.

53. a—A size 0 capsule can contain up to 500 mg, size 1 (400 mg), size 2 (300 mg), and size 3 (200 mg).

54. d—USP <797> requires the laminar flow hood blower be on for at least 30 minutes before a sterile compound is prepared.

55. a—A type A hood recirculates a portion of the air (after it first passes through a HEPA filter) within the hood and exhausts a portion of this air back into the parenteral room. A type A laminar flow hood can be converted to a type B hood.

56. d—USP <795> requires that a pharmacy balance be certified every 12 months.

57. a—USP <795> requires that all pharmacies maintain a class A balance.

58. c—USP <797> requires that a laminar flow hood's air velocity must 90 linear feet/min (+/−20%).

59. d—The physician's name does not need to appear on an IV admixture label. The required information includes the name of the pharmacy, patient's name, date the medication was filled, ingredients with quantity of each in IV, total quantity of IV, directions for usage, infusion rate, and expiration date. The label must be initialed by the technician who prepared it and contain the licensed pharmacist's initials.

60. a—The Department of Transportation is responsible for the transportation of hazardous materials.

61. c—Radioactive yellow III has the highest concentration, radioactive yellow II has the second highest, and radioactive white I has the lowest. A radioactive orange IV does not exist.

62. d—A reconstituted product should contain a "Shake Well" label to ensure the medication is mixed thoroughly before administering it.

63. a—OSHA requires that all hazardous drugs and chemical have an SDS.

64. b—Safety Data Sheets (SDS or formerly known as Material Safety Data Sheets [MSDS]) are required to be provided to the purchaser of hazardous drugs and chemicals.

65. c—A filter needle is used to remove very small particles of glass that may have fallen into the liquid when the ampule was broken.

66. a—An electronic infusion device provides a precise flow rate of an IV solution. IVP is an acronym for IV piggy bag, and a roller clamp provides a variable flow rate.

67. b—Only a counter balance can weigh up to 5 kg.

68. d—Infections can be curbed in a hospital pharmacy can be curbed through following universal precautions, following standards contained in USP <797> that address personnel training, wearing personal protective equipment, using aseptic techniques, and proper preparation of various compounded sterile products.

69. d—USP <797> contains standards for compounding sterile products; USP 795 has standards for nonsterile compounding.

70. d—USP <797> requires that total parenteral nutrition products be compounded in a sterile environment.

71. c—Total parenteral nutrition is introduced into the body through an IV line; enteral nutrition provides food through a tube placed in the nose, the stomach, or the small intestine; and oral nutrition occurs through the placement of food in the mouth and traveling through the digestive system.

72. c—USP <797> requires that chemotherapeutic agents be compounded in a vertical laminar airflow workbench.

73. b—ASHP recommends that individuals wash hands for 30 seconds before compounding sterile products.

74. a—USP <797> prohibits artificial nails, cosmetics, and jewelry to be worn when compounding sterile compounds.

75. d—Infections can be transmitted through airborne, contact, or droplet transmission.

CHAPTER 4 ANSWERS

1. c—A pharmacy is required to provide patient package inserts to all patients receiving metered-dose inhalers, oral contraceptives, estrogen, progesterone, and Accutane.

2. b—MEDMARX tracks medication errors that have been reported.

3. b—The Food and Drug Administration (FDA) is responsible for overseeing Med Watch.

4. b—The FDA approves "tall man" letters, which are used to distinguish differences in spelling between two or more similarly spelled drug names.

5. b—The Institute of Safe Medication Practices (ISMP) implemented the "error-prone abbreviation" list; The Joint Commission (TJC) implemented the "do-not use" list.

6. b—The ISMP is responsible for MEDMARX.

7. b—"Tall man" letters are used to indicate differences in the spelling of similar drug names. Using tall man (mixed case) letters helps draw attention to the dissimilarities in their names. Several studies have shown that highlighting sections of drug names using tall man letters can help distinguish similar drug names, making them less prone to mix-ups.

8. b—Antibiotics; medications identified on the ISMP List of high-alert drug classes include adrenergic agonists, adrenergic antagonists, anesthetic agents, antiarrhythmics, antithrombotic agents, cardioplegic solutions, chemotherapeutic agents, dextrose, dialysis solutions, epidural or intrathecal medications, oral hypoglycemics, inotropic agents, insulin, liposomal forms of drugs, moderate sedation agents, narcotics and opioids, neuromuscular blocking agents, parenteral nutritional agents, radiocontrast agents, sterile water for injection, inhalation, and irrigation sodium chloride for injection.

9. a—The ISMP developed guidelines for the administering of medications in an acute care facility where medications are to be administered either 30 minutes before or 30 minutes after the scheduled time for the drug to be administered to the patient. The guidelines only apply to scheduled medications, which are all maintenance doses that are administered in a standard, repeated cycle of frequency, such as q4h, QID, TID, BID, daily, and so on.

10. d—Medication errors are of one of three types: prescribing errors are caused by physicians; dispensing errors occur in the pharmacy; and administration errors may be caused by nurses, patients, or caregivers.

11. a—Electronic prescribing reduces the number of prescription errors by eliminating illegible prescriptions, using clinical decision support to reduce preventable errors, and improving communication between the clinician and patient.

12. d—Both The Joint Commission (TJC) and the Institute for Safe Medication Practices (ISMP) have identified the abbreviation "os" to be mistaken with "od," "ou," "as," "ad," and "au."

13. b—Spelling the drug's name out instead of using an abbreviation will eliminate any confusion caused by a prescriber.

14. d—Any warnings occurring during drug utilization evaluation should be referred to the pharmacist to make a decision in filling the prescription. A pharmacy technician is not permitted to judgment decisions in the practice of pharmacy.

15. a—The Institute of Safe Medication Practices (ISMP) states these medications are to be administered within 30 minutes of their scheduled time.

16. c—The following medications appear on the ISMP's "high-alert medication" list: epoprostenol (Flolan), magnesium sulfate injection, methotrexate (oral, non-oncologic use), opium tincture, oxytocin (IV), nitroprusside sodium for injection, potassium chloride for injection concentrate, potassium phosphates injection, promethazine (IV), and vasopressin (IV).

17. b—Only a pharmacist may counsel a patient.

18. c—A pharmacy technician should listen carefully to the patient and inform the pharmacist of the situation; only the pharmacist can make a decision on the proper course of action.

19. d—The pharmacy technician should hand the prescription to the pharmacist, and the pharmacist will make a decision on the situation. The pharmacist will call the doctor regarding verification of the prescription.

20. c—Inform the pharmacist of the situation.

21. a—The look-alike drug names have been modified using "tall man" (mixed case) letters to help draw attention to the dissimilarities in their names.

22. c—A category I error is an error that may have contributed or resulted in patient's death.

23. a—MEDMARX has identified the following medications that have been associated with a high incidence of medication errors: insulin, morphine, potassium chloride, albuterol, heparin, vancomycin, cefazolin, acetaminophen, warfarin, and furosemide.

24. d—MERP has made the following recommendations that an institution initiate policies that describe limitations or prohibitions on use of verbal orders, provide a mechanism to ensure the validity or authenticity of the prescriber, list the elements required for inclusion in a complete verbal order, describe situations in which verbal orders may be used, and list and define the individuals who may send and receive verbal orders.

25. a—The following organizations possess medication error reporting systems: The Food and Drug Administration (FDA), the Institute of Safe Medication Practices (ISMP), Institute of Medicine (IOM), The Joint Commission (TJC), the National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP), the United States Pharmacopoeia (USP).

CHAPTER 5 ANSWERS

1. c—The pharmacy is not permitted to accept professional samples.

2. d—The Joint Commission (TJC) does not certify or accredit retail pharmacies; however, it is involved with certifying hospitals, long-term care facilities, and nursing homes.

3. c—The Food and Drug Administration (FDA) may issue a drug recall because it is responsible for the purity, safety, and efficacy of medicines in the United States.

4. d—The Pharmacy and Therapeutics (P&T) committee is responsible for developing a formulary or approved list of medications to be used within a hospital or organization.

5. b—Hazardous drugs and chemicals stocked in a pharmacy require the pharmacy to have a Safety Data Sheet for each product.

6. a—The repackaging date does not appear on the package label; however, it is recorded in the repackaging log.

7. b—The American Society of Health System Pharmacists (ASHP) established three different risk levels for pharmacy-prepared sterile products. *Level I* products are to be stored at room temperatures and administered completely within 28 hours after being prepared; unpreserved products that are prepared for more than one patient that contain preservatives; and products prepared by closed system aseptic transfer of nonpyrogenic, sterile finished products (in sterile containers) from licensed manufacturers. *Level II* products are administered more than 28 hours after preparation and stored at room temperature; products that are batch prepared with no preservatives for more than one patient; and products compounded by various manipulations of sterile ingredients using close-system aseptic transfer from licensed manufacturers. *Level III* products are compounded from nonsterile components, containers, or equipment before they are terminally sterilized and products prepared with sterile or nonsterile products prepared from sterile or nonsterile ingredients using open-system transfer before they are terminally sterilized.

8. c—USP <797> addresses sterile compounding, and USP 795 deals with nonsterile compounding.

9. a—An organization's infection control policy requires the Centers for Disease Control and Prevention be notified if an employee is exposed to pathogens while at work.

10. b—Face-to-face communication is the most effective form of communication.

11. c—The Food and Drug Administration (FDA) is responsible for maintaining the FDA Error Reporting System (FAERS; formerly known as AERS).

12. b—Both PTCB and ExCPT certification are valid for 2 years.

13. d—The Food and Drug Administration (FDA) attempts to reduce the number of medication shortages from occurring because of manufacturing, supply issues, and medications being discontinued by drug manufacturers. The FDA attempts to find alternative sources for a specific product from other drug manufacturers.

14. d—Information that is obtained through MERP is used to report the medication error; understand

the medication error; provide additional knowledge of the problem; evaluate data that have been collected; develop educational tools to identify means to prevent the medication error from occurring; provide confidential consulting services to health care systems; cooperate with legislative and regulatory bodies, health care practitioners, health care institutions, regulatory and accrediting agencies, and the pharmaceutical industry; communicate information to consumers, employers, and health care providers; and provide a voluntary reporting program.

15. c—Gloves should be changed hourly or after they become contaminated.

16. c—Sharps containers are red.

17. c—OSHA is responsible for requiring Safety Data Sheets (formerly known as Material Safety Data Sheets) to be maintained in pharmacy for medications and hazardous compounds.

18. c—USP <797> prohibits jewelry from being worn when compounding sterile products because the jewelry may rip or puncture the gloves.

19. b—Face-to-face communication is the most effective because in addition to the words being said an individual is able to see the body language and able to ask questions.

20. a—The Food and Drug Administration (FDA) oversees the Vaccine Adverse Events Reporting System (VAERS).

21. a—MedWatch is the FDA's Safety Information and Adverse Event Reporting Program.

22. c—The Institute of Safe Medication Practices (ISMP) oversees two error-reporting programs, the National Medication Errors Reporting Program (ISMP MERP) and the National Vaccine Errors Reporting Program (ISMP VERP). Both are confidential national voluntary reporting programs that examine causes of medication and vaccine errors and provide suggestions for the prevention of errors.

23. a—The pharmacist and pharmacy technician should have a professional relationship with patients, not a personal relationship.

24. b—Isopropyl alcohol should be used to clean a pill tray to reduce cross-contamination.

25. b—A prescription should be viewed a minimum of three times during the prescription filling process.

26. b—MAR stands for medication administration report, CSAR stands for controlled substance administration report, POS stands for physician order sheet, and TAR stands for treatment administration report.

27. d—USP <797> requires that used syringes must be placed in a sharps container.

28. b—One should never bend, break, or manipulate needles by hand.

29. c—USP <797> requires that a laminar airflow workbench must be certified every 6 months unless the HEPA filter becomes wet.

30. d—FAERs is involved with postmarket surveillance of the drug in which adverse effects can be reported to the FDA.

31. c—The United States Pharmacopeia (USP) establishes the standards for the identity, strength, quality, and purity of medications. The FDA ensures that medications are pure, safe, and effective; the ISMP focuses on medication safety and methods to reduce medication errors from occurring; and the TJC is concerned about patient safety in hospitals, long-term care facilities, and nursing homes.

32. a—E-prescribing is preferred over other means of providing a prescription to the pharmacy because it reduces the possibility of a prescription error from occurring.

33. a—The Centers for Disease Control and Prevention (CDC) is concerned with the spread of infectious diseases.

34. c—Recalled medications should be isolated from other medications in the pharmacy to prevent the recalled medications from accidentally being dispensed to a patient.

35. d—USP <795> requires that pharmacy weights be calibrated every year.

CHAPTER 6 ANSWERS

1. a—The subscription on a prescription provides the pharmacist with special compounding instructions.

2. d—Although many computer systems have fields that allow a pharmacist or pharmacy technician to indicate a patient would like an easy-open container, the pharmacy is protected from lawsuits from being initiated if the patient signs the back of the prescription indicating this desire. There is no written documentation supporting the request if it is entered into the computer system.

3. b—The patient's identification number is not required on a prescription. The required information on a prescription includes the patient's name, home address (street number, street, city, state, and zip code), telephone number, and birth date.

4. c—A medication or prescription number would not be found on a medication order label.

5. b—The expiration date and medication lot number do not need to appear on patient product insert. Information contained on a patient product insert includes the drug name, clinical pharmacology, indications and usage, contraindications, warnings, precautions, adverse reactions, drug abuse and dependence, overdosage, dosage and administration, how supplied, storage information, the date of initial product approval; and a toll-free number and Internet address.

6. c—The medication lot number does not need to appear on the prescription label. The required information on a prescription label includes the date when the prescription was filled, serial (prescription) number of the prescription, pharmacy name and address, patient name, prescribing physician name, all directions for use of the prescription, generic or brand name of the prescription, medication strength, drug manufacturer name, drug quantity, prescription expiration, licensed pharmacist's initials, and number of refills allowed.

7. b—An ACE inhibitor does not require a patient product insert to be given to the patient.

8. c—Tablets, capsules, and caplets should be counted out in multiples of fives when counting out medications manually.

9. a—A noncontrolled prescription with "prn" refills may only be refilled up to 1 year from the date the prescription was written.

10. d—One pint is equal to 480 mL, and all quantities must be entered using metric units.

11. c—A patient's social security number is not required on a prescription.

12. c—The Controlled Substance Act only permits a maximum of five refills within 6 months of the date the prescription is written if authorized by the prescriber on the prescription.

13. d—Auxiliary labels provide additional information to the patient on how to take the medication, store the medication, and possible side effects the patient may experience.

14. b—The Poison Prevention Act of 1970 allows the prescriber or the patient to request an EZ-open container.

15. b—A prescription may be transferred only one time from one pharmacy to another pharmacy if there are refills indicated. This applies to both controlled and noncontrolled prescriptions.

16. d—A physician's DEA number does not have to appear on the prescription label, but it does need to appear on the original prescription.

17. a—DAW 0 = no product selection indicated; DAW 1 = substitution not allowed by provider; DAW 2 = substitution allowed—patient requested product dispensed; and DAW 3 = substitution allowed—pharmacist selected product dispensed.

18. d—The suffix *-ology* means "study of." Suffixes for the other terms include *-pathy* for disease and *-itis* for inflammation; the root word for heart is *-cardio*.

19. d—bid means twice a day, qid means four times a day, qd means every day, and tid means three times a day.

20. a—The inscription on a prescription identifies the name of the medication and its strength. A prescription is an order from a licensed prescriber for a medication drug for a patient. The signa contains directions to the patient on taking the medication, and the subscription identifies for the pharmacist any special compounding directions.

21. b—The prescription will last 10 days (Quantity dispensed/Quantity taken per day).

22. c—A "prn" refill allows for a prescription to be refilled for 1 year from the date the prescription was written.

23. c—Counseling patients can only be done by a pharmacist; pharmacy technicians perform technical duties in the pharmacy to include obtaining patient information, data entry, pouring, counting, and labeling medication containers.

24. d—Take 2 tablets (tabs) by mouth (po) four times a day (qid) before meals (ac) and at bedtime (hs)

25. d—Suspensions need to be shaken before administering them to ensure the medication is the same concentration throughout the entire liquid.

26. a—The prefix *hyper-* means above; the prefixes for the other terms are across *(trans-),* below *(hypo-),* and fast *(tachy-).*

27. d—A unit-dose (repackaging log) must be completed when preparing unit dose medications, a DEA Form 224 is submitted when registering a pharmacy with the DEA, a mixing record is used when compounding medications, and an SDS is a document for hazardous chemical or drugs.

28. b—A cool environment is defined as any temperature between 8° and 15° C (46° and 59° F).

29. a—A beyond-use date is assigned when medications are compounded or repackaged. An expiration is assigned by the drug manufacturer, and the packaged date is recorded on a unit-dose or compounding log to indicate the date the medication was packaged or compounded.

30. b—CHF is an abbreviation for congestive heart failure.

31. b—DAW 1. DAW 0 = no product selection indicated; DAW 1 = substitution not allowed by provider; DAW 2 = substitution allowed—patient requested product dispensed; and DAW 3 = substitution allowed—pharmacist selected product dispensed.

32. a—A *hermetic container* is impervious to air and gas, a *multiple-dose container* is defined as a multiple unit container for parenteral administration, a *single-dose container* is a single unit container for parenteral administration, and an *unit-dose container* is a single-unit container intended for administration other than parenteral.

33. b—Fluoxetine (Prozac) is not a controlled substance; therefore, a physician's DEA number does not have to appear on the prescription.

34. c—Under the Poison Prevention Act of 1970, oral contraceptives do not need to be packaged in child-resistant containers.

35. d—Pharmacy technicians are not permitted to counsel patients; only pharmacists are permitted to counsel patients.

36. a—The following information is required to be filled out on a unit-dose log record: date unit dose was prepared, drug (generic name, medication strength, dosage form, quantity prepared, drug manufacturer, drug manufacturer lot number, manufacturer's expiration date), pharmacy-assigned beyond-use date, pharmacy lot number, pharmacy technician's initials, and pharmacist's initials.

37. a—A blister pack is a unit-dose package for solid oral dosage forms such as tablets, caplets, and capsules.

38. a—01 refers to the cardholder, 02 is the spouse of the cardholder, and 03 and 04 refer to cardholder's dependent based on chronological order (oldest to youngest).

39. b—The Latin expression *signa* means "write on label," which is the directions for the patient on how to take the medication.

40. a—"dtd" is a Latin expression meaning "give of such doses."

CHAPTER 7 ANSWERS

1. c—The pharmacy and therapeutics committee (P&T) establishes and maintains the formulary for an institution. The pharmacist in charge (PIC) may be a member of the P&T committee.

2. d—A perpetual inventory shows the actual quantity of a specific on hand at a specific moment of time in a pharmacy. A biennial inventory is a required inventory of all controlled substances in a

pharmacy every 2 years. An initial inventory is taken before the opening of a pharmacy for business or when there is a change in the pharmacist in charge.

3. c—OSHA requires an SDS sheet be provided to a purchaser of hazardous chemicals.

4. d—Changes in a physician's prescribing habits, a change in prescription's being filled either because of competition or a change in the number of physicians in the area, seasonal changes, drug discontinuations or recalls, and new drug entities or indications may require an adjustment in a pharmacy's inventory level of a medication.

5. c—The Controlled Substances Act requires that a pharmacy complete a biennial inventory of controlled substances every 2 years. A pharmacy's policy and procedure manual may require an inventory of controlled substances be taken before 2 years.

6. d—Drug recalls and damaged and expired medication are possible reasons why a medication may be returned to the drug manufacturer.

7. a—Group purchasing organizations (GPOs) negotiate prices with the drug manufacturers for their members.

8. c—The FDA may issue a drug recall. In addition, the drug manufacturer may initiate a drug recall.

