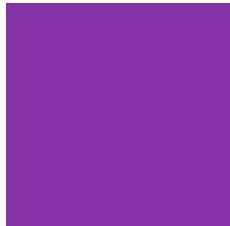


# Preparing for the ACT<sup>®</sup> Test



## What's Inside

- Full-Length Practice Tests, including a Writing Test
- Information about the Optional Writing Test
- Strategies to Prepare for the Tests
- What to Expect on Test Day

Esta publicación también se puede ver o descargar en español en [www.actstudent.org](http://www.actstudent.org)



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## A Message to Students

This booklet, which is provided **free of charge**, is intended to help you do your best on the ACT® test. Included in this booklet are **complete practice tests**—“retired” ACT questions that were administered to students on a National test date—including a writing prompt, a sample answer document, answer keys, and self-scoring instructions.

Read this booklet carefully and take the practice tests well before test day so you will be familiar with the tests, what they measure, and the strategies you can use to do your best on test day.

Go to **www.actstudent.org** for additional ACT test preparation materials, including ACT Online Prep™, **The Real ACT Prep Guide**, sample questions, and the Question of the Day.

The ACT is administered nationally and internationally to examinees in English, including all instructions and questions. Select states testing as part of the State and District testing program permit the use of translated instructions, but such testing does not result in a college-reportable score.

ACT is committed to representing the diversity of society in all its aspects, including race, ethnicity, and gender. Thus, test passages, questions, and writing prompts are deliberately chosen to reflect a range of cultures.

ACT is also committed to ensuring that test questions and writing prompts are fair—that they do not disadvantage any particular group of examinees. Extensive reviews of the fairness of test materials are rigorously conducted by both ACT staff and external consultants. ACT also employs statistical procedures to help ensure that test materials do not unfairly affect the performance of any group.

**Note:** Since the ACT is a curriculum-based achievement test