9. b—A prime vendor agreement is between a pharmacy and a wholesaler in which the pharmacy agrees to purchase 90% to 95% of its medications from the wholesaler. The wholesaler in turn provides the pharmacy with various resources to improve productivity. A purchase order is an order placed by a pharmacy to a wholesaler in which the pharmacy agrees to pay for the products being ordered.

10. a—A DEA Form 41 must be completed when surrendering controlled substance to be destroyed.

11. a—A class I drug recall may cause irreversible damage or death to an individual, a class II drug recall may cause reversible harm to an individual, and a class III drug recall does not harm an individual. There is no such thing as a class IV drug recall.

12. d—Security requirements are not an environmental factor that may affect the integrity of a medication. Heat, humidity, and light may cause a medication to break down.

13. b—A prime vendor agreement is established between a pharmacy and wholesaler. A purchase order is a form that is used to order drugs and supplies from a wholesaler. Information found on a purchase order includes the following: name and address of the institution, shipping address, date the order was placed, vendor's name and address, the purchase order number (a tracking number used to identify a purchase order), the ordering department's name and location, the expected date of delivery, shipping terms, account name or billing designation, description of items ordered, quantity of items ordered, unit price, extended price, total price of the order, and buyer's name and phone number.

14. d—Controlled substances may be stored either throughout the pharmacy or in a locked room or safe.

15. b—A biennial inventory must be taken every 2 years according to the Controlled Substances Act.

16. b—A DEA Form 106 must be completed immediately when a theft of controlled substances is discovered.

17. a—Phase I determines the appropriate dose with regard to safety and toxicity. Phase II is performed in 100 to 300 patients who have the disease or condition to be treated. Phase III conducted in larger (several hundred to several thousand) patients in groups that the medication is ultimately intended. A comparison is between new treatment and the standard therapy or placebo. The medication is used in the manner in which it will be used after approval.

18. b—Innocuous substances pose no harm to an individual. Hazardous waste may be ignitable, reactive, or toxic.

19. d—The "want book" is used to record medications that need to be reordered from a wholesaler.

20. c—A drug accountability record (DAR) is used to account for the usage of investigational drugs in an institution.

CHAPTER 8 ANSWERS

1. Answer = $3,377,865. Overhead is the sum of all the expenses a business experiences. In this problem, because there are two pharmacists, multiply the pharmacist's salary by 2 and the pharmacy technician's salary by 3 to calculate the total salaries. Add up all of the expenses to obtain the overhead.

2. Answer = $8.00. Gross profit can be calculated by subtracting the cost, which in this case is the same as the average wholesale price (AWP) or from the retail price: $67.99 − $59.99 = $8.00.

3. Answer = $4.00. *Markup* is another term for gross profit. In this problem, the markup is equal to retail price (13.99) − Cost (9.99), which is $4.00.

4. Answer = 30%. Markup rate is the markup dollars divided by the cost times 100. Calculate the markup: Retail price ($25.99) − Cost ($19.99) = $6.00. Divide the markup dollars ($6.00) by the cost ($19.99) and multiply by 100: ($6.00/$19.99) × 100 = 30%.

5. Answer = $8.75. Net profit is the retail price ($112.99) minus the cost of product or the actual acquisition cost ($99.99) minus any expenses ($4.25) associated with the product: ($112.99 − $9.99) − $4.25 = $8.75.

6. Answer = $94.68. Add the cost of the test strips ($67.50) to the overhead costs ($3.50) to obtain the total cost ($67.50 + $3.50 = $71.00). To calculate the selling price, add the total cost and net profit together to obtain the selling price: $71.00 + $23.68 = $94.68.

7. Answer = $1911. The pharmacy will receive a 2% discount off the total bill if the bill is paid in full within 30 days. $1,950.00 − (0.02)(1950.00) = $1911.00.

8. Answer = 11.76. Inventory turns can be calculated by dividing total sales by the inventory value or the average inventory value. Sales ($3,000,000)/ Inventory ($255,000) = 11.76 inventory turns.

9. Answer = 10.95. The average inventory can be calculated by adding the initial inventory ($225,000) and the final inventory ($250,000) and dividing the sum ($475,000) by 2, resulting in an average inventory of $237,500. Divide total sales ($2,600,000) by the average inventory ($237,500) = 10.95 inventory turns.

10. b—A standardized prescription card format does not result with increased calls to the help desk; it does the opposite because the number of calls will decrease. A standardized prescription card format will result in a speedier prescription claim process and fewer problems with claims submission and will allow for additional time to be able to counsel patients.

11. c—DAW 2 is substitution allowed—patient requested product dispensed; DAW 0 is no product selection indicated; DAW 1 is substitution not allowed by provider; and DAW 3 is substitution allowed—pharmacist selected product dispensed.

12. c—Online adjudication is the electronic billing process for a prescription covered by a pharmacy benefits manager. The banking identification number (BIN) and the group number are pieces of information found on a prescription drug card. A rejection code is provided to the pharmacy to explain why a prescription claim was rejected.

13. d—Medicare Part D provides for prescription medications, biologicals, insulin, vaccines, and select medical supplies. All medications are not covered under Medicare Part D.

14. Medicare Part A covers inpatient hospital care, skilled nursing facilities, hospice, and home health care. There is no cost if the patient worked for 10 years in Medicare-covered employment. Medicare Part B provides for physician services, outpatient care, and some physical and occupational therapy. Medicare Part B requires an extra monthly payment. Medicare Advantage (Part C) allows participants in Medicare Part A and B to obtain coverage through an HMO or PPO that provides additional services at a higher cost.

15. b—Medicaid is a federal program that provides medical services and prescriptions at a very low cost to individuals or families who are below a predetermined income level. Medicare is federal program for elderly and permanently disabled individuals with medical and prescription care at a reduced rate to subscribers. A health maintenance organization (HMO) and a preferred provider organization (PPO) are examples of two forms of managed care organizations.

16. c—Generic drugs that are covered under a prescription drug plan would not require prior authorization.

17. c—Drug cost + Dispensing fee is the basic formula in calculating the cost of a prescription. Actual acquisition cost (AAC), average wholesale price (AWP), and maximum allowable cost (MAC) are cost systems used to determine the drug cost.

18. d—Medicaid does not cover individuals who have an above average income. Individuals covered under Medicaid include individuals earning less than a specified yearly income, individuals with disabilities, and children whose parents receive Medicaid.

19. c—Health care saving plans were created under the Medicare Modernization Act of 2003, which allows individuals to set aside money from their paychecks to be used for medical purposes in a calendar year. This money is tax deductible, but there are limits to how much may be deducted, and if the money is not used during the calendar year, it is forfeited.

20. c—The actual acquisition cost (AAC) is the price the pharmacy actually pays after receiving discounts, rebates, and shipping costs have been applied. Average wholesale price (AWP) is the average price paid by wholesalers in a geographic area. A deductible is the amount of money that must be paid on a yearly basis before copays apply. A premium is the cost of an insurance plan.

21. a—Although the drug's cost does play an important role in developing a formulary, it should not be the basis of including it in the formulary. Medications should be obtained from a reputable drug source (manufacturer). The drug should be pure, safe, and effective for the condition being treated.

22. c—Prescription drug benefits are designed to control costs, and some of the controls in place are pricing tiers, covering and excluding medications, and drug classes and when refills can be processed.

23. a—Medicare does not cover children.

24. d—A pharmacist or pharmacy technician's name is not transmitted during on-line adjudication. Information that is transmitted includes the date of service; patient information; prescriber information; quantity dispensed to include day's supply; and medication information such as drug manufacturer, drug entity, and drug packaging.

25. d—Medicap (Medicare Supplemental Policy) is an additional Medicare policy that can be purchased by a qualified subscriber that covers gaps in the original Medicare program.

26. c—Third-party rejection codes were developed by the National Council for Prescription Drug Programs (NCPDP). A bank identification number (BIN) is a six-digit number used to identify the company that will reimburse the pharmacy for the prescription being filled. Good manufacturing practices (GMPs) are principles that are followed in drug manufacturing and compounding to ensure product quality. SCRIPT is the standards by which prescriptions are transferred to another pharmacy.

CHAPTER 9 ANSWERS

1. c—An interface can be either uni- or bidirectional. A unidirectional interface is able to send data to another computer system but is unable to receive input back; bidirectional interfaces are capable of sending data back and forth.

2. d—User name and password that consist of letters numbers and symbols and are employee specific are used to log into a computer.

3. b—A monitor is not an input device; examples of input devices include touch screens, light pens, mice, and voice recognition.

4. c—The computer's processor is referred to as the "brains" of the workstation. A modem is a device that allows a computer to communicate over a network. Memory (RAM or random access memory) provides the computer with a temporary workspace. Storage is a permanent place for read-only memory (ROM) information.

5. d—Information contained in an electronic health care record (EHR) are patient demographics, progress notes, problems, medications, vital signs, medical history, immunizations, laboratory data radiology reports, and advanced directives.

6. b—A large amount of information is available to practitioners, such as medication orders, laboratory requests and results, and clinical notes.

7. d—Computerized order entry systems require the correct diluent, the correct dosage, and the correct dosage form be selected when intravenous medications are being entered.

8. b—A desktop computer is an example of a stationary point-of-care device. Computers on wheels (COWs), notebooks, and PDAs are mobile devices.

9. d—Retrievability requires use of standardized titles, formats, templates, macros, terminology, abbreviations, coding; enable authorized data searches, indexing, and mining.

10. c—Database maintenance contains drug files, physician files, clinical monitoring, and payer and insurance information.

11. d—Computer technology being used in the practice of pharmacy includes bar coding, touch screens, light pens, mice, voice recognition, automated packaging, unit-dose systems, automated compounders, and automated dispensing systems for both institutional and outpatient pharmacies.

12. d—Pharmacy computers allow an individual to enter patient information and prescription information, verify orders entered by pharmacy technicians, generate labels, and price medications.

13. b—Therapeutic duplications would be detected on a patient's profile.

14. a—A light pen is an example of an input device. Plotters, printers, and speakers are examples of output devices.

15. d—Decentralized automation is found in the patient care unit.

16. a—Computer files should be backed up daily.

17. c—Mouse technology involves dragging a device over a surface, pointing on a screen, and clicking. The sound of a bell does not occur with current mouse technology.

18. b—The goal of voice recognition is to eliminate the need for a computer keyboard and recognize any individual's voice. It may be used in pharmacies to document pharmacist's intervention or patient education.

19. a—Ambulatory care automation increases efficiency and productivity while streamlining the workflow. Unfortunately, additional costs are associated with automation.

20. c—A sign-on consists of an user name and password that are specific for a particular individual. Depending on an employee's status, it determines the functions the individual will be able to access.

CHAPTER 10 PRACTICE EXAMINATION I ANSWERS

1. c—The right price is not considered one of the five patient rights. Each patient is entitled to the following: the right drug, the right dose, the right dosage form, the right route of administration, and the right time of administration. **Domain 4**

2. c—According to the Controlled Substances Act of 1970, the maximum number of authorized refills for a Schedule III to V drug is five. **Domain 2**

3. c—DAW 2 means that a physician approved the dispensing of a generic drug but the patient requested the brand name drug. DAW 0 means that the physician approved the dispensing of a generic drug; DAW 1 indicates that the physician wants the patient to receive the brand name drug only. DAW 5 means that the pharmacy has designated this drug as its generic drug of choice. **Domain 8**

4. b—A side effect of antianxiety medications, antidepressants, and anticonvulsants is drowsiness. **Domain 6**

5. c—The basic formula for medication reimbursement is Drug cost + Dispensing fee. There are many variations of this formula taking into consideration AWP, AAC, MAC, and percentages. **Domain 8**

6. b—A class II drug recall is one in which the probability exists that the use of the product will cause adverse health events that are temporary or medically reversible. A class I drug recall shows that there is a reasonable probability that use of the product will cause or lead to serious adverse events or death. A class III recall means that the drug will probably not cause an adverse health event. **Domain 5**

7. c—GMP stands for good manufacturing practices, which are followed in compounding prescriptions. The DEA is responsible for the Controlled Substances Act; the FDA ensures that food and medications are pure, safe, and effective; and OBRA '90 requires drug utilization evaluation and counseling patients. **Domain 3**

8. b—AWP plus the dispensing fee is a common method of reimbursing pharmacies for medications. Calculate the cost of 30 tablets (100 tablets/$120.00 = 30 tablets/X), where X is $36.00 and the AWP for this medication; $3.25 is added to the AWP ($36.00), yielding $39.25. **Domain 8**

9. c—Metformin is the generic name for Glucophage. The other drug names are glipizide (Glucotrol), glyburide (Micronase or DiaBeta), and pioglitazone (Actos). **Domain 1**

10. c—The Kefauver-Harris Amendment requires that all drugs be pure, safe, and effective as a result of the thalidomide incident. **Domain 2**

11. d—"qs ad" are directions to the pharmacist in compounding a prescription meaning "to make up to" a given weight or volume of a substance. **Domain 6**

12. b—According to the Controlled Substances Act, an individual may purchase only one 4-oz bottle of an "exempt narcotic" every 48 hours. **Domain 2**

13. d—Tuberculosis most often affects the lungs because *Mycobacterium tuberculosis* prefers an area of high oxygen content. **Domain 1**

14. c—Using Clark's rule (Weight [lb]/150) × Adult dose provides the correct dose for the child: ([70 lb]/150) × 250 mg = 116 mg. **Domain 6**

15. c—Medicare is a federal program for individuals older than 65 years of age. Medicaid is a federal program administered by the state for individuals (families) who meet specific income guidelines. Worker's compensation is for individuals who are injured while working. **Domain 8**

16. d—Vitamin K is a warfarin antagonist. It increases clotting factors II, VII, IX, and X. **Domain 1**

17. d—Medication errors can result from prescribing, dispensing, and administering medications. **Domain 4**

18. d—30 mL (1 oz) MOM (Milk of Magnesia) PO (by mouth) ac (before meals) and hs (at bedtime) prn (as needed). **Domain 6**

19. d—Proteins are not used in preparing a total nutrient admixture. Amino acids, dextrose, and lipids are used in preparing a total nutrient admixture, which is a parenteral form of nutrition for patients with specific conditions. **Domain 3**

20. b—FDA stands for Food and Drug Administration. **Domains 2, 5**

21. c—A wrong time error is one in which the medication is administered outside the scheduled time frame; if the facility allows plus or minus 30 minutes, the dose is given outside of the variance. **Domain 4**

22. d—An individual taking Lasix as a diuretic may lose potassium and require a potassium supplement. Aldactone, Dyazide, and Dyrenium are potassium-sparing diuretics. **Domain 1**

23. d—The Controlled Substances Act requires that a pharmacy perform a biennial inventory of all controlled substances stocked in the pharmacy. An exact count must be performed on Schedule II medications, and an estimated count must be done on Schedule III to V medications. An institution may perform an inventory more frequently if required by either state law or organizational policy. **Domains 2, 7**

24. b—Antibiotics have not been classified as a "high-alert medication"; those classified include adrenergic agonists; adrenergic antagonists; anesthetic agents; antiarrhythmics; antithrombotic agents; cardioplegic solutions; chemotherapeutic agents; dextrose; (hypertonic, 20% or greater); dialysis solutions; epidural or intrathecal medications; hypoglycemic (oral); inotropic agents; insulin; liposomal forms of drugs; moderate sedation agents; narcotics and opioids; neuromuscular blocking agents; parenteral nutritional agents; radiocontrast agents; sterile water for injection, inhalation, and irrigation (excluding pour bottles); and sodium chloride for injection (hypertonic, greater than 0.9% concentration). **Domain 4**

25. c—STAT means immediately. Medications administered twice a day (bid), four times a day (qid), and three times a day (tid) are provided

to the patient at specific times in a hospital. **Domain 4**

26. b—Forceps are used to prevent oils from the hands from being deposited on the weight, which may alter the composition of the weight. **Domain 3**

27. b—Calculate the amount of active ingredient by multiplying the final volume by the percent of clindamycin expressed as a decimal (480 mL × 0.02 = 9.6 g). Convert 9.6 g to grams by multiplying 9.6 g × 1000 mg/g = 9600 mg. Divide the total weight of clindamycin by the weight of each capsule (9600 mg/150 mg per capsule = 64 capsules). **Domain 3**

28. c—Any errors made on a DEA Form 222 cannot be corrected. This form must be retained in the pharmacy for at least 2 years. **Domain 2**

29. c—Calculate the total number of doses required (2 tablets/dose × 2 doses/day × 25 days = 100 tablets). Calculate the cost of 100 tablets ($321.66/500 tablets = X/100 tablets, where X = $64.33). Look for the fee on the table that corresponds to an AWP of $64.33, which would be $10.00. AWP + fee ($64.33 + $10.00 = $74.33). **Domain 8**

30. c—The following are the approved DAW codes used in pharmacy: DAW 0, generic allowed by physician; DAW 1, brand name required by physician; and DAW2, generic allowed but patient requested brand name drug. **Domain 8**

31. a—Outside air flows into the back of the horizontal airflow hood and through the hood's HEPA filter and out toward the opening, and the air is recirculated into the room. A vertical airflow hood is similar to the horizontal hood except that the air cannot be recirculated into the room. This air goes through two HEPA filters and is released into an open area or is vented to the outside. **Domain 3**

32. b—Look at the bottom of the meniscus or the lowest point of the liquid when measuring a liquid. **Domain 3**

33. a—Atorvastatin is the generic name for Lipitor, which is used in the treatment of hyperlipidemia (high cholesterol). **Domain 1**

34. b—Solve using the following formula (IS)(IV) = (FS)(FV); (2%)(120 mL) = (FS)(480 mL), where the FS is 0.5%. **Domains 3, 6**

35. c—Cocaine is a Schedule II drug under the Controlled Substances Act of 1970. Cocaine does have a medical use in the United States, but it has a high potential for abuse. **Domain 2**

36. a—The patient would take a maximum of two tablets per dose with a maximum of six doses per day. 60 tablets (2 tablets/dose) at 6 doses/day will last 5 days. **Domain 6**

37. c—The maximum number of refills allowed for a Schedule III medication if approved by the prescriber is five refills within 6 months of the date the prescription was written. **Domain 2**

38. c—Rx means to take a given product of a given strength and quantity. **Domain 6**

39. c—According to the ASHP, it would be a monitoring error. A monitoring error is defined as a failure to review a prescribed medication for proper regimen, appropriateness; detection of problems in dosage, or failure in using laboratory results to correctly adjust dose. **Domain 4**

40. a—Inventory management attempts to minimize the costs associated with placing orders to the wholesaler, not maximize the costs. **Domain 7**

41. b—Anticholinergics have a tendency to dry up all bodily secretions as a side effect. **Domain 1**

42. d—Unit-dose labels require the name and strength of the medication, expiration date of the medication, manufacturer's name, and lot number. **Domains 5, 6**

43. b—Inventory turnover rate is a tool used to measure the effectiveness of a business with their investment in money and product. Few inventory turns indicates that the pharmacy has too much inventory on hand. Conversely, a high number of inventory turns may indicate there is not sufficient inventory, resulting in medication outages and poor customer service. **Domain 7**

44. d—AWP plus dispensing fee and capitation are both types of third-party reimbursement formulas; a copayment is a predetermined amount of money or a percentage of money that one is responsible for paying on every prescription. A deductible is a yearly, predetermined sum of money payable before the insurer will begin making payments to an individual or institution. **Domain 8**

45. d—30 tablets are dispensed, but one tablet is being taken every other day; therefore, it will last 60 days. **Domain 6**

46. a—The Isotretinoin Safety and Risk Management Act of 2004 does not permit refills on prescriptions of Accutane (isotretinoin). The prescription must be handwritten by the physician and dispensed within 7 days of being written. **Domain 2**

47. b—According to the Medication Error Reporting and Prevention (MERP) categories, an error occurred but did not reach patient. **Domain 4**

48. a—Only registered pharmacists are allowed by law to counsel patients. **Domain 2**

49. b—Itraconazole is the antifungal agent known as Sporanox. **Domain 1**

50. b—An inventory of all control substances taken before the first day of business or before a new pharmacist in charge takes over the pharmacy is known as an initial inventory, according to the Controlled Substance Act. **Domain 2**

51. b—Class A balances are used in extemporaneous compounding, not in the preparation of intravenous preparations. **Domain 3**

52. b—Narcotics have a tendency to sedate an individual (i.e., to cause central nervous system [CNS] depression). CNS stimulation would have the opposite effect. **Domain 1**

53. c—Parchment paper may be used if an ointment slab is not available. After use, the parchment paper is discarded. **Domain 3**

54. d—Poor handwriting, performance deficit, and knowledge deficit are a few of the causes of medication errors. **Domain 4**

55. a—The drug manufacturer assigns a lot number or batch number for each production run of a specific medication. **Domain 5**

56. d—Beakers and graduates are not precise enough to measure a small volume such as 1.5 mL. A measuring device cannot have a capacity greater than five times the amount of volume to be measured. **Domain 3**

57. a—Zithromax is the brand name for azithromycin; the other drug names are as follows: Biaxin (clarithromycin), Minocin (minocycline), and Floxin (ofloxacin). **Domain 1**

58. c—Multitasking has been associated with medication errors in the pharmacy. **Domain 4**

59. c—The Controlled Substances Act requires that a partially filled Schedule II prescription be filled within 72 hours if the pharmacy did not have the entire quantity for the patient. If it is not filled within 72 hours, the remaining quantity will become void. **Domain 2**

60. d—Counseling is a judgmental task that only pharmacists are permitted to perform. Pharmacy technicians currently are allowed to perform only technical tasks. **Domains 2, 5, 6**

61. a—TJC stands for The Joint Commission. Pyxis, Robot-Rx, and SureMed are automated dispensing systems. **Domain 9**

62. d—Use the following formula: Rate (mL/hr) $\times$ Drop factor (gtt/mL) $\times$ (1 hr/60 min) = gtt/min. Substitute the following: (500 mL/6 hr) $\times$ (15 gtt/mL) $\times$ (1 hr/60 min) = 20.83 gtt/min. 20.83 gtt/min is rounded down to 20. **Domain 3**

63. c—The Controlled Substances Act of 1970 allows an individual age 18 years or older to purchase a 4-oz bottle of an exempt narcotic every 48 hours. **Domain 2**

64. d—Melatonin has been shown to be effective in assisting individuals fall asleep, especially when traveling in different time zones. **Domain 1**

65. d—Plastic is less expensive than glass, the pliability of the bag requires less storage space, and the bags are transparent. **Domain 3**

66. a—A fee for service is one of the two methods of reimbursements to a pharmacy. The other method is capitation. **Domain 8**

67. d—D10W stands for 10% dextrose dissolved in water. w/v% is the number of grams dissolved in 100 mL of solution. Using the following proportion, one can solve the problem: (10 g/100 mL = X g/1000 mL), resulting in 100 g. **Domain 3**

68. d—"os" means "left eye," which is the only difference among all of the interpretations. **Domain 8**

69. d—Even though both lotions and suspensions are dispersions, lotions are dissolved particles, but suspensions contain solid particles. **Domain 3**

70. a—*Otic* refers to the ear. **Domain 6**

71. d—According to the FDA, an X rating indicates that a medication is contraindicated in pregnant women. **Domain 5**

72. b—A retail pharmacy uses an open formulary system in which medications are ordered based on the prescribing habits of the physicians. **Domain 7**

73. d—Nitroglycerin is most often taken sublingually. **Domains 1, 6**

74. d—Some of the functions performed by pharmacy computers include providing drug information, performing drug utilization evaluation, assisting in performing quality assurance checks, developing work lists, and monitoring medication dosing regiments and intervention documentation. **Domain 9**

75. b—An elixir is a mixture of alcohol and water. **Domain 3**

76. c—Copies of the Controlled Substances Act and the United States Pharmacopeia—National Formulary are required in all pharmacies by the state boards of pharmacy. All pharmacies must maintain a library for reference. **Domains 2, 5**

77. b—MEDMARX has identified the following medications as being involved in a large number of medication errors: insulin, morphine, potassium chloride, albuterol, heparin, vancomycin, cefazolin, acetaminophen, warfarin, and furosemide. **Domain 4**

78. d—Bar coding identifies the correct drug name, strength, dosage form, lot number, and expiration date of a particular drug. **Domain 9**

79. d—Product rotation is a tool used in inventory management that minimizes the amount of product that expires before it can be used by placing the medication with the shortest amount of time in front of medication with the longest amount of time. **Domain 7**

80. d—*Room temperature* is any temperature between 15° and 30° C (59° and 86° F). Storage temperature terms assigned by the USP include the following: *freezer* temperature is maintained thermostatically between -25° and -10° C (-13° and 14°F); *cold* is not to exceed 8° C (46° F); *cool* is any temperature between 8° and 15° C (46° and 59° F); *warm* is any temperature between 30° and 40° C (86° and 104° F); *excessive heat* is any temperature above 40° C (104° F); *protect from freezing* means that freezing medication leads to a loss of strength, potency, or destructive alterations; and *dry temperature* denotes that conditions do not exceed 40% humidity at controlled room temperature. **Domains 4, 5, 7**

81. d—The Joint Commission (TJC) developed the "do not use" list of pharmacy abbreviations. The Institute of Safe Medication Practices (ISMP) developed the "error-prone abbreviations, symbols, and dose designations list." **Domain 4**

82. c—A fingerprint is an example of a biometric used to identify an individual. **Domain 9**

83. c—DAW 2 = substitution allowed—patient requested product dispensed. Other DAW codes include DAW 0 = no product selection indicated; DAW 1 =substitution not allowed by provider; and DAW 3 = substitution allowed—pharmacist selected product dispensed. **Domain 8**

84. d—The maximum dose and dose range may need to be modified by an institution if they use uncommon dosing protocols based upon specific populations. **Domain 9**

85. d—Warm means any temperature between 30° and 40° C (86° and 104° F). Storage temperature terms assigned by the USP include the following: *freezer* temperature is maintained thermostatically between -25° and -10° C (-13° and 14° F); *cold* is not to exceed 8° C (46° F); *cool* is any temperature between 8° and 15° C (46° and 59° F); *warm* is any temperature between 30° and 40° C (86° and 104° F); *excessive heat* is any temperature above 40° C (104° F); *protect from freezing* means that freezing medication leads to a loss of strength, potency, or destructive alterations; and *dry temperature* denotes that conditions do not exceed 40% humidity at controlled room temperature. **Domains 4, 5, 7**

86. b—Group purchasing organizations (GPO) negotiate prices for hospitals, but it is the responsibility of the hospital to make all purchases. **Domain 8**

87. c—CPOE is an acronym for computerized prescriber order entry. **Domain 9**

88. c—The FDA has implemented "tall man" letters to distinguish similar spelled medication by capitalizing differences between in the drug names. The Institute of Safe Medication Practices created the "do not crush" list and the "sound-a-like, look-a-like names" list. All are tools to assist in reducing medication errors. **Domain 5**

89. d—OBRA '90 requires all pharmacies to maintain patient profiles on all patients. These actions enable pharmacies to provide improved drug utilization evaluations and patient counseling. **Domain 2**

90. d—Noncovered, nonformulary, and restricted drugs may be approved by a third-party prescription payer by submitting a preauthorization request. Each third-party provider has a process by which rejected prescription medications may be appealed. **Domain 8**

91. d—A pharmacy information system is able to provide management with distribution, financial, workload, and file maintenance. **Domain 9**

92. c—There are nine Medication Error Reporting and Prevention (MERP) categories. They are lettered "A" through "I," where those classified as "I" have circumstances that have potential for causing errors but "no error" has occurred and "I" when an error occurred that may have contributed or resulted in patient's death. **Domain 4**

93. a—The actual acquisition cost (AAC) is the price the pharmacy actually pays for a medication after all discount and rebates have been applied. The average wholesale price (AWP) is the average price from several wholesalers for a particular medication. The maximum allowable cost (MAC) is the maximum price per unit that a third-party prescription provider will reimburse a pharmacy for dispensing a medication. **Domain 8**

94. d—Pharmacy technology uses automated dispensing systems for both centralized and decentralized pharmacies, bar coding, touch screens, robotics, computerized prescriber order entry systems, voice recognition, and personal digital assistants. **Domain 9**

95. d—USP 797 prohibits individuals with rashes, sunburn, weeping sores, conjunctivitis, active respiratory infections, and wearing cosmetics from compounding sterile preparations. **Domains 3, 5**

96. c—The abbreviation "ou" can be mistaken for "os" and "od." **Domain 4**

97. c—The Institute of Safe Medication Practices (ISMP) has developed a variety of tools that can be used to reduce medication errors. These include the "do not crush," "error-prone abbreviations," "confused drug names," and "high-alert medications" lists. **Domains 4, 5**

98. b—This is classified as a category B error, which states that an error occurred but did not reach the patient. **Domain 4**

99. c—USP 797 requires that 70% isopropyl alcohol be used to disinfect gloves after making contact with nonsterile objects. **Domains 3, 5**

100. d—The Modern Medicare Act provided prescription coverage for Medicare patients. **Domains 2, 8**

CHAPTER 10 PRACTICE EXAMINATION II ANSWERS

1. d—An individual may experience a severe rash as a result of photosensitivity to the sun if the patient is taking tetracycline. A patient should take tetracycline 1 hour before or 2 hours after a meal, which will prevent food and the medication from binding together. Antibiotics should be taken until they are completed. **Domain 6**

2. c—Convert the ratio to percent (1 : 200 = 0.5%). 0.5 g/100 mL = X g/30 mL where X= 0.15 g. Convert g to mg (0.15 g × 1000 mg/g = 150 mg). **Domain 3**

3. d—Drug names are as follows: sulfamethoxazole–trimethoprim DS (Bactrim DS), amoxicillin–clavulanate (Augmentin), cephalexin (Keflex), and sulfamethoxazole–trimethoprim (Bactrim or Septra). **Domain 1**

4. a—Oxycodone with acetaminophen is the generic name for Percocet, which is a Schedule II drug under the Controlled Substances Act. Prescriptions for Schedule II drugs cannot be refilled. **Domain 2**

5. c—The NCPDP has established standards for e-prescribing. These standards are for batch transaction standard, billing unit standard, financial information reporting standard, formulary and benefit standard, Medicaid subrogation, member enrollment standard, payment reconciliation, payment tape format, pharmacy identification cards, post-adjudication standard, prescription transfer standard, telecommunication standard, universal claim form, and medication history standard. **Domain 9**

6. d—DUE is an acronym for Drug Utilization Evaluation, which is mandated under OBRA '90. **Domains 2, 6**

7. c—Mark-up is defined as the difference between the selling price and cost. A discount is a deduction from the original price; inventory turnover is defined total cost of goods sold divided by average inventory value; and net profit is defined as the selling price minus the cost of good sold minus expenses associated with selling the good. **Domain 8**

8. c—Room temperature is 15° to 30° C (59° to 86° F). **Domain 8**

9. a—Atenolol is the generic name for Tenormin. Other drug names are as follows: metoprolol (Lopressor or Toprol XL), nadolol (Corgard), and propranolol (Inderal). **Domain 1**

10. c—Convert grams to milligrams: 1 g = 1000 mg. Use a proportion \$250.00/1000 mg = \$X/24 mg where X = \$6.00. **Domain 8**

11. c—MedWatch is a program instituted by the FDA that involves the voluntary reporting of adverse health events and medical products. **Domains 4, 5**

12. b—All pharmacies dispensing controlled substances must register with the DEA by submitting a DEA Form 224. **Domain 2**

13. b—DAW1 means the physician is requesting that the patient receive the brand name drug. **Domain 8**

14. d—"i tab tid" means take one tablet three times per day. 30 tablets/3 tablets/day = 10 days' supply. **Domain 6**

15. d—Flow rate is a specific volume per unit of time (1000 mL/8 hr = 125 mL/hr). **Domain 3**

16. a—According to the DEA and the Controlled Substances Act, medications placed in Schedule I have no medicinal use in the United States and have the highest potential for abuse. **Domain 1**

17. c—MAC stands for maximum allowable cost and is used in reimbursement of multisource drugs by third-party insurance plans. Whereas generic drugs are nonproprietary, brand name or trade drugs are proprietary drugs covered by a patent. **Domain 7**

18. a—E-prescribing results with a reduction of medication errors because the prescription is legible; there are fewer calls to the physician's office to obtain a new or refill prescription, which results in less time to process a prescription. Unfortunately, there is a cost associated with e-prescribing that is charged to the pharmacy. **Domain 9**

19. b—Neither federal nor state law allows a patient to call a new prescription into the pharmacy. A patient may request a refill of a prescription by telephone. **Domain 6**

20. c—The lumen is the opening in the needle by which medication is expelled from a syringe. **Domain 3**

21. b—An LCSW is a licensed clinical social worker, who works with individuals with affective disorders. LCSWs cannot prescribe medications. **Domains 2, 6**

22. c—Solve using the following formula: (IS)(IV) = (FS)(FV); (10%)(100 mL) = (0.9%)(X mL), where X = 1111 mL. To calculate the amount of diluent, subtract the initial volume from the final volume (1111 mL − 100 mL = 1011 mL of diluent). **Domain 3**

23. d—Premarin is conjugated estrogen, unlike the other three products, which are different dosage forms of estradiol. **Domain 1**

24. d—ii (Roman numeral for 2) gtt (drops) os (left eye) bid (twice per day). **Domain 6**

25. d—A syrup contains sucrose (sugar). **Domain 3**

26. a—A class A balance is a piece of required equipment for all pharmacies. Class A balances have a sensitivity of 6 mg. **Domain 3**

27. a—PO means by mouth. **Domain 6**

28. d—Information found in an Electronic Health Record includes patient demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data radiology reports, and advanced directives. **Domain 9**

29. a—A proper size syringe should not contain more than five times the volume to be measured. **Domain 3**

30. a—The Controlled Substances Act of 1970 requires that a pharmacy submit a DEA Form 41 in triplicate before the destruction of any controlled substances. **Domains 2, 7**

31. c—Pills, tablets, and capsules should be counted in multiples of five. **Domain 6**

32. a—The American Pharmacist Association's (APHA) goal are to improve medication use and advance patient care. They advocate for the practice of pharmacy regardless of the setting and provide informational resources for both pharmacists and pharmacy technicians. **Domain 5**

33. d—D5W is 5% dextrose in water. 1 L = 1000 mL. %w/v is defined as the number of grams per 100 mL of solution. This can be solved using the following proportion: 5 g/100 mL = X g/ 1000 mL, where X = 50 g. **Domain 3**

34. d—Venlafaxine is the generic name for Effexor and is an SNRI. **Domain 1**

35. c—1 gr is equal to approximately 65 mg; therefore, 2 gr would weigh 130 mg. **Domain 3**

36. a—*Osteo* is the word root for bone. The following word roots are for the other terms: cell *(cyte),* lymph *(lymph),* and muscle *(myo).* **Domain 6**

37. d—One of the advantages of a computerized physician order entry (CPOE) system is that it may be accessed from a variety of locations such a patient care setting, pharmacy, or physician's office. **Domain 9**

38. d—Solve by calculating the amount of medication the patient is to receive daily: Weight of child × Dose × Frequency (30 kg × 10 mg/kg × 3 doses/day = 900 mg/day). To calculate the volume, solve using a proportion: 50 mg/mL = 900 mg/X mL, where X = 18 mL. **Domains 3, 6**

39. c—Drug names are as follows: Zyprexa (olanzapine), Aricept (donepezil), Skelaxin (metaxalone), and Risperdal (risperidone). **Domain 1**

40. a—A month is considered to have 30 days in it. Because the patient is taking the medication only every other day, the patient would be taking 15 tablets in 30 days. **Domain 6**

41. c—One pair of gloves is worn underneath the cuffs of the protective clothing, and the second pair of gloves goes over the top of the cuffs of the protective clothing. **Domain 3**

42. c—Lorazepam is a Schedule IV drug. **Domain 2**

43. d—Prior authorization requires a physician to obtain approval from a managed care organization for a specific medication prior to it being dispensed by the pharmacy. **Domain 8**

44. c—Set up the problem as proportion using 3 mg/ 1 lb = X mg/60 lb, where X = 180 mg. **Domain 3**

45. b—A nonproprietary drug is another name for a generic drug; a proprietary or trade name is another name for a brand name drug; investigational drugs have not obtained FDA approval; and an OTC is an over-the-counter medication that does not need a prescription from a physician to be purchased. **Domain 1**

46. d—A pharmacy technician may screen patient profiles for drug–disease contraindications. Pharmacy technicians cannot perform duties that require and type of decision making; they may only perform technical duties. **Domain 2**

47. d—A corticosteroid ointment is more potent than a cream, gel, or lotion, assuming they are of the same concentration. **Domain 3**

48. c—The relationship between HIPAA and technology allows patients to access their information. **Domain 9**

49. a—A unit dose is the amount of medication required for one dose. The order is for 40 mg. To solve for the volume desired, use 10 mg/mL = 40 mg/X mL or 4 mL. **Domain 3**

50. c—The Pharmacy and Therapeutics Committee, composed of physicians, nurses, pharmacists, and administrators, determines the formulary based on the advantages and disadvantages

of a medication and its cost effectiveness. **Domain 8**

51. a—The Accreditation Council for Pharmacy Education (ACPE) accredits both pharmacy educational programs and continuing education for both pharmacists and pharmacy technicians. **Domain 5**

52. d—Stock rotation is the process in which newly purchased product is placed behind the older medication by checking the expiration dates. The product with the shortest life is placed in the front of the product with longer life span. **Domain 7**

53. c—Continuous quality improvement (CQI) does not focus on the individual who caused an error; rather, decisions are based on objective data, and CQI has a systemic approach toward improvement. **Domain 5**

54. d—Failing to perform pharmacy calculations properly is a mechanical error. Failing to screen a patient properly, making incorrect decisions during drug utilization evaluation, and failing to counsel a patient are judgmental errors. **Domain 4**

55. c—50 mg/1 mL = 75 mg/X mL, where X = 1.5 mL. **Domains 3, 6**

56. a—An improper dose error occurs when the patient is administered a dose that is greater or less than the prescribed amount. **Domain 4**

57. a—"Non rep" means do not repeat and is used to indicate that no additional refills are authorized. **Domain 6**

58. d—Information technology requires that it may be audited, is retrievable, and has unique methods to identify a patient. **Domain 9**

59. c—Enalapril is the generic name for Vasotec. The other drugs are Accupril (quinapril); Monopril (fosinopril), and Zestril (lisinopril). **Domain 1**

60. c—DEA numbers are required only on the hard copy of a prescription for a controlled substance. **Domain 6**

61. b—ii (2) caps (capsules) stat (immediately) then i (one) cap (capsule) q (every) hr (hour), max (maximum) 5 caps (5 capsules)/(per or in) 12 hr (hours). **Domain 6**

62. c—Medicare is a federally funded program for elderly patients. **Domain 8**

63. c—Category I medication errors are defined as an error occurred that may have contributed or resulted in patient's death. **Domain 4**

64. c—"JIT" is an acronym for "just in time," which is a technique used in inventory management in which the medication is reordered before it runs out. **Domain 7**

65. b—A Class II recall is one in which the medication causes reversible harm in an individual. Class I recalls may cause irreversible harm or death to an individual. A Class III recall does not cause any harm to a patient. There is no such thing as a Class IV recall. **Domains 4, 5**

66. a—Automatic dispensing systems are efficient, improve productivity in the pharmacy, and reduce medication errors. Unfortunately, they are expensive to purchase and maintain. **Domain 9**

67. c—GERD is an acronym for gastroesophageal reflux disease, which describes symptoms commonly referred to heartburn. GERD affects the gastrointestinal system. **Domain 1**

68. b—Military time begins at 12:01 AM and ends at midnight, which is 2400 hours. 0800 is the same as 8 AM. **Domain 6**

69. d—Examples of clinical decision supports systems (CDSS) include therapeutic duplication; drug–allergy, drug–drug, drug–food, drug–disease, and drug–laboratory test interactions; and IV compatibilities. **Domain 9**

70. a—The Food and Drug Administration (FDA) oversees MedWatch, which is a tool used to report adverse effects of a medication. The Institute of Medicine (IOM) provides information regarding health and wellness. The Institute of Safe Medication Practices (ISMP) examines means to reduce medication errors. The Joint Commission (TJC) accredits hospitals and long-term care facilities. **Domains 4, 5**

71. c—Cytotoxic medications are classified as hazardous compounds according to OSHA and therefore must be treated as such. In addition, they are regulated under the Resource Conservation and Recovery Act (RCRA). Hazardous waste must be placed in a specialized sharps container and

labeled as "hazardous waste." These products are picked up by companies authorized to handle its removal and disposition. **Domains 2, 7**

72. d—The Controlled Substance Act requires that a red "C" that is 1 inch in size be stamped on all controlled substance prescriptions and invoices containing controlled substances. **Domain 2**

73. c—Flow rate is calculated by using the following formula: Total volume/Infusion time (1000 mL/ 24 hours= 41 mL/hr.) **Domains 3, 6**

74. c—A medication is recalled because of impurities found in the medication (adulteration), packaging lacks required or incorrect information on the label, or it has been shown to cause harm or death to a patient. A damaged package is not a reason for a medication to be recalled. **Domain 4**

75. a—Accutane (isotretinoin) may irritate the mucous membrane if it is crushed. **Domain 4**

76. d—An institution's operating procedure manual describes the steps to follow in performing a procedure. Failing to follow these steps or procedure may affect the outcome of the procedure. Environmental factors such as storage temperatures and the proper packaging of a medication may affect the effectiveness of a medication. **Domain 5**

77. d—Fexofenadine is available only as an oral dosage form. Clonidine, estradiol, and fentanyl are available in the transdermal dosage form. **Domain 1**

78. a—*Inventory* refers to all products available for sale. *Investigational drugs* have not been approved by the FDA and are used in clinical studies. *Reclamation* refers to unsalable inventory. A *return* refers to any product that is being returned to its purchase source. **Domain 7**

79. d—Assigning blame to an individual is counterproductive and does not solve a potential problem. It is more important to understand the cause of the problem and identify a solution to prevent the incident from reoccurring in the future. **Domains 4, 5**

80. a—Examples of work lists include cart-fill updates, IV pick, IV fill, and labels. **Domain 9**

81. a—Health savings accounts were created under the Medicare Modernization Act that allows money to deducted from an individual's paycheck and to be used for medical purchases during a calendar year. There are limits to how much can be allocated. Money that has been set aside and not used during the calendar is forfeited. **Domain 8**

82. d—A physician in a hospital is responsible for ordering investigational drugs for a study. **Domain 7**

83. c—USP 797 states that gloves are removed in the "clean" side of the anteroom. **Domain 3**

84. a—Anticholinergic medication is not indicated in the treatment of depression. Monoamine oxidase inhibitors (MAOIs), selective serotonin reuptake inhibitors (SSRIs), and tricyclic antidepressants (TCAs) are drug classifications indicated in the treatment of depression. **Domain 1**

85. a—A *policy* is the rules of an institution, a *procedure* is the way something is performed, a *protocol* is a specific way of doing something under specific conditions, and a *standard* is a norm. **Domain 5**

86. d—"bupropion–busPirone" is an example of "tall man" letters used to distinguish two or more medications that are spelled similarly. The capital letters draw attention to the part of the drug name that is different. **Domain 4**

87. d—Unopened bottles of medication in their original packaging may be returned to a drug manufacturer based on the terms of the agreement between the drug manufacturer and pharmacy. **Domain 7**

88. a—A glass mortar and pestle should be used in mixing liquids because it will not stain the surface such as a porcelain or Wedgewood mortar and pestle. Porcelain and Wedgewood are used to triturate solid particles. **Domain 3**

89. b—The Food and Drug Administration (FDA) is responsible for establishing packaging guidelines to be used by drug manufacturers. **Domain 6**

90. b—Investigational drugs have special receiving practices, storage requirements, and disposition practices. Some of the storage requirements include being secured in an area with limited access, and they must be kept separate from other medications; the storage area must have a backup power source; a daily log of temperature must be maintained; the storage of study drugs are under appropriate conditions of temperature, humidity,

and light so that the identity, strength, quality, and purity of the study drugs are not affected; the site is responsible for investigational medications being safely stored, controlled, administered, and destroyed; there are acceptable storage conditions; temperature, storage times, and reconstitution requirements should be determined by the sponsor of all investigational products; and the packaging of study drugs is to prevent contamination and deterioration during transport and storage. **Domains 4, 5, 7**

91. c—Unfortunately, centralized automation can not be used for all medications and dosage forms. **Domain 9**

92. c—Solve by using the following information 2 tablespoons (30 mL) and 3 fl oz (90 mL). Set up the problem (IS) (IV) = (FS)(FV), where IS = 85%, IV=30 mL and FS = 10%; therefore, FV = 255 mL. Calculate the number of bottles using the following: 90 mL/1 bottle = 255 mL/X bottles where X = 2.88 or 3 bottles. **Domain 6**

93. a—USP 797 requires that the sink, all contact surfaces, and the floor be cleaned at least once a day. **Domains 3, 4**

94. c—The Institute of Safe Medication Practices (ISMP) oversees MEDMARX. **Domains 4, 5**

95. d—A drug formulary provides all of the drug information of a product covered under the formulary. **Domain 7**

96. a—A common side effect of antihistamines is drowsiness. **Domain 1**

97. b—Health maintenance organizations (HMOs) use a capitation payment system in which the pharmacy receives an agreed amount of payment per patient regardless of the number of prescriptions filled or the cost of the prescription. **Domain 8**

98. b—These are adverse effects of anticholinergic drugs. Anticholinergic drugs dry up body fluids. **Domain 1**

99. c—A synergistic effect is one in which the combined effect is greater than the effect of the two drugs combined. An additive effect is a sum of the drugs two effects. Potentiation occurs when one drug causes the effect of another drug to last longer than if taken alone. **Domain 1**

100. c—A *prime vendor agreement* occurs between a pharmacy and a wholesaler when the pharmacy agrees to purchase 90% to 95% of its purchases from that vendor. *ABC analysis* is a classification system that identifies the most commonly prescribed drugs in a pharmacy. *Group purchasing organizations* negotiate prices for hospitals. **Domain 7**

CHAPTER 10 PRACTICE EXAMINATION III ANSWERS

1. c—Postmarketing monitoring of medications is a tool for quality assurance to ensure medications are pure, safe, and effective. Adverse side effects are monitored, and any potential for harm is noted. If the medication may have detrimental effects on an individual, it may be pulled from the market by the manufacturer or the FDA. **Domain 5**

2. a—The abbreviation "hs" means at the hour of bed or hour of sleep. **Domain 6**

3. c—According to the Controlled Substances Act of 1970, the maximum number of refills allowed by a physician is five refills within 6 months of the date of the prescription being written. **Domain 2**

4. a—Colchicine is used in the treatment of gout and is not an NSAID. **Domain 1**

5. c—The abbreviation "os" means left eye. **Domain 6**

6. b—To solve this problem, the following formula should be used: (IS)(IV) = (FS)(FV), and substitute the following: (50%)(120 mL) = (FS)(300 mL), where the final volume (FV) is calculated by adding 6 oz (180 mL) to the initial volume (IV) of 120 mL. The final strength (FS) is 20%. **Domain 3**

7. b—Both horizontal and vertical laminar airflow hoods must be on for at least 30 minutes before being used in the preparation of sterile products. **Domain 3**

8. d—A prescribing error occurs with a physician. Prescribing errors include the physician failing to identify the route of administration; a patient's allergies; the correct medication name, strength, quantity, and refills; and complete directions for use. **Domain 4**

9. c—Noncompliance reports are a tool used to monitor savings and losses of a pharmacy when a group purchasing organization has negotiated specific prices for pharmaceutical products with a specific vendor. **Domain 7**

10. d—Warfarin would be contraindicated with vitamin K therapy. **Domain 1**

11. a—An interface is a connection between two or more computer systems that allows information to be transferred. **Domain 9**

12. d—Overhead is defined as the sum of all business's expenses. **Domain 7**

13. c—Ranitidine (Zantac) is not among the drugs to be excluded from using child-resistant containers under the Poison Control Act of 1970. **Domains 2, 6**

14. d—A biennial inventory is required of all controlled substances by the DEA every 2 years. **Domain 2**

15. c—The patient is receiving 10 mg per dose and will receive three doses in 1 day. 3 doses × 10 mg/dose equals 30 mg. **Domain 6**

16. c—A joint would be affected. **Domain 6**

17. c—Convert 154 lb to kilograms (154 lb/2.2 lb per kg = 70 kg). Calculate the amount of drug the patient will receive per day (12 mg/kg/day × 70 kg = 840 mg). Multiply the amount per day times 5 days (840 mg/day × 5 days = 4200 mg). Convert milligrams to grams (4200 mg/1000 mg per gram = 4.2 g). **Domains 3, 6**

18. d—Online adjudication (electronic) is the method most commonly used to submit payments to insurance carriers. In certain situations, a hard copy of the claim form (Universal Claim Form) may be required to be submitted for payment. **Domain 8**

19. d—Pharmacy technicians are not permitted to counsel patients. **Domains 2, 6**

20. b—MAOIs inhibit the activity of enzymes that break down catecholamine; therefore, the buildup of transmitters occurs at the synapse. Because of this buildup, MAOIs must be washed out of the system before treatment with another antidepressant is begun. **Domain 1**

21. a—Alert fatigue occurs when the computer operator is continuously seeing warnings and alerts that causes them to become overwhelmed and begin to ignore warnings and alerts. **Domain 9**

22. b—A patient would receive a maximum of six doses of (5 cc = 5 mL)/day for 5 days. The pharmacy would need to dispense 150 mL (5 fl oz) to fill the prescription. **Domains 2, 3, 6**

23. b—70% isopropyl alcohol is used to clean both horizontal and vertical laminar flow hoods. **Domains 3, 5**

24. d—i (1) cap (capsule) qid (four times per day) ac (before meals) and hs (bedtime). **Domain 6**

25. d—The number size is inversely proportionate to the amount it will contain; the smaller the number, the greater the capacity of the capsule. **Domain 3**

26. a—Capitation is a form of reimbursement used by insurance companies. This form of reimbursement favors the insurance company when the cost of the prescriptions exceeds the capitation being paid. **Domain 8**

27. c—Ciprofloxacin (Cipro) is a quinolone antibiotic. **Domain 1**

28. a—AAC means actual acquisition cost, which means the pharmacy is reimbursed for what it actually paid for the medication after receiving discounts from either the manufacturer or wholesaler. **Domain 8**

29. c—Zestril is the brand name for lisinopril. The other drug names are enalapril (Vasotec), fosinopril (Monopril), and quinapril (Accupril). **Domain 1**

30. a—The inscription is the name, strength, and quantity of the medication to be dispensed; Rx means to take a particular drug, the signa means "write on label" and is the direction to the patient, and the subscription contains instructions to the pharmacist (e.g., regarding refills, packaging, and generic substitution). **Domain 6**

31. a—Epinephrine is classified as class P hazardous waste. **Domain 5**

32. d—This is an alligation problem. Draw a tic-tac-toe table and place the highest concentration (10%) in the upper left corner; the lowest concentration

(1%) in the lower left corner; and the quantity to be prepared in the middle (45 g or 2%). Perform the following: $10 - 2 = 8$ parts of the 1% solution and $2 - 1 = 1$ part of the 10%. Add the parts together ($8 + 1 = 9$ parts); calculate the amounts of each by concentration (10%: $1/9 \times 45\ g = 5\ g$; 1%: $8/9 \times 45\ g = 40\ g$). **Domain 3**

33. d—Pharmacy technicians perform technical tasks; responding to a potential contraindication is a judgment decision, which only pharmacists can perform. **Domain 2**

34. c—The FDA is responsible for ensuring that all medications are pure, safe, and effective. If a product is adulterated or misbranded, the FDA may issue a product recall if the manufacturer does not voluntarily issue one. **Domain 5**

35. c—According to the ASHP, this is an example of a wrong drug preparation, which is defined as a drug being incorrectly formulated or manipulated and the medication is administered to patient. **Domain 4**

36. c—Class I recalls are associated with serious adverse health consequence or death. Class II recalls are associated with drugs that may cause temporary or medically reversible adverse health consequences. Class III recalls are associated with drugs not likely to cause an adverse health consequence. **Domain 5**

37. d—If tetracycline is taken after it has passed its expiration date established by the manufacturer, the patient may die. If the other products are taken after they have expired, the effectiveness will not be guaranteed by the manufacturer, and the patient may experience side effects. **Domains 1, 4**

38. c—A used needle should be disposed of in a red plastic sharps container to prevent an individual from being injured by the needle. **Domain 3**

39. b—One teaspoon is equal to 5 mL. "tid" means three times per day. The patient will be receiving 1 tsp three times per day, or 15 mL. The total amount of medication to be dispensed is 75 mL. 75 mL/15 mL per day = 5 days. **Domain 6**

40. b—The first five digits of an NDC number identify the drug manufacturer, the next four digits indicate the drug product, and the last two digits refer to the packaging of the drug. **Domains 2, 6**

41. d—None of the medications listed should be chewed. Actonel is an irritant, K-Dur is an extended-release dosage form, and nitroglycerin is a sublingual dosage form. **Domain 4**

42. b—Methylphenidate (Ritalin) is a Schedule II drug according to the Controlled Substances Act. **Domains 1, 2**

43. c—Nifedipine is generic name for both Procardia and Adalat, which are calcium channel blockers. **Domain 1**

44. c—Medicare is a federally funded prescription program for senior citizens. A health maintenance organization (HMO) is a type of a managed care organization. Medicaid is a federally funded prescription program administered by the states for families or individuals who fail to earn a specific yearly salary. **Domain 8**

45. b—The maximum number of different Schedule II medications legally allowed on a Form 222 is 10, which is found in the Controlled Substances Act of 1970. **Domains 2, 7**

46. d—The prescription would last 10 days (Quantity dispensed/Quantity taken per day). **Domain 6**

47. X—A computerized physician order entry system allows physicians to order laboratory tests, medical procedures, and prescriptions for their patients. **Domain 9**

48. c—Inunction is the process of rubbing a topical substance, such as creams, gels, and ointments, into the skin. **Domain 3**

49. c—A procedure is the way a specific task or responsibility is to be performed within an organization. **Domain 5**

50. b—A kilogram is equal to 2.2. lb. This problem can be solved using a proportion where 2.2 lb/1 kg = 4.4 lb/X kg. **Domain 3**

51. d—The expiration date of the drug administered is not required to be on a controlled substance administration record (CSAR). Items that do need to be recorded on a CSAR include the name of the medication, patient name, the amount, the amount that is wasted, the date and time it was administered and the individual, and who administered the controlled substance. **Domain 5**

52. d—A 20% solution contains 20 g of solute dissolved in 100 mL of solvent. The problem may be solved using the following proportion: 20 g/100 mL = 40 g/X ml. **Domain 3**

53. c—Lorabid (Loracarbef) is a synthetic β-lactam antibiotic of the carbacephem class. **Domain 1**

54. c—A monograph is literature on a specific drug product provided by the drug manufacturer. Information contained in a drug monograph includes the chemical name, indications of the medication, adverse effects, daily dosage, contraindications, warnings, precautions, and available doses of the medication. **Domain 5**

55. c—Telepharmacy brings pharmacy care to patients when it is not possible to bring the patient to the pharmacy setting; video conferencing is an example often used in telepharmacy during which patient counseling occurs in real time. **Domain 9**

56. d—Inject 10 mg of morphine sulfate (MSO_4) intramuscularly (IM) every (q) 4 hours (4h) as needed (prn) pain. **Domain 6**

57. d—NSAIDs are used for their analgesic, antiinflammatory, and antipyretic properties. **Domain 1**

58. c—Flow rate is calculated as Total volume/Time = 1000 mL/8 hr. **Domain 3**

59. b—Ciprofloxacin is a quinolone antibiotic and should not be prescribed to individuals younger than 18 years of age because it may cause damage to the tendons. **Domain 1**

60. b—Although the pharmacy technician may answer the pharmacy's telephone, the technician may not accept a new prescription over the telephone from the physician's office. **Domains 2, 5**

61. a—Both The Joint Commission and the Institute of Safe Medication Practices prohibit the use of trailing zeroes when accompanying a number because the decimal point may be missed. **Domain 4**

62. b—Use the following formula (IS)(IV) = (FS)(FV), where IS is 0.9%, IV is 250 mL, and FS is 0.45%. The final volume is 500 mL. However, the problem is looking for the amount of diluent; therefore, FV − IV = Amount of diluent. **Domain 3**

63. a—According to the Durham-Humphrey Amendment, the federal legend is "Caution: Federal Law prohibits dispensing without a prescription." **Domain 2**

64. c—*Cardio* is a root word meaning "heart." **Domains 1, 6**

65. b—The patient controls the electronic personal health record. The electronic personal health record can be originated with the physician, health care providers, or pharmacy. **Domain 9**

66. d—The Occupation Safety and Health Administration is responsible for enforcing regulations that affect employee safety. **Domains 2, 5**

67. d—Metronidazole is an antibiotic that may irritate an individual's stomach. All antibiotics should be taken for the entire course of therapy. Because this medication may irritate an individual's stomach, it should be taken with either food or milk. Metronidazole interacts with alcohol; therefore, alcohol should be avoided before, during, and for 3 days after taking the medication. **Domain 1**

68. c—This is an alligation problem in which one would use 9.4 g of the 10% ointment and 15.6 g of the 2% ointment to make a 25 g of a 5% compound. **Domain 3**

69. b—Patient-controlled analgesia (PCA) is a device attached to the finger that reacts to pressure being exerted by the individual and releasing the analgesic intravenously into the patient. **Domains 3, 4**

70. b—*Phase I* determines the appropriate dose range with regard to safety and toxicity. *Preclinical studies* are performed on animals to help establish boundaries of safety when human testing begins. An investigational new drug (IND) application is submitted to request permission to begin human testing (not an application for approval). *Phase II studies* are performed in 100 to 300 patients who have the disease or condition to be treated. *Phase III studies* are conducted in larger (several hundred to several thousand) patients in groups that the medication is ultimately intended. **Domain 7**

71. d—According to The Joint Commission (TJC), the abbreviation "u" has been mistaken for "cc," "4," and "0." **Domain 4**

72. b—When Phenergan suppositories are dispensed, they should be inserted rectally (pr). **Domains 1, 3, 6**

73. c—Any quantity of an investigational medications must be returned to the drug manufacturer when the study is completed. **Domains 1, 2, 5**

74. c—The Occupational and Safety Act was enacted to protect employees at work. The Occupational Safety and Health Administration was created as a result of this legislation. **Domains 2, 5**

75. d—Patient, physician, and insurance plan information can be entered and modified in a pharmacy database. In addition, medication and prescription pricing can be added to the database. **Domain 9**

76. c—*Medication reconciliation* is the process of obtaining a list of all medications (prescription and over-the-counter drugs) that a patient is taking. *Drug utilization* evaluation, formerly known as drug utilization review, is part of the prescription filling process in which the prescription being filled is being checked against other medications on a patient's profile to make sure there are no drug interactions or contraindications. A *patient profile* is information about the patient to include demographic information, a history of disease states or illness, allergies, and medications the patient is taking. **Domain 5**

77. c—Decentralized automated systems are used to solve medication management issues such as lost or missing billing information, medication pilferage, narcotic diversion and address poor record keeping. **Domain 9**

78. a—A DEA Form 41 is used to designate controlled substances that are being surrendered because for destruction because of damage or being expired. DEA Form 106 is used to report the theft of controlled substances. DEA Form 222 is used to order Schedule II medications. DEA Form 224 is used to register a pharmacy with the DEA that will allow it to dispense controlled substances. **Domain 2**

79. b—The most common problem associated with repackaging and preparing unit dose is the lack of entering the correct information into the repackaging log or failing to record the information. **Domain 7**

80. b—The pharmacy and therapeutics committee develops, maintains, and modifies a formulary for an institution or organization. **Domains 5, 7**

81. c—2.4 g is equal to 2400 mg. The problem can be solved using the following proportion: 600 mg/tablet = 2400 mg/X tablets. **Domains 3, 6**

82. b—*Comminution* is defined as an act of reducing a substance to small, fine particles. *Blending* is an act of combining two substances. *L*evigation is trituration of a powder drug with a solvent, in which the drug is insoluble with the solvent. *Tumbling* is the process of combining powders in a bag and shaking it. **Domain 3**

83. b—Purchasing medications directly from the drug manufacturer is cheaper than going through a wholesaler or prime vendor. The benefits of using a prime vendor include delivering 95% to 98% of the order on schedule, providing 24-hour, 7-day-per-week emergency service, and providing electronic ordering equipment and supplies to the pharmacy. **Domain 7**

84. b—A "dumb terminal" cannot function as a personal computer. These terminals are inexpensive and must be hooked up to a mainframe in order to be functional. "Dumb terminals" allow pharmacists and pharmacy technicians to access patient profiles. **Domain 9**

85. b—The abbreviation "dc" may be interpreted either as discontinue or discharge. **Domain 4**

86. d—A reverse distributor is permitted to handle the disposition of controlled substances. The DEA enforces the Controlled Substance Act, which defines a reverse distributor. The FDA is responsible that medications classified as controlled substances by the DEA are pure, safe, and effective. A drug manufacturer is not classified as a reverse distributor. **Domains 2, 7**

87. d—Factors that may influence a medication's effect on an individual includes age, gender, disease state(s), and other medications a patient is being prescribed. **Domain 1**

88. b—The American Society of Health System Pharmacists (ASHP) accredits pharmacy technician programs in the United States. The American College of Pharmacy Education (ACPE) accredits pharmacy education and continuing education in the United States. The Pharmacy Technician

Certification Board (PTCB) is one of two organizations that certify pharmacy technician. The Pharmacy Technician Certification Examination (PTCE) is the certification examination offered by the PTCB. **Domain 5**

89. d—Worker's compensation came about because of the enactment of the Occupational and Safety Act. **Domains 2, 5**

90. b—A fentanyl patch is changed every 3 days. **Domain 1**

91. d—A specific form is not required to order Schedules III, IV, or V. Schedule II medications require the usage of DEA Form 222 to order them. **Domains 2, 7**

92. c—Similar to online adjudication, the pharmacy incurs a fee when e-prescribing is used. **Domains 6, 9**

93. d—Warfarin has been identified through MEDMARX as one of the 10 most common medications involved in medication errors. **Domain 4**

94. d—Automation results in cost savings, higher productivity, and a reduction in medication errors. Work lists can be generated that allow pharmacy technicians to fill carts and replace floor stock; automatic compounders are used in preparing TPNs and computerized pumps to fill syringes. **Domain 9**

95. d—The state board of pharmacy (BOP) oversees the practice of pharmacy within the state. This is accomplished through enacting pharmacy regulations that allow for the state BOP to discipline individuals for failing to adhere to pharmacy regulations. **Domain 5**

96. a—Buccal tablets are placed between the gum and the cheek and are absorbed into the bloodstream at that point. Medications administered orally are swallowed and travel through the digestive tract to where they are absorbed, rectal suppositories are inserted in the rectum, and sublingual tablets are placed under the tongue. **Domain 3**

97. c—Solve by using the following formula: (IS)(IV) = (FS)(FV), where IS = 70%, IV = 1000 mL, and FS = 30%; FV = 2333 mL. The amount of water needed = FV − IV (2333 mL − 1000 mL = 1333 mL of water). **Domain 3**

98. c—Vitamin B is measured in milligrams. **Domain 1**

99. b—The NCPDP has established standards for batch transactions, pharmacy identification, and medication history. **Domain 9**

100. d—A goiter is associated with hyperthyroidism. **Domain 1**

CHAPTER 10 PRACTICE EXAMINATION IV ANSWERS

1. b—Calculate the volume of medication required to deliver the prescribed amount of drug per hour: 1 g (1000 mg)/250 mL = 250 mg/X mL, where X = 62.5 mL. To calculate the flow rate, solve using the following formula: Rate (mL/hr) × Drop size (drop/mL) × 1 hr/60 min = gtt/min (62.5 mL/hr)(10 gtt/mL)(1 hr/60 min) = 10 gtt/min. **Domain 6**

2. a—*Absorption* is the process of taking a drug from the administration site to the bloodstream, *distribution* is the process of taking the medication to organs and tissues, *metabolism* transforms the medication in the liver, and *elimination* (excretion) is the process by which the drug is removed from the body. **Domain 2**

3. a—Benazepril is the generic name for Lotensin. **Domain 1**

4. b—One must work at least 6 inches inside the laminar airflow hood to follow USP 797. **Domains 3, 5**

5. b—Capsules have a gelatin shell as an outer covering, unlike the other products mentioned. **Domain 3**

6. b—The Durham-Humphrey Amendment is being violated if a prescription drug is dispensed without a valid prescription.—**Domain 2**

7. c—AWP stands for average wholesale price and is a term used in determining costs and calculating the profitability of a product. **Domain 8**

8. b—During the process of geometric dilution, an individual is combining more than one ingredient. One begins by using the most potent (normally the smallest quantity) first in the mortar; then an equal amount of the next most potent

drug is added. This process continues until all quantities have been added and mixed. During geometric dilution, the total quantity of drug being prepared is approximately doubling with each ingredient added. **Domain 3**

9. c—The patient will be taking one capsule four times a day; therefore, the prescription will last 10 days. **Domain 6**

10. c—Diltiazem (Cardizem) is a calcium channel blocker. Atenolol and carvedilol are beta-blockers, and lisinopril is an ACE inhibitor. **Domain 1**

11. b—Convert 10 g to milligrams (10 g × 1000 mg/g = 10,000 mg). Divide the total weight by the weight per dose (10,000 mg/500 mg per dose = 20 doses). **Domain 6**

12. d—Glucosamine has been shown to be helpful in treating arthritis, feverfew may be used for migraines, ginger is used as an antiemetic, and ginkgo is used for circulatory issues. **Domain 1**

13. d—*Thickening agents* are used to make a liquid thicker (increases its viscosity or resistance to flow); *emulsifiers* are used to mix oil with water by creating an emulsion; *flocculating agents* are used to prevent clumping of particles in a suspension; and a *mucilage* is a thick, glue-like substance. **Domain 3**

14. b—A sign-in or access code identifies a particular user on a computer. The sign-in is specific for a particular individual and may consist of numbers, letters, or symbols. It is a form of computer security. An individual should never provide another individual with his or her sign-in or access code. **Domain 9**

15. a—Alendronate is the generic name for Fosamax. The other medications are calcitonin–salmon (Miacalcin), etidronate (Didronel), and raloxifene (Evista). **Domain 1**

16. a—According to the FDA classification system, AA shows that the medication meets bioequivalence requirements. **Domains 1, 2, 4**

17. c—Kaiser Permanente is an example of an HMO. Blue Cross-Blue Shield is an example of pharmacy benefit manager, CHAMPUS is an example of government-managed care organization, and worker's compensation is a program under the Occupational Safety and Health Administration that provides benefits to employees who are injured on the job. **Domain 8**

18. a—One of the ingredients of a compound must be a legend drug. **Domain 8**

19. c—Olanzapine is the generic name for Zyprexa, olopatadine is the generic for Patanol, nefazodone is generic for Serzone, and trazodone is generic for Desyrel. **Domain1**

20. X—d—Using a proportion, calculate the amount found in 4 fl oz (120 mL): 50 g/1000 mL = X g/120 mL, where X = 6 g. **Domain 3**

21. a—An *auxiliary label* provides additional information to the patient. *Patient product inserts* are required for products containing estrogens. *Patient profiles* provide the pharmacist with information about the patient, such as illness, both OTC and Rx medications being taken, drug allergies, and demographic and payment information. A *prescription label* provides information to the patient containing the name, strength, and quantity of drug and directions for usage as prescribed by the physician. **Domain 6**

22. c—A printer is an output device. **Domain 9**

23. c—HCTZ is an abbreviation for the diuretic hydrochlorothiazide. **Domains 1, 6**

24. c—The Poison Prevention Act of 1970 permits certain medications (e.g., nitroglycerin) not to be dispensed in child-resistant containers. **Domains 2, 6**

25. a—Aspirin does not reduce the level of cholesterol in the body. Fibric acid derivatives and HMG-CoA reductase inhibitors are classifications of drugs used to treat hyperlipidemia. Metamucil has been shown to lower cholesterol in the body. **Domain 1**

26. c—A *subscriber* is the individual who has a health insurance policy. A *deductible* is the amount of money to be paid by the subscriber before coverage taken place on a yearly basis. The *provider* is the individual or organization providing the service. The *third-party organization* is the organization making the payment to the provider. **Domain 8**

27. b—For patients who are allergic to penicillin, there is a 10% chance they will be allergic to a cephalosporin. **Domain 1**

28. b—Class A balances, which are used to measure solid ingredients in compounding in a pharmacy, must have a minimum sensitivity of 6 mg. **Domain 3**

29. c—To convert a ratio to a percent, write the ratio as a fraction, divide the numerator by the denominator, and multiply by 100. 1 : 20 is the same as 1/20. 1/20 = 0.05; 0.05 × 100 = 5.00%. **Domain 3**

30. d—U&C means the charge is the usual and customary charge that a patient would pay if his or her third-party payer were not involved in the transaction. **Domain 8**

31. c—PAR is the acronym for periodic automatic replacement in which a medication is automatically reordered when it reaches a predetermined quantity. **Domain 7**

32. d—Solve using the following formula: (Rate) (Kit size) (1 hr/60 min) = gtt/min, where (100 mL/0.5 hr) (10 gtt/mL) (1 hr/60 min) = 33 gtt/min. **Domains 3, 6**

33. b—The first letter may be an A, B, F, or M. The second letter is the first letter of the prescriber's last name. Next, the numbers in the first, third, and fifth positions are added. Then the numbers in the second, fourth, and sixth positions are added; this sum by is multiplied by 2. Both sums are added together, and the correct number should be the last number. **Domains 2, 6**

34. a—A biennial inventory of all control substances in a pharmacy is required to be completed every 2 years under the Controlled Substance Act. An open inventory is one in which a pharmacy does not use a formulary and the inventory is based on the physician's prescribing habits. A perpetual inventory is one that provides an accurate count of a medication at a particular moment in time. A physical inventory provides a dollar value for the pharmacy's inventory. **Domains 2, 7**

35. d—Examples of computer technology found in pharmacies today include automatic dispensing and compounding devices, bar coding, robotics, touch screens, computerized physician order entry devices, and PDAs. **Domain 9**

36. d—Whereas tablets are a solid dosage form, creams, ointments, and suspensions are dispersions. **Domain 3**

37. b—The Controlled Substances Act of 1970 allows for a maximum of five refills for Schedules III to V drugs within 5 months of the date the prescription was written. **Domain 2**

38. d—A premium is the cost of the health insurance. A benefit is something provided to an individual that does not need to be provided. The copay is the amount of money an individual covered under a prescription drug plan pays for a prescription. A deductible is the amount of money individual must pay before coverage takes place on a calendar year. **Domain 8**

39. d—The fluffy precipitate indicates the precipitation of dextrose; the solution must be shaken to ensure that dextrose is thoroughly distributed throughout the bag. **Domains 3, 4**

40. a—The Controlled Substances Act of 1970 does not allow for refills for Schedule II medications. **Domain 2**

41. b—CSAR stands for controlled substance administration record. CSARs are used in hospitals and other institutional facilities to acknowledge the administration of a controlled substance to a patient. The individual administrating the medication must sign his or her name and the time of administration. **Domains 2, 6**

42. c—Using the formula (IS)(IV) = (FS)(FV), the initial strength is 25%, the initial volume is 600 mL, and the final volume is 700 mL (Initial volume + Amount of diluent). Substituting these values in the equation yields a final strength of 21.4%. **Domains 3, 6**

43. b—The Drug Listing Act of 1972 provided a unique numbering system for each product. This 11-digit number identifies the manufacturer, the product, and its package. **Domains 2, 6**

44. d—Glyburide, an oral hypoglycemic agent, is used in the treatment of diabetes. **Domain 1**

45. a—Oxycodone + APAP is the same as Percocet and Tylox. Under the Controlled Substances Act of 1970, these products have a extremely high potential for abuse, but they have a medicinal use in the United States. **Domains 1, 2**

46. c—Isoniazid is used to treat tuberculosis. Albuterol, ipratropium, and salmeterol are used to treat asthma. **Domain 1**

47. c—The American Society of Health System Pharmacists accredits residency programs for pharmacists and pharmacy technician training programs. **Domain 5**

48. c—Patient package inserts are to given to all patients receiving metered-dose inhalers, oral contraceptives, estrogen, progesterone, and Accutane. **Domains 5, 6**

49. d—A tablet can be produced either through compression or molding. **Domain 3**

50. a—Acetaminophen is safe to take for a headache. Acetylsalicylic acid (aspirin), ibuprofen, and naproxen sodium are contraindicated for individuals with peptic ulcer disease. **Domain 1**

51. b—Nurses administer medications to patients in hospitals, so they sign the Medication Administration Record after administering a patient's medication. Physicians, pharmacists, and pharmacy technicians do not administer medications to patients. **Domain 5**

52. c—Instill one (i) drop (gtt) in each eye (ou) three times a day (tid) as directed (ud). **Domain 6**

53. c—1 gr = 65 mg; therefore, the problem can be solved as 1 gr/65 mg = 1.5 gr/X mg. **Domain 3**

54. d—It is voluntary to report prescription errors. **Domain 4**

55. b—A pharmacy has 7 days from the date the prescription is written to fill a prescription for Accutane, according to the Isotretinoin Safety and Risk Management Act of 2004. **Domain 2**

56. b—Calculate the number of minutes infusion will take (20 units/min = 100,000 units/X min; X = 5000 min). Calculate gtt/min (1000 mL/5000 min × 60 gtt/mL = 12 gtt/min). **Domain 3**

57. d—Doxycycline should be taken with food because it may irritate the stomach. **Domain 1**

58. d—A "mini-drip" system yields 60 drops/mL. **Domain 3**

59. a—USP 797 requires that hazardous drugs be compounded in a biological safety hood. **Domains 3, 5**

60. d—There is 600 mg of guaifenesin in 240 mL of the compound. The patient is to receive 4 doses a day (qid), and one dose is 5 mL. Set up problem as follows: 600 mg/240 mL = X mg/20 mL; X= 50 mg. **Domain 3**

61. d—Upon discovery of a prescription error by a pharmacy technician, the technician should inform the pharmacist immediately. **Domain 4**

62. d—Solve problem: 30%/100% = X/$2.00, where X = $0.60 (profit). Cost ($2.00) + Profit ($0.60) = Retail price ($2.60). **Domain 8**

63. b—Oxycodone with acetaminophen is a Schedule II controlled substance under the Controlled Substance Act and must be locked in the pharmacy safe. **Domains 2, 7**

64. b—Imitrex is used to abort migraine headaches. Amoxicillin is used prophylactically for dental work for patients who have artificial heart valves. Norgestimate-ethinyl estradiol is used to prevent pregnancy. Propranolol is used to prevent migraine headaches. **Domain 1**

65. a—Bupropion is marketed as an antidepressant under the brand name Wellbutrin and as a smoking cessation agent under the brand name Zyban. **Domain 1**

66. c—Vaccine Adverse Events Report (VAERS) is used to report vaccine adverse events, and FDA Adverse Events Reporting (FAERS) is used to report drug adverse events. **Domain 4**

67. c—D10W is a 10% w/v solution in which 10 g of dextrose is dissolved in 100 mL of solvent. The problem can be solved using the following proportion 10 g/100 mL = 100g/X mL. X = 1000 mL or 1 L. **Domain 3**

68. c—An 80/20 report is a tool used in inventory management that identifies drug products that use 80% of the pharmacy's purchasing dollars. 20% of the medications stocked in a pharmacy account for 80% of the inventory dollars. **Domain 7**

69. a—Electrolytes are measured in milliequivalents. **Domain 3**

70. a—Under the Controlled Substance Act, all medications classified as controlled substance require the prescriber possess a DEA number to prescribe them. **Domains 2, 6**

71. a—The Durham-Humphrey Amendment defined both prescription and over-the-counter medications. In addition, all prescription medications carried the federal legend. **Domain 2**

72. d—Some of the reports generated by a pharmacy computer include Controlled Substance Drug Report, customer history, daily prescription log, and PAR values for each medication and controlled substance prescribed by physicians. **Domain 9**

73. c—One of the requirements of OBRA-90 is that drug utilization evaluation be performed on all prescriptions during the prescription filling process. In addition, OBRA-90 requires patient profiles to be maintained on all patients and an offer be made to counsel all patients. **Domains 2, 6**

74. d—Singular (montelukast) is a single entity drug. Advair (fluticasone–salmeterol), Allegra D (fexofenadine–pseudoephedrine), and Combivent (ipratropium–albuterol) are combination medications. **Domain 1**

75. d—A suppository is not a dispersion. **Domain 3**

76. b—An interface is a connection to two or more computer systems. **Domain 9**

77. b—"w/v" is defined as the number of grams per 100 mL. **Domain 3**

78. d—No pharmacy technicians can recommend an OTC product to a patient because this is considered counseling, and pharmacy technicians cannot counsel patients. **Domain 2**

79. c—Medicare is priced according to the contracted provider rate. **Domain 8**

80. a—When in doubt about filling a prescription, ask the pharmacist. **Domain 4**

81. b—The abbreviation "pr" means "per rectum." **Domains 3, 6**

82. c—A prescription or medication order becomes active immediately whether it is entered by a pharmacist or a pharmacy technician. **Domain 6**

83. d—Schedule II controlled substances must be ordered with a DEA Form 222, according to the Controlled Substance Act. **Domains 2, 7**

84. a—Pharmacy automation improves the efficiency and accuracy of pharmacy tasks and simplifies the workflow. It provides pharmacists with the opportunity to allocate more time to perform clinical tasks such as counseling patients. Unfortunately, these systems are expensive and require a minimum number of prescriptions to be filled each day to be cost effective. **Domain 9**

85. d—Convert the ratio to a fraction (1 : 10 = 1/10) and then convert to a percent (1/10 = X%/100%; X = 10%). **Domain 3**

86. c—Climara, Estraderm, and Vivelle are transdermal dosage forms. Premarin is available as a tablet and vaginal cream. **Domain 1**

87. b—A class II drug recall causes reversible harm and is temporary. A class I drug recall causes permanent harm or may be fatal to the patient. A class III drug recall does not cause any harm to the patient. There is no such thing as a class IV drug recall. **Domains 4, 5, 7**

88. b—Bar codes require the use of a scanner to read the bar code. Information contained on the bar includes the drug manufacturer, medication, lot number, and expiration date. **Domain 9**

89. a—25,000 units/500 mL = 50 units/mL. **Domains 3, 6**

90. 9—USP 797 states that multidose containers must be used within 28 days. **Domains 3, 5**

91. d—Some of the things that may contribute to medication errors include noise, insufficient help during peak periods of time, poor pharmacy lighting, employees multitasking, and having a cluttered pharmacy. **Domain 4**

92. b—A deficiency of vitamin B_1 may lead to beriberi, a deficiency of vitamin A may lead to vision problems, a deficiency of vitamin C may lead to scurvy, and a deficiency of vitamin D may lead to rickets. **Domain 1**

93. d—USP 797 states that USP purified water is be used to remove water-soluble residue. **Domains 3, 5**

94. d—Automated dispensing systems are not capable of restocking all medication dosage forms. **Domain 9**

95. d—Medications returned by the patient cannot be returned to the drug manufacturer unless they are part of a drug recall. **Domain 7**

96. d—Automated compounding devices are capable of preparing IV admixtures for both adult and neonatal total parenteral nutrition. This device contains pumps that add the base solution, electrolytes, and nutrients. Some pumps are able to prefill syringes.

97. d—125 mg/5 mL= 500 mg/X mL, where x = 20 mL. **Domain 9**

98. c—Community pharmacies purchase their medications from drug manufacturers or a wholesaler. Not all community pharmacies are chain pharmacies and therefore would not use a chain pharmacy warehouse. Group purchasing organizations negotiate prices for hospitals, but they do not purchase the medications for a hospital. Also, they do not represent community pharmacies. **Domain 7**

99. c—Hepatotoxicity affects the liver. **Domains 1, 6**

100. b—Universal precautions are used to prevent a health care provider from contacting bloodborne pathogens and infections. **Domain 5**

CHAPTER 10 PRACTICE EXAMINATION V ANSWERS

1. d—Rhinitis is a runny nose. **Domain 1**

2. a—A small-volume parenteral contains 100 mL or less of solution. **Domain 3**

3. b—*Inhibition* is the process whereby an agent can slow or block enzyme activity, which impairs the metabolism of drugs and as a result may increase their concentration. *Additive effects* are the combined effects of two drugs. *Potentiation* is an effect that increases or prolongs the action of another drug; the total effect is greater than the sum of the effects of each drug taken alone. *Synergism* is the joint action of drugs in which their combined effect is more intense or longer in duration than the sum of their individual effects. **Domain 1**

4. c—Sulfasalazine may cause photosensitivity in an individual if he or she is exposed to direct sunlight; one should drink plenty of water to prevent crystals from developing in the kidneys. Sulfasalazine has the tendency to change the color of urine from a yellow to an orange-brown color. **Domains 1, 6**

5. a—The gauze swab will protect the finger from being cut by fine pieces of glass. **Domains 3, 4**

6. b—Inventory turnover rate is calculated by dividing the total sales by the average inventory value. $2,750,000/[($225,000 + $250,000)/2] = 11.58. **Domain 7**

7. d—OSHA stands for the Occupational Safety and Health Administration, which is concerned with employee safety. HIPAA stands for the Health Insurance Portability and Accountability Act, which is concerned with patient confidentiality. TJC is The Joint Commission, which is responsible for establishing standards for hospitals, nursing homes, and long-term care facilities and ensuring that the standards are maintained. OBRA is the Omnibus Budget Reconciliation Act, which requires drug utilization review and that an offer to counsel is to be made to every customer. **Domain 2**

8. c—Pharmacy calculation errors may be caused by failing to use proper pharmacy conversions, misplacing the decimal point, using trailing zeros, using incorrect calculation formulas, failing to check one's work, and not having the pharmacist check the technician's work. **Domain 4**

9. X—A 25% solution means that it contains 25 g/100 mL. The problem can be solved using the following: 25 g/100 mL = X g/250 mL, where X = 62.5 g. **Domain 3**

10. d—Latanoprost (Xalatan) must be refrigerated after opening. **Domains 1, 7**

11. c—Solve by using the following formula: (Initial volume)(Initial strength) = (Final volume)(Final strength): (300 mL)(50%) = (300 mL + 200 mL = 500 mL)(Final strength), where the final strength is 30%. 30% means that there is 30 g in 100 mL. To calculate the number of grams in 500 mL, a proportion is used: 30 g/100 mL = X g/500 mL, where X = 150 g. **Domain 3**

12. a—Air flows in only one direction in a laminar flow hood, away from the hood in a horizontal flow hood and upward in a vertical flow hood. **Domain 3**

13. a—The sale of an "exempt narcotic" requires that an individual be at least 18 years of age and a

resident of the community and that no more than one 4-oz bottle be sold in the original manufacturer's bottle every 48 hr. The patient must complete the exempt narcotic log (record), which includes the date of the purchase and his or her name and address. The pharmacist must see that the name, quantity of the product, and the selling price of the product are entered in the "exempt narcotic book." The pharmacist must sign his or her name in the book as the seller of the "exempt narcotic." **Domain 2**

14. c—Evista is used to treat osteoporosis. **Domain 1**

15. c—The master formula sheet, also known as a pharmacy compounding log, indicates the amount of each ingredient used, the procedures used in the preparation, and the labeling instructions. **Domain 3**

16. a—At bedtime (hs), if needed (prn). **Domain 6**

17. b—A list price is a synonym for suggested retail price. Discounted price, net price, and sale price reflect a reduction in price. **Domain 8**

18. c—"Readily retrievable" means able to be provided to a third party, such as the DEA or representatives from a particular state board of pharmacy, within 72 hours. **Domain 2**

19. b—An *elixir* is a clear, sweetened, flavored hydroalcoholic solution containing water and alcohol that may or may not be medicated. *Collodions* are a topical dosage form that contains pyroxylin and is dissolved in alcohol and ether. A *suspension* is a two-phase system in which solid particles are dispersed in a liquid vehicle, which may be oral, topical, or injectable. *Syrups* are aqueous solutions containing sucrose or sucrose substitutes. **Domain 3**

20. c—Convert grams to milligrams: 2 g × 1000 mg/g = 2000 mg. Set up a proportion: 2000 mg/30 mL = X mg/5 mL, where X = 333 mg. **Domain 6**

21. d—Pharmacy technicians are not permitted to take new verbal prescriptions over the phone from a nurse or anybody else in a doctor's office. Verbal prescriptions order may result in more medication errors than those sent electronically. Selections a, b, and c are methods to reduce medication errors. **Domains 2, 5, 6**

22. b—The generic drug names are irbesartan (Avapro), candesartan (Atacand), losartan (Cozaar), and valsartan (Diovan). **Domain 1**

23. d—Etoposide must be prepared in a biologic safety cabinet because it is a plant alkaloid used in the treatment of cancer. **Domains 2, 3, 4**

24. d—The state board of pharmacy (BOP) will investigate all reported claims of medication error and will consider appropriate sanctions against all providers. The state BOP is concerned with the practice of pharmacy in a particular state, which includes the behavior of pharmacists. The DEA is concerned with adherence to the Controlled Substances Act. The FDA's priorities are to ensure that food and medications are pure, safe, and effective. MedWatch is concerned with adverse effects of medications. **Domains 4, 5**

25. d—The Joint Commission requires the following to be part of an institution's infection control policy: containment and disposal of waste, hand-washing technique and personal hygiene requirements, infection surveillance, prevention and control for the pharmacy, irrigation solution preparation, microbial monitoring of laminar flow hoods, preparation of sterile parenteral nutrition products, proper use of laminar flow hoods, reporting of unsanitary conditions and practices, requirements for assessing sterile technique of personnel and frequency assessed, routine cleaning of pharmacy facilities, shelf life of all sterile items in storage, storage of sterile medication products, testing for microbial contamination of hospital-prepared sterile products, traffic control of sterile medication preparation areas, and use of single-dose and multidose containers. **Domain 5**

26. d—The Controlled Substances Act allows for certain controlled substances to be purchased without a prescription under specific conditions. These substances are Schedule V drugs. The medications involve products containing specific amounts of codeine and paregoric. To purchase a container, the individual must be at least 18 years of age, the product must be packaged in the manufacturer's original container (4-oz bottle), the exempt narcotic log must be signed, the drug must be sold by a pharmacist, and the patient may purchase only one 4-oz bottle in 48 hours. **Domain 2**

27. d—Computers do all of these activities. **Domain 9**

28. c—Certified pharmacy technicians must renew their certifications every 2 years. **Domain 5**

29. d—Prescriptions are medication orders written by a physician to be obtained through a community or mail-order pharmacy. **Domain 6**

30. b—Lansoprazole is generic for Prevacid, esomeprazole is generic for Nexium, omeprazole is generic for Prilosec, and pantoprazole is generic for Protonix. **Domain 1**

31. b—FDCA 1938 is the Food, Drug, and Cosmetic Act of 1938, which clearly defined adulteration and misbranding. Preparing prescriptions under unsanitary conditions is an example of adulteration. **Domain 2**

32. d—Convert grams to milligrams: 1.2 g × 1000 mg/g = 1200 mg. Use a proportion to calculate the volume to be infused: 50 mg/1 mL = 1200 mg/X mL, where X = 24 mL. **Domains 3, 6**

33. b—During phase II, a final review is done on the ingredients of the agent in question. The public is able to give feedback. All data are taken into account. In phase I, advisors evaluate the agent in question to determine whether it is safe and effective when taken by the consumer or patient. During phase III, all of the final evidence is presented, all aspects of the agent are exhausted, and the final monograph is published. **Domain 5**

34. b—Only the state board of pharmacy (BOP) may discipline a pharmacy technician for inappropriate behavior because the BOP oversees the practice of pharmacy within the state. **Domains 2, 5**

35. b—A HEPA filter is a high-efficiency particulate air filter found in a laminar flow hood to remove contaminants. **Domain 3**

36. c—Insurance companies prefer that generic medications be dispensed because of the potential savings to both the insurance company and the patient. **Domain 8**

37. b—25% means that there are 25 g in 100 mL of solution. Solve using a proportion: 25 g/100 mL = X g/200 mL, where X = 50 g. To calculate the kilocalories, solve using the following proportion: 1 g/3.4 kcal = 50 g/X kcal, where X = 170 kcal. **Domains 3, 6**

38. c—The subscription on a prescription consists of directions to a pharmacist and may include compounding, packaging, labeling, and refill instructions and information about the use of generic medication. **Domain 6**

39. c—A *deductible* is an amount an individual must pay before the insurance company begins to make a payment. *Coinsurance* means that two parties are responsible for the payment. *Copayment* means the insured party must pay a given amount of money each time before the insurance company begins to pay. *Maximum allowable cost* is the most the insurance company will pay for a generic medication. **Domain 6**

40. b—i is the Roman numeral for 1, gtt means drop, "ou" means each eye, and "bid" means twice per day. Instill 1 drop in each eye twice per day. **Domain 6**

41. d—Schedules II, III, and IV are monitored through prescription monitoring programs. **Domain 2**

42. a—Insulin is measured in USP units. **Domains 1, 6**

43. a—The Accrediting Council for Pharmacy Education accredits continuing education for both pharmacists and pharmacy technicians. **Domain 5**

44. c—A 1:25 ratio is converted to a percentage by dividing the first number of the ratio by the second number and multiplying the answer by 100. **Domains 3, 6**

45. c—Cordarone is used to treat arrhythmias. **Domain 1**

46. c—NPI stands for National Provider Identifier. **Domain 8**

47. d—The ASHP considers a wrong drug preparation as one in which the drug is incorrectly formulated or manipulated and the medication is administered to patient. All of the examples provided would be considered wrong drug preparation errors. **Domain 4**

48. b—A modified unit dose is a drug distribution system that combines unit-dose medications blister-packaged onto a multiple-dose card instead of being placed into a box. Such packages are referred to as punch cards, bingo cards, or *blister cards,* and one card may contain 30, 60, or 90 units. **Domains 4, 7, 9**

49. a—An emulsion may be either oil-in-water or water-in-oil. **Domain 3**

50. c—This is an alligation problem requiring an individual to make a 40% dextrose solution from both 60% and 10% dextrose solution. Place the 60% in the upper left corner, the 40% in the middle, and

the 10% in the lower left corner. 60% − 40% = 20 parts of the 10% solution. 40% − 10% = 30 parts of the 60% solution. The total number of parts is equal to 50 parts. To calculate the required quantities of each solution, use a proportion. 30 parts of 60% solution/50 parts of 40 solution = X mL of 60% solution/1000 mL of 40% solution, where X = 600 mL of 60%. 20 parts of 10% solution/50 parts of the 40% solution = X mL of 10% solution/1000 mL of 40% solution, where X = 400 mL of the 10% solution. **Domains 3, 6**

51. d—The drug manufacturers have done all of the above to reduce medication errors. The drug name Losec was changed to Prilosec, the labeling on Synthroid bottles is the same color as the tablets inside, and "tall man" letters have been developed for medications to help eliminate medication errors. **Domain 4**

52. b—A list of the patient's prescriptions and over-the-counter medications is not required when releasing patient information. **Domains 2, 6**

53. b—Drug formularies are reviewed and updated by an organization's pharmacy and therapeutics committee every 12 to 18 months. **Domains 7, 8**

54. b—Using Young's rule: Age of child in years × Adult dose/(Age of child in years + 12) will yield 3.3 mg. **Domains 3, 6**

55. c—Automation decreases the possibility of medication errors. **Domains 4, 9**

56. b—Anabolic steroids are classified as Schedule III controlled substance as a result of the Anabolic Steroid Control Act of 1990. **Domain 2**

57. d—Prescriptions for drugs in Schedules III, IV, and V may be faxed to a pharmacy from a physician's office. **Domain 2**

58. c—A microgram is the smallest unit of weight of the answers. Going from smallest to largest, they are microgram, milligram, gram, and kilogram. **Domain 3**

59. c—The abbreviation "dtd" is from a Latin expression meaning "give of such doses." **Domains 3, 6**

60. c—IV means intravenous. The other routes of administration are IA (intraarterial), IM (intramuscular), and SL (sublingual or under the tongue). **Domain 3**

61. d—Vicoprofen is a controlled substance. **Domain 2**

62. a—According to the ASHP, if a patient does not adhere to his or her prescribed regimen, it is known as a compliance error. **Domain 4**

63. a—MAR stands for medication administration record. **Domains 4, 5**

64. a—Convert pounds to kilograms: 44 lb × 1 kg/2.2 lb = 20 kg. Next, calculate amount the patient is to receive each day: 4 mg/kg × 20 kg = 80 mg/day. Then calculate the volume to be given to the patient: 30 mg/5 mL = 80 mg/X mL, where X = 13.3 mL. **Domain 6**

65. b—Elixirs, spirits, and syrups contain either alcohol or sugar; people with diabetes should not receive either of them. Emulsions do not contain alcohol or sugar. **Domain 3**

66. c—Percocet is oxycodone plus acetaminophen. The other drug names are Tylenol C Codeine (acetaminophen–codeine), Vicodin and Lortab (hydrocodone–acetaminophen), and Darvocet N (propoxyphene–acetaminophen). **Domains 1, 2**

67. b—Expired medications are identified and removed automatically by robotics scanning the bar codes. **Domain 9**

68. a—A "crash cart" is synonymous with a code blue cart. A code blue is announced whenever a patient develops a serious condition that may result in death. Serious situations involving the heart or the lungs are the most common causes for calling a code blue. **Domain 7**

69. a—The generic drug name for Ativan is lorazepam. Flurazepam is generic for Dalmane, clonazepam is generic for Klonopin, and diazepam is generic for Valium. **Domain 1**

70. a—A drug coupon card is an incentive provided by the drug manufacturer for individuals who may not able to afford a medication. **Domain 8**

71. c—Pharmacy technicians may gather information for quality assurance purposes and enter and organize the data in the computer, but they may not interpret this information. **Domain 9**

72. b—All employees must be provided yearly training in bloodborne pathogens. Employers are

required to offer hepatitis B injections to their employees, but the employee may refuse to receive one. Nonlatex gloves must be provided who may be exposed to bloodborne pathogens because of latex allergies. **Domain 5**

73. b—ASHP stands for American Society of Health-System Pharmacists. **Domain 5**

74. c—Generating labels is not a management function; pharmacy technicians may generate labels. **Domain 9**

75. c—There is 480 mL in 1 pint. **Domain 3**

76. c—1 mg of protamine sulfate will neutralize 90 to 120 units of heparin. **Domain 1**

77. d—Staff should be made aware of the continuous issue regarding medication errors. Every attempt should be made to provide the pharmacy staff with the necessary tools to prevent medication errors from occurring whether it is through newsletters, ISMP materials, or yearly meetings to address this issue. **Domain 4**

78. c—The Drug Topics Orange Book is included in *USP DI* Volume III and contains the FDA's approved drug products. **Domain 5**

79. c—Salicylates have a tendency to irritate the stomach and affect blood platelets before an overdose occurs. Tinnitus is a ringing in the ears and is a symptom of salicylate overdosage. **Domain 1**

80. a—The problem can be solved using the following formula: (IS)(IV) = (FS)(FV), where IS = 65%, IV = 1200 mL, and FS = 45%, or (65%)(1200 mL)/(45%) = 1733 mL. The amount of diluent added is equal to FV − IV, which is 1733 mL − 1200 mL = 533 mL. **Domains 3, 6**

81. d—Spironolactone (Aldactone) is a potassium-sparing diuretic. **Domain 1**

82. a—The gram is the basic unit of measurement for weight in the metric system. **Domain 3**

83. d—Clinical decision support systems perform patient monitoring that includes therapeutic duplication; drug–allergy, drug–drug, drug–food, drug–disease, and drug–laboratory test interactions; and IV compatibility in real time that promotes patient safety. **Domain 9**

84. d—A preferred provider organization provides the subscriber with the most options regarding health care because physician referrals are not required. As a result of the number of choices available to the subscriber, the cost is higher. **Domain 8**

85. c—A DEA Form 224 is required to request DEA Form 222 to be provided to the pharmacy so that Schedule II medications may be ordered. **Domain 2**

86. c—A purchase order is a commitment from a pharmacy to pay for a specific item or group of items from a vender. **Domain 7**

87. c—A "code blue" is a system to communicate to hospital staff that a patient is experiencing a life-threatening situation, such as cessation of his or her heartbeat or breathing. A code blue allows the hospital staff to respond with appropriate emergency procedures. **Domain** 1

88. d—The Joint Commission has collected data that reveals that the abbreviation "ou" (each eye) has been mistaken for both "od" (right eye) and "os" (left eye). **Domain 4**

89. b—A patient's demographics are not required on a patient's medication profile; however, they are required on a patient's profile. **Domain 6**

90. c—Biometrics are the identification of an individual by certain physical traits such as eye scan, fingerprint, or handprint. **Domain 9**

91. a—The Isotretinoin Safety and Risk Management Act of 2004 limits the dispensing of isotretinoin to a 30-day supply with no refills. Refills for the medication can only be obtained by a follow-up visit to the physician and receiving a new prescription that may not be called into the pharmacy. **Domain 2**

92. a—The hypothalamus regulates the body, and its goal is to maintain homeostasis within the body. **Domain** 1

93. b—USP <797> requires the following sequence of donning personal protective equipment: shoes or shoe covers, head and facial hair coverings, face mask, fingernail cleansing, hand and forearm washing and drying, and nonshedding gown. **Domains 3, 5**

94. c—Failing to follow an institution's procedure manual greatly increases the possibility that a prescription will occur. Procedures are developed to ensure consistency within an organization and to maximize positive outcomes and minimizing negative outcomes. **Domain 4**

95. a—Group purchasing organizations negotiate prices for hospitals. They do not make the actual purchase of medications for hospitals. **Domain 8**

96. b—MEDMARX is a registry of adverse drug events that occurred in the United States. It is aimed at preventing medication errors leading to ADEs and better understanding adverse drug reactions. **Domain 4**

97. b—Clotrimazole is an antifungal agent. **Domain 1**

98. b—Alligation should be used to solve the problem. When subtracting the desired concentration from the higher concentration and subtracting the lower concentration from the desired concentration, one sees that equal quantities of each strength will be used. **Domains 3, 6**

99. a—*Cardio* is derived from the Greek term *kardia,* meaning "heart." **Domains 1, 6**

100. a—OSHA requires that both employee training and safety equipment be evaluated yearly. **Domains 2, 5**

CHAPTER 10 PRACTICE EXAMINATION VI ANSWERS

1. d—Medicare Part D reimburses a pharmacy for prescriptions for Medicare recipients. **Domain 8**

2. c—A patient taking milk with tetracycline experiences a drug–food interaction. Milk chelates (binds) with tetracycline, resulting in a loss of effectiveness of the medication. Adverse effects are undesirable effects of a medication; a synergistic effect occurs when the sum of the effects of two drugs is greater than their effects if taken separately. **Domain 1**

3. c—1800 hours is the same as 6 PM. Military time begins at midnight, and each hour of the day corresponds to a specific time. Military time does not reset at noon or use AM or PM. **Domain 6**

4. b—H_2 receptor agonists would aggravate a gastrointestinal problem rather than cure it or alleviate the symptoms. **Domain 1**

5. a—A pharmacy is to prepare a "stat order" as quickly as possible, within 5 to 15 minutes of receiving the order. **Domain 6**

6. c—This problem can be solved by using a proportion. 4.4 mEq/1 mL = 45 mEq/X mL, where X = 10.2 mL. **Domains 3, 6**

7. c—A *subscriber* is the policyholder. A *beneficiary* is the individual who may receive a cash payout on the death of the subscriber. A *dependent* is an individual covered under an insurance plan. A *patient* may be either a subscriber or a dependent on an insurance plan. **Domain 8**

8. a—Hydrochlorothiazide is one of the ingredients found in all of the following medications: Diovan HCT, Dyazide, Hyzaar, and Zestoretic. Diovan HCT is valsartan and hydrochlorothiazide, Dyazide is triamterene and hydrochlorothiazide, Hyzaar is losartan and hydrochlorothiazide, and Zestoretic is lisinopril and hydrochlorothiazide. **Domain 1**

9. a—Medical record numbers are used only for patients in a hospital. **Domain 6**

10. c—MDI is an abbreviation for metered-dose inhaler. **Domain 3**

11. d—Each state has a board of pharmacy (BOP) that is responsible for determining the licensing requirements of pharmacists in that state. The state BOP can suspend or revoke the license of a pharmacist in that particular state. The BOP is responsible for the practice of pharmacy in a state, which includes pharmacy technicians. **Domain 2**

12. a—This can be solved by using the following formula: Cost + [(Markup rate)(Cost)] = Retail price. \$4.50 + [(0.30)(4.50)] = \$5.85. **Domain 8**

13. c—Laminar flow hoods used in the preparation of IV admixtures are a critical component of aseptic technique. The class of the HEPA filter used determines the number of particles allowed per given area. **Domain 5**

14. a—Capsules can be prepared using the "punch method." **Domain 3**

15. b—One liter contains 1000 mL, and 2 teaspoons is equal to 10 mL: 1000 mL/10 mL per dose will yield 100 doses. **Domains 3, 6**

16. b—The Justice Department set up the Drug Enforcement Agency to enforce the Controlled Substances Act of 1970. **Domain 2**

17. c—Doxycycline is in the tetracycline family of antibiotics. **Domain 1**

18. d—The subscription consists of instructions to the pharmacist. These instructions may include the following information: compounding, packaging, labeling, and refill information and whether a generic drug is permitted to be dispensed. **Domain 6**

19. a—A *closed formulary* is a limited list of medications that may be used in filling prescriptions in an institution or allowed by a managed care third party, an *open formulary* allows any medication to be dispensed, and a *restricted formulary* is a hybrid of both an open and closed formulary system. **Domain 7**

20. c—An advantage of parenteral medication is that it is injected directly into the patient, and the patient does not need to be conscious. **Domain 3**

21. a—

$$\frac{1\ gr}{60\ mg} = \frac{\frac{1}{4}\ gr}{X\ mg}$$

Cross-multiplying and dividing will yield X = 15 mg.

$$\frac{15\ mg}{1\ tablet} = \frac{15\ mg}{X\ tablet}$$

X = 1 tablet. **Domain 6**

22. a—Presently, only pharmacists are allowed to accept new prescriptions being telephoned into a pharmacy from a physician's office, according to federal law. **Domains 2, 6**

23. d—Medications can be degraded by light, temperature, and moisture. Amber containers are used to block ultraviolet rays from breaking down the medication. **Domain 5**

24. a—The Americans with Disabilities Act prohibits discrimination against individuals with physical, mental, and emotional disabilities. The employer must make a reasonable accommodation for the employee. If the disability does not interfere with the individual's ability to perform a particular task, he or she must be considered for employment. **Domain 2**

25. a—The generic drug names are as follows: Depakote (divalproex), Neurontin (gabapentin), Mysoline (primidone), and Depakene (valproic acid).

26. a—120 mg is the minimum weighable amount on a class A or class III balance. **Domain 3**

27. a—Body surface area is the most accurate method because it considers both the height and weight of the patient. **Domains 3, 6**

28. c—A variable copayment takes into consideration whether or not the medication is brand or generic, whether it is a formulary medication, and whether it is considered a "lifestyle" drug. **Domain 8**

29. d—USP <797> outlines the processes and procedures to be followed when compounding sterile products. **Domains 3, 4**

30. d—Information required for a repackaged label includes the generic name of the drug, strength, dosage form, manufacturer's name and lot number, and expiration date assigned at time of repackaging. **Domain 3**

31. b—Ambien is used to induce sleep and should be taken at bedtime. **Domains 1, 6**

32. c—"Patient not found" or "invalid ID number" indicates the patient is not enrolled in the prescription plan based on the information entered into the system. It is advisable to check that the bin number, group number, and patient ID number were entered correctly. **Domains 8, 9**

33. a—Etoposide should be prepared in a biologic safety cabinet. **Domains 1, 3, 4**

34. d—One could take two tablets every 4 hours, which would total 12 tablets in a day. **Domain 6**

35. d—The patient's telephone number is not required on a prescription label. **Domain 6**

36. d—Zofran is indicated for severe nausea and vomiting, often when a patient is undergoing chemotherapy. **Domain 1**

37. a—*-dipine* is a suffix that may designate a drug as a calcium channel blocker, *-mycin* designates macrolides, *-olone* designates steroids, and *-pril* designates ACE inhibitors. **Domain 1**

38. b—Solve using a proportion: 500 mL/4 hr = X mL/1 hr, X = 125 mL. **Domains 3, 6**

39. c—Prescriptions for Accutane can be written for a maximum of 30 days. **Domain 2**

40. c—Convert pounds to kilograms: 180 lb × 1 kg/2.2 lb = 81.82 kg. Calculate the daily dosage: 81.82 kg × 1.75 mg/kg/day = 143 mg/day. **Domains 3, 6**

41. b—Generic drugs are nonproprietary drugs. **Domain 2**

42. b—Days supply = Total quantity dispensed/Quantity taken per day (40 capsules/4 capsules/day = 10-day supply). **Domain 6**

43. a—The abbreviation "pc" means after meals. Abbreviations for the other terms are *as needed* (prn), *before meals* (ac), and *by mouth* (PO). **Domain 6**

44. b—Meperidine is a Schedule II drug that must be stored in a safe per the Controlled Substances Act of 1970. **Domain 2**

45. d—Solving the problem using the formula 9C = 5F − 160 will yield an answer of 50° F. **Domain 3**

46. c—2% talc means there is 2 g of talc in 100 g of compound. It can be solved by using the following proportion: 2 g/100 g = X g/120 g, where X = 2.4 g. 2.4 g needs to be converted to milligrams by multiplying 2.4 g × 1000 mg/g = 2400 mg. **Domains 3, 6**

47. c—OSHA requires a pharmacy to have on hand Safety Data Sheets (SDS), formerly known as Material Safety Data Sheets (MSDS), for all hazardous substances the pharmacy possesses. **Domains 2, 4, 5**

48. d—The abbreviation "qid" means four times a day. Abbreviations for the other terms are once a day (qd), twice a day (bid), and three times a day (tid). **Domain 6**

49. d—Protamine sulfate is used to counteract an overdose of heparin. The effect of Coumadin (warfarin) is counteracted by phytonadione (vitamin K). Enoxaparin (Lovenox) is a low-molecular-weight heparin. **Domain 1**

50. c—Amoxicillin suspension should be stored in the refrigerator after it has been reconstituted. **Domains 3, 5, 6**

51. a—Total parenteral nutrition contains 50% dextrose, 10% amino acids, and 20% fat. **Domain 3**

52. d—The pharmacy and therapeutics committee, consisting of physicians, pharmacists, and nurses, develops the drug formulary. **Domain 8**

53. c—The Latin expression "qsad" means "a sufficient quantity to make." **Domain 6**

54. c—The Controlled Substance Act requires that controlled substance records (prescriptions, invoices, initial inventory, and biennial inventory) be maintained for a minimum of 2 years. **Domains 2, 7**

55. c—1:10,000 is the same as 1 g/10,000 mL. Set it up as a proportion: 1 g/10,000 mL = x g/100 mL; X = 0.01 g. **Domain 3**

56. a—ACE inhibitors are designated by the suffix *-pril*. **Domain 1**

57. b—The Food, Drug and Cosmetic Act 1938 clearly defined adulteration and misbranding. *Adulteration* is defined as "consisting "in whole or in part of any filthy, putrid, or decomposed substance," "prepared, packed, or held under unsanitary conditions," "prepared in containers," "composed, in whole or in part, of any poisonous or deleterious substance," containing unsafe color additives and claims to be or represented as drugs recognized "in an official compendium" but differing in strength, quality, or purity of the drugs. *Misbranding* is defined as labeling that is "false or misleading in any particular way"; packaging that does not bear a label containing the name and place of business of the manufacturer, packer, or distributor or an accurate quantity of contents or is not conspicuously and clearly labeled with information required by the act; failure to carry a label indicating "Warning—May be habit forming" if the product is habit forming; failure to "bear the established name of the drug; and in case it carries more than two or more active ingredients, the quantities of the ingredients, the amount of alcohol and also including—whether

active or not—the established name and quantity of certain other substances described in the act," failure to label "adequate directions for use" or "adequate warnings against use in certain pathological conditions"; or products that are "dangerous to health when used in the dosage or manner or duration prescribed, recommended or suggested in the labeling." **Domain 2**

58. a—3% net means that 3% of the amount due is the minimum amount due to the vendor in 30 days based on the information provided. To solve: 3% × $500 = $15.00. **Domain 7**

59. b—A pharmacy benefit manager will reimburse a retail pharmacy a 30-day of a medication. **Domain 8**

60. b—The root word *osteo* means "bone." **Domains 1, 6**

61. b—The medication with the shortest amount of time before it expires should be placed in front of the other medications; this is known as product rotation. **Domain 7**

62. a—An *emulsion* is one liquid dispersed in another liquid; it may be water in oil (w/o) or oil in water (o/w). A *lotion* is a liquid for topical application that contains insoluble solids or liquids. *Ointments* are homogeneous, viscous, semisolid preparations, most commonly greasy, thick oils (oil 80%, water 20%) with a high viscosity that are intended for external application to the skin or mucous membranes. A *suspension* is a two-phase system in which solid particles are dispersed in a liquid vehicle, which may be oral, topical, or injectable. **Domain 3**

63. d—Touch-screen technology has low resolution. **Domain 9**

64. d—There is 30 mL in 1 fl oz; therefore, 240 mL is equal to 8 fl oz. **Domain 3**

65. b—A master formula sheet does not require the color of the ingredients being used. Master formula sheets contain the name and strength of the compound, the quantities of each ingredient being used, the lot number and expiration date of each ingredient, the compounding procedures, the individual who weighed or measured the ingredients, auxiliary labels used, and the product's stability. If a pharmacy technician does the compounding, the signature of the pharmacist who checked the work is required. **Domain 3**

66. d—The United States Pharmacopeia and National Formulary (USP-NF) is the official compendia for the United States. **Domain 5**

67. b—Ease of administration is an advantage of an oral dosage form. There are no special skills required to administer this form. **Domain 3**

68. d—It is the responsibility of the pharmacy technician to inform the pharmacist if a prescription error occurs. It is the responsibility of the pharmacist to determine the proper course of action upon determining an error has occurred. **Domain 4**

69. d—USP <797> requires that a class 100 environment is present when compounding sterile products. **Domain 3**

70. d—A "want book" identifies items that must be ordered from a vendor, wholesaler, or drug manufacturer. A formulary is an approved list of medications for an institution or organization. The *Orange Book* identifies therapeutic equivalent products, and the *Red Book* contains pricing information. **Domain 7**

71. c—The user name and password allow an individual to access a computer or system. User names and passwords are user specific. **Domain 9**

72. c—Automation decreases the possibility of medication errors from occurring. **Domain 9**

73. b—Calculate rate per hour and then divide by 60 min/hr: 800 mL/12 hr = 66 mL/hr; 66 mL/hr/60 min/hr = 1.1 mL/min. **Domain 6**

74. c—Heparin may be administered either subcutaneously or intravenously. **Domains 1, 3**

75. a—Quality assurance programs are designed to improve the outcomes of a process through error reduction. To design quality assurance programs, it is necessary to understand the cause or causes of the error before a solution can determined. Quality assurance programs are not intended to place blame on an individual. **Domain 5**

76. d—The Joint Commission has developed those initiatives. **Domain 5**

77. d—MEDMARX has identified performance deficit as the largest cause of medication errors. **Domain 4**

78. a—A patient should not take penicillin with juices or colas because an enzyme found in these products prohibits the drug from metabolizing properly. **Domain 6**

79. b—OBRA-90 required that a pharmacy maintain profiles, perform drug utilization evaluation, make offers to counsel patients. Patient confidentiality is mandated under HIPAA. The Prescription Drug Marketing Act of 1987 required a veterinarian prescription for animals and prohibited a pharmacy from dispensing professional samples. **Domain 2**

80. b—*Derm* means skin, *cerebr* means brain, *cranio* means skull, and *dent* means tooth. **Domain 1**

81. a—Continuous quality improvement focuses on processes, not people. **Domain 5**

82. d—Protected health information (PHI) includes the following: any information related to past, present, or future physical and mental health; past, present, or future payments for health services received; and specific care the patient received, is receiving, or is willing to receive. In addition, PHI includes any information that can identify the patient as the individual receiving the care such as patient name; Social Security number; date of birth, admission, discharge, or death; telephone or fax number; e-mail addresses; medical records or account numbers; health plan beneficiary numbers; certificate or license numbers; photographs; or biometric indicators. **Domain 2**

83. b—An individual must determine how long the bag will last (1000 units/hr = 20,000 units/X hr). The bag will last 20 hr. The rate of infusion can be calculated by dividing 500 mL by 20 hr, resulting in 25 mL/hr. Then, use the following formula: Rate × Drop size × 1 hr/60 min = gtt/min. Therefore, using (25 mL/hr)(15 gtt/mL)(1 hr/60 min) yields 6 gtt/min. **Domain 6**

84. a—The monoamine oxidase inhibitors may interact with cured cheeses and red wines containing tyramine. **Domain 1**

85. c—A modem is a device that allows a computer to communicate over a network. **Domain 9**

86. b—Capitation and fee for service are the two systems used to reimburse pharmacies for services rendered. **Domain 8**

87. a—MicroMix is an automated compounder. Robot RX and SureMed are automated dispensing systems. **Domain 9**

88. d—Changes in physician prescribing habits, drug manufacturer shortages, seasonal changes, drug recalls, and discontinuations may result in unexpected medication shortages in the pharmacy. **Domain 7**

89. c—USP <797> requires that if a HEPA filter becomes wet, it will need to be recertified. **Domains 2, 3**

90. a—OSHA requires that Safety Data Sheets (SDS) be provided to the purchaser of all hazardous drugs and chemicals. **Domains 2, 5**

91. a—The Food and Drug Administration is responsible for reviewing and approving all investigational new drug applications before additional clinical studies may commence. **Domains 2, 5**

92. a—The Comprehensive Drug Abuse Prevention and Control Act (also known as the Controlled Substances Act) requires the following to appear on both the manufacturer's and patient's bottle: "Warning: May Be Habit Forming." This warning is required because of the potential abuse of controlled substances. **Domain 2**

93. b—Solve using Clark's rule: (Weight [lb]/150) × Adult dose; (25/150) × 100 mg = 16.67 mg (17 mg). **Domain 6**

94. d—Negligence is a failure to exercise the care that a reasonably prudent person would exercise in similar circumstances. It involves harm caused by *carelessness,* not intentional harm. **Domains 2, 4**

95. a—Glass mortars and pestles are best used for mixing liquids because of their smooth surfaces and because they will not stain as porcelain or Wedgwood will. **Domain 3**

96. c—Pyxis MedStation is decentralized dispensing system that found in nursing units. **Domain 3**

97. d—Title II of HIPAA (Administrative Simplification) established electronic transaction and Code Set Standards and required Health Information Privacy. **Domains 2, 9**

98. d—The Joint Commission mandated that unit dose be dispensed in a hospital to reduce medication errors. **Domain 5**

99. c—Benzonatate will numb the digestive tract if chewed. **Domain 1**

100. a—A patient taking warfarin is concerned about his or her blood's ability to clot properly. Aspirin (ASA), narcotic analgesics, and NSAIDs have the ability to thin the blood, which may cause an individual to hemorrhage. **Domain 1**

CHAPTER 10 PRACTICE EXAMINATION VII ANSWERS

1. d—There is 480 mL in a pint solution, and a teaspoon dose is equal to 5 mL. 480 mL/5 mL/dose = 96 doses. **Domains 3, 6**

2. c—Nephro is the Latin word root for "kidney." **Domain 1**

3. d—Insulin is administered subcutaneously above and below the waist, in the buttocks, and in the upper arms. **Domains 1, 3**

4. d—Answer A is incorrect because it states that tsp was tablespoonful instead of teaspoon; qod is every other day instead of four times per day; and answer C states penicillin G, but the prescription indicates Pen G. There is a difference between penicillin and penicillin G. **Domain 6**

5. c—Sulfasalazine does not require monitoring through blood work. Patients taking lithium, phenytoin, and warfarin need to have frequent blood samples tested to ensure they are receiving the appropriate dose of medication. **Domain 1**

6. c—The *Physicians' Desk Reference* contains information from the package inserts of more than 4000 prescription drugs. **Domains 4, 5**

7. b—Tylenol 2 contains ¼ gr of codeine, Tylenol 3 contains ½ gr of codeine, and Tylenol 4 contains 1 gr of codeine. **Domains 1, 2, 3**

8. c—Oral medications are the most commonly used method of administration because of the ease of administering. **Domain 3**

9. a—*Pharmacokinetics* is the study of the absorption, distribution, metabolism, and elimination of a drug from the body. *Pharmacognosy* is the study of natural products. *Pharmacology* describes how a drug works on the body. *Pharmacopeia* is a listing of drugs. **Domain 1**

10. b—100 units of insulin is found in 1 mL of liquid.

$$\frac{100\text{ units}}{1\text{ mL}} = \frac{40\text{ units}}{X\text{ mL}}$$

Cross-multiplying and dividing yields 0.4 mL. **Domain 3**

11. a—URI is an acronym for upper respiratory infection. **Domain 6**

12. a—The smaller the number in the denominator, the larger the value of the number. **Domains 1, 3**

13. c—"qid" (four times a day) indicates how many times per day a medication would be taken. The terms "ac and hs" tell the patient when during the day the medication is to be taken. **Domains 6, 7**

14. a—Disulfiram (Antabuse) is used to treat patients who abuse alcohol. Disulfiram stops the metabolism of alcohol at the aldehyde stage, which causes aldehyde to accumulate in the body. If alcohol is consumed, the patient becomes extremely sick. This sickness is characterized by symptoms of blurred vision, confusion, difficulty breathing, intense throbbing in the head and neck, chest pain, nausea, severe headache, severe vomiting, thirst, and uneasiness. **Domain 1**

15. b—Norflex is a skeletal muscle relaxant. **Domain 1**

16. d—Using the formula (IV)(IS) = (FV)(FS), where 5% is the initial strength, 1 pint (480 mL) is the initial volume, and 1 : 50 (2%) is the final strength, the final volume would be 1200 mL. **Domain 3**

17. c—Itraconazole (Sporanox) is an antifungal agent that is taken by pulse dosing. Pulse dosing requires that the patient take one capsule daily for 1 week, skip 3 weeks, and resume. This form of dosing is effective therapeutically and is cost effective. **Domains 1, 6**

18. a—BS is an abbreviation meaning blood sugar. **Domain 6**

19. b—A generic drug must contain the same active ingredients as the original brand name drug; be identical in strength, dosage form, and route of administration; have the same use indications; meet the same batch requirements for identity, strength, purity, and quality; and yield similar blood absorption and urinary excretion curves for the active ingredient. **Domains 1, 5**

20. d—Sublingual tablets are absorbed directly into the bloodstream by being placed under the tongue and therefore bypass the digestive system. **Domain 3**

21. c—Solve using proportions. 1 L = 1000 mL. 100,000 units/1000 mL = X units/50 mL, where X = 5000 units. **Domain 3**

22. d—*Hypo* means low, *gly* means sugar, and *emia* means blood. Hypoglycemia is low blood sugar. **Domain 1**

23. b—Inderal can be used prophylactically for migraines. Imitrex, Midrin, and Stadol are used as abortive therapies for migraine headaches. **Domain 1**

24. b—"prn" means as needed. **Domain 6**

25. c—The *Drug Topics Red Book* provides drug costs. Information found in the *Red Book* includes emergency information, clinical reference guides, practice management and professional development information, listings of pharmacy and health care organizations, drug reimbursement information, manufacturer and wholesaler information, product identification, Rx product listings, OTC and nondrug product listings, and complementary and herbal product referencing. **Domains 7, 8**

26. b—The Consumer Products Safety Commission is responsible for enforcing the Poison Prevention Act of 1970. **Domain 2**

27. a—Symptoms of congestive heart failure include shortness of breath (dyspnea) when exerting oneself or when lying down; fatigue and weakness; swelling (edema) in the legs, ankles, and feet; a rapid or irregular heartbeat; persistent cough or wheezing with white or pink blood-tinged phlegm; swelling of the abdomen; and sudden weight gain from fluid retention. **Domain 1**

28. d—Hyperthyroidism—overproduction of the thyroid gland—may result in a goiter. **Domain 1**

29. d—A disadvantage of robotic cart filling systems is that it requires special packaging and equipment. In addition, not all medication dosage forms are available for use in a robotic cart filing system. **Domain 9**

30. d—Two pairs of gloves—one under the laboratory gown and one pair over the cuff of the gown—should be worn when handling antineoplastic agents. **Domains 2, 3, 5**

31. d—*Intra-* means within, *hypo-* means below, *iso-* means equal, and *inter-* means between. **Domain 6**

32. b—Protected health information security does not cover providing the information in a timely manner. **Domains 2, 9**

33. b—Guidelines have been established in hospitals for automatic stop dates for various drug classification. If an antibiotic is to be continued after 14 days, the physician must provide a new medication order. **Domain 6**

34. a—This is an example of a situation that requires a judgment to be made by the pharmacist. Whereas pharmacy technicians perform technical tasks, pharmacists perform both technical and judgmental tasks. **Domain 6**

35. a—The suffix *-ism* means "condition." **Domain 6**

36. c—The Combat Methamphetamine Epidemic Act of 2005 requires that an individual be at least 16 years of age to purchase pseudoephedrine. **Domain 2**

37. d—Quality assurance monitors, evaluates, and improves the quality of pharmacy services. **Domain 5**

38. d—Miacalcin is not a bisphosphonate used to treat osteoporosis. **Domain 1**

39. a—A class A fire extinguisher is used on wood, cloth and paper. Class B extinguishers are used on fires involving flammable liquids, such as grease, gasoline, oil, and oil-based paints. Class C extinguishers are suitable for use on fires involving appliances, tools, or other equipment that is electrically energized or plugged in. Class D extinguishers are designed for use on flammable metals and are often specific for the type of metal in question. Class K fire extinguishers are intended for use on fires that involve vegetable oils, animal oils, or fats in cooking appliances. **Domain 5**

40. b—A pharmacy is required to provide patient package inserts to all patients receiving metered-dose inhalers, oral contraceptives, estrogen, progesterone, and Accutane. **Domains 1, 5, 6**

41. c—The Occupational Safety and Health Act of1970 requires that Safety Data Sheets (SDS) be provided to purchasers of hazardous drugs and chemicals. **Domain 2**

42. d—An individual should compare the drug name on the written prescription with the drug name on the medication bottle and the NDC number on the prescription label with the NDC number on the stock bottle. **Domains 4, 6**

43. d—The *therapeutic effect* of a medication is the desired effect of a drug, an *adverse effect* is an undesired effect (side effect) of a drug, a *physiological effect* is how it works on the body, and a *psychological effect* is how it affects the mind. **Domain 1**

44. b—The flexible spending account also known as a health savings account is part of the Medicare Modernization Act, which allows an employee to set aside a predetermined dollar amount (that is tax deductible) from paycheck to use for medical purposes per calendar year. Any money not used during the calendar is forfeited. The Affordable Care Act reduced the amount that may be set aside for an account. **Domain 8**

45. b—A modem connects a computer to a remote network. **Domain 9**

46. c—OBRA-90 addressed patient profiles, drug utilization evaluation, and counseling. The Food, Drug and Cosmetic Act defined adulteration and misbranding. OBRA-87 addressed issues affecting nursing homes. The Pure Food Act of 1906 initially addressed a drug's purity. **Domain 2**

47. d—The generic drug name for Glucophage is metformin). Glimepiride is generic for Amaryl, glipizide is generic for Glucotrol, and glyburide is generic for Micronase. **Domain 1**

48. a—A *procedure* is a way to perform a task, and a *policy* is a rule. **Domain 5**

49. a—A Pyxis is an automated dispensing machine. **Domain 9**

50. b—The Kefauver-Harris amendment addressed drugs' effectiveness as a result of the thalidomide incident. **Domain 2**

51. a—Crixivan (indinavir) must be dispensed in its original container. **Domains 1, 6**

52. d—$12.43/100 tablets = $X/50 tablets; X = $6.22. Cost of medication ($6.22) + Dispensing fee ($6.50) = Selling price ($12.72). **Domain 8**

53. a—Each medication has an optimum storage temperature to ensure its efficacy. **Domains 2, 5**

54. a—The expiration date should be checked to make sure the medication has not gone beyond its expiration date. The drug manufacturer assigns an expiration to each individual lot of medication stating that the medication is effective and safe to use until that date. **Domain 7**

55. b—Iodine is required to produce the thyroid hormone. **Domain 1**

56. b—Selling price ($50.00) − Cost ($35.00) = Markup ($15.00). Gross profit ($15.00)/Drug cost ($35.00) = Percent markup (42.8% or 43%). **Domain 8**

57. d—The Controlled Substance Act requires that a red C be stamped on the bottom right corner of prescriptions for controlled substances. **Domain 2**

58. d—According to the United States Pharmacopoeia, syrup USP contains sucrose (sugar) dissolved in water. **Domain 3**

59. b—The pharmacy benefit manager manages a third-party prescription plan. Health maintenance organization, point of service, and preferred provider organization are types of managed care organizations. **Domain 8**

60. c—The oral (PO) route of administration produces its effects the slowest of those listed because it must travel through the digestive tract before its absorbed into the body and produces its effect. Food in the stomach may slow down the absorption process. **Domain 3**

61. a—Purchases ($500,000)/Average inventory ($125,000) = Inventory turns (4). **Domain 7**

62. d—Information found on a package insert includes the following: drug description, clinical pharmacology, indications and usage, contraindications, warnings, precautions, adverse reactions, drug abuse and dependence, overdosage, dosage and administration, how supplied, and date of the most recent revision of the labeling. Patient product inserts do not list prices. **Domains 5, 6**

63. a—Inventory control systems are able to track costs, purchases and usage, wastage, discarded or outdated inventory, and transfers to other pharmacies. Inventory control systems are used for organizational tracking not personal tracking of expenses. **Domain 7**

64. a—The actual acquisition cost (AAC) is the cost a pharmacy pays for a medication after all discount, rebates, and shipping costs. The average wholesale price (AWP) is the cost assigned to a medication based on the average wholesale price for a drug in a given area. AWP is used in by many pharmacy benefit managers in determining the reimbursement of a medication. A discounted price is not the original price but a reduced price. First-in, first-out is a method of calculating the value of an inventory. **Domain 8**

65. c—Paperless charting saves time that may be used to allow more time for patient care. **Domain 9**

66. d—The Orphan Drug Act provides incentives for drug manufacturers to develop drug entities that could benefit individuals with rare diseases (fewer than 200,000 cases in the world) by streamlining the drug development process. **Domain 2**

67. a—Ethics is a moral philosophy of right versus wrong. **Domain 2**

68. d—According to American Society of Health System Pharmacists (ASHP), an *unauthorized drug error* occurs when a medication is administered to a patient from an unauthorized patient or a physician not licensed in that state or not an authorized prescriber. A *compliance drug error* occurs when a patient does not adhere to prescribed regimen. A *monitoring drug error* is the failure to review a prescribed medication for proper regimen, appropriateness, detection of problems in dosage, or failure in using laboratory results to correctly adjust dose. A *prescribing order* takes place when a prescriber orders a medication that is incorrect or is selected incorrectly based on indications or contraindications and the medication reaches the patient. **Domain 4**

69. b—According to the Medication Error Reporting and Prevention, this is the definition of a category B error. **Domain 4**

70. d—Regular insulin may be added to intravenous solutions. **Domain 1**

71. d—Medications may be produced from vegetables, minerals, or animals or may be made synthetically. **Domain 1**

72. d—When a patient arrives to pick up a prescription that has been ordered but not checked in properly, the technician should make a note that it has been removed from the order, fill the prescription, have it checked by the pharmacist, and reconcile it when the order is being checked. **Domain 7**

73. a—The patient controls his or her own electronic personal health record, but it may be generated by any health care provider or organization. **Domain 9**

74. c—This is an example of a compliance error in which the patient does not adhere to his or her prescribed regimen. **Domain 4**

75. d—A TPN solution must be isotonic to the blood or the blood cells will either expand or collapse in the blood vessel. Whereas a hypotonic solution will cause the blood cells to collapse, a hypertonic solution will cause the cells to expand. **Domain 3**

76. d—As a patient ages, his or her ability to hear properly is reduced; the patient may begin to develop multiple disease states; as a result of multiple disease states, the patient is required to take multiple medications. **Domain 4**

77. c—The USP establishes all medication standards to include terminology associated with storage temperatures, medication containers, and medications. **Domain 3**

78. d—Pharmacy computers can generate the following work lists for tasks to be performed: unit-dose cart fill, cart fill updates, IV pick, IV fill, IV fill updates, and labels. **Domain 9**

79. c—The Catapres TTS patch is changed weekly. **Domain 1**

80. c—The Pharmacy Technician Certification Board certifies pharmacy technicians. **Domain 5**

81. d—Prednisone is the generic name for Deltasone. The other drug names are lithium (Eskalith), methylprednisolone (Medrol), and prednisolone (Pediapred). **Domain 1**

82. b—An auxiliary label provides additional information to a patient on taking the medication, such as

when to take it with regard food, how it is administered, how to store the medication, and warnings about possible adverse effects. **Domain 6**

83. d—Intravenous (IV) medications provide a rapid therapeutic effect by bypassing the digestive tract. IV medications can be administered to patients who are unable to take medications orally because of a variety of reasons. Unfortunately, all medications are not available in as an IV dosage form; they are much more expensive than oral medications, and an individual needs to be trained to administer IV medications. **Domain 3**

84. b—The Drug Listing Act created National Drug Code numbers to identify the drug manufacturer, the drug entity, and its packaging. **Domain 2**

85. a—It is a pharmacy error when a patient does not receive the full quantity of medication prescribed by a physician and the pharmacy fails to inform the patient of the situation. **Domain 4**

86. b—The *drug accountability report* (DAR) is used to document the administration of an investigational drug. A *controlled substance administration reports* (CSAR) is used to document the administration of controlled substances. A *medication administration report* (MAR) is used for prescription medications. A *treatment administration report* (TAR) is used to document external preparations. **Domain 5**

87. c—The last two digits of an NDC number identify the drug package. The first five digits identify the drug manufacturer, and the middle four numbers identify the drug entity. **Domains 2, 6, 7**

88. b—According to USP 797, the critical area is an ISO class 5 environment and is the area between the HEPA filter and where the sterile product is being compounded. The critical site is any part or fluid pathway surface or openings at risk with direct contact of air or moisture or direct contact with contamination. A laminar area workbench is where a compounded sterile product is prepared. **Domain 3**

89. a—An invoice is a statement for money owed to an individual or organization for services rendered. **Domain 7**

90. c—A hospital does not have a preference of a centralized or decentralized automation. They are two different forms of automation with different functions. Often both are used in a hospital. **Domain 9**

91. b—A pharmacy scale must be certified every 12 months. **Domains 2, 5**

92. d—The following information is required on an intravenous (IV) label: name of pharmacy, patient's name, date the medication was filled, ingredients with quantity of each in IV, total quantity of IV, directions for usage, infusion rate, any special notes, and expiration date. The label must be initialed by the technician who prepared it and contain the licensed pharmacist's initials. **Domain 6**

93. b—A hospital pharmacy does not bill and collect payments for medications provided to patients. The hospital's billing department is responsible for submitting all of the expenses incurred by a patient to the patient's insurer. **Domains 8, 9**

94. b—USP 797 has defined three different risk levels—low, medium, and high—for compounded sterile preparations. **Domain 3**

95. c—Humulin N insulin is an intermediate-acting insulin that has an onset of action of 1 to 2 hours and a duration of 14 to 20 hours. **Domain 1**

96. d—Medication safety is the greatest concern during compounding sterile products because of the possibility of introducing pathogens into the preparation. **Domain 4**

97. c—1 pint = 480 mL. Solve by using a proportion: 2 mg/1 mL = X mg/480 mL, where X = 960 mg. Convert milligrams to grams: 960 mg $\times$ 1 g/1000 mg = 0.96 g. **Domain 3**

98. a—*Antihypertensives* are used to lower blood pressure, *antimanics* are used to treat patients in the state of mania, *antipyretics* are used to reduce fevers, and *antitussives* are prescribed for coughs. **Domain 1**

99. d—Potassium chloride is an electrolyte that maybe added to a total parenteral nutrition (TPN). Amino acids, dextrose, and lipids are the components of a TPN. **Domains 1, 3**

100. c—Scurvy is a deficiency of vitamin C, a deficiency of vitamin A results in night blindness, a deficiency of B_1 may cause beriberi, and a deficiency of vitamin D results in rickets. **Domain 1**

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Appendix H

Technician Professional Membership Organizations

American Association of Colleges of Pharmacy (www.aacp.org)
American Association of Pharmacy Technicians (www.pharmacytechnician.com)
American Pharmacists Association (www.pharmacist.com)
American Society of Health-System Pharmacists (www.ashp.org)
Canadian Association of Pharmacy Technicians (www.capt.ca)
National Pharmacy Technician Association (www.pharmacytechnician.org)

Laboratory Values*

SERUM PLASMA	
Albumin	3.2–5 g/dL
Bicarbonate	19–25 mEq/L
Blood urea nitrogen/creatinine ratio	10 : 1–20 : 1
Calcium	8.6–10.3 mg/dL
Chloride	98–108 mg/L
Creatinine	0.5–1.4 mg/dL
Creatinine clearance	75–125 mL/min
Glucose	80–120 mg/dL
Hemoglobin	4%–8%
Magnesium	1.6–2.5 mg/dL
Potassium	3.5–5.2 mEq/L
Sodium	134–149 mEq/L
Blood urea nitrogen	7–20 mg/dL
Cholesterol	
Total	<200 mg/dL
Low-density lipoprotein	65–170 mg/dL
High-density lipoprotein	40–60 mg/dL
Triglycerides	45–150 mg/dL
LIVER ENZYMES	
γ-Glutamyl transferase	
Male	11–63 IU/L
Female	8–35 IU/L
Serum glutamic-oxaloacetic transaminase or aspartate transaminase	<35 IU/L (20–48)
Serum glutamic pyruvic transaminase or alanine transaminase	<35 IU/L (10–35)
COMPLETE BLOOD CELL COUNT	
Hemoglobin	
Male	13.5–16.5
Female	12.0–15.0
Hematocrit	
Male	41–50
Female	36–44

*The normal ranges are for reference only and will vary based on specific laboratory references.

Appendix J

Pharmaceutical Conversions

METRIC PREFIXES

Nano-: 1/1,000,000,000 of the unit of measure
Micro-: 1/1,000,000 of the unit of measure
Milli-: 1/1000 of the unit of measure
Kilo-: 1000 × the unit of measure
Another way to understand this relationship is shown below:

Nano- (smallest)	Micro-	Milli-	Unit	Kilo- (largest)

To move from a smaller unit to a larger unit, divide in multiples of 1000. To move from a larger unit to a smaller unit, multiply in multiples of 1000.

METRIC UNITS OF MEASURE

WEIGHT

gram (g or gm)

VOLUME

liter (L)

HOUSEHOLD UNITS OF MEASURE

VOLUME

5 mL = 1 teaspoon (tsp)
3 tsp = 1 tablespoon (tbsp)
2 tbsp = 1 fluid ounce (fl oz)
8 fl oz = 1 cup
2 cups = 1 pint (pt)
2 pt = 1 quart (qt)
4 qt = 1 gallon (gal)

mL (smallest)	tsp	tbsp	oz	cup	pint	quart	gallon (largest)

WEIGHT

1 pound (lb) = 16 oz

APOTHECARY

VOLUME

1 fluid dram (fl dr) = 1 tsp
3 fl dr = 1 tbsp

WEIGHT

28.35 grams (g) = 1 ounce (oz)
16 oz = 1 lb
2.2 lb = 1 kilogram (kg)

MILITARY TIME

STANDARD TIME	MILITARY TIME
1:00 AM	0100
2:00 AM	0200
3:00 AM	0300
4:00 AM	0400
5:00 AM	0500
6:00 AM	0600
7:00 AM	0700
8:00 AM	0800
9:00 AM	0900
10:00 AM	1000
11:00 AM	1100
Noon	1200
1:00 PM	1300
2:00 PM	1400
3:00 PM	1500
4:00 PM	1600
5:00 PM	1700
6:00 PM	1800
7:00 PM	1900
8:00 PM	2000
9:00 PM	2100
10:00 PM	2200
11:00 PM	2300
Midnight	2400

Appendix K

State Boards of Pharmacy

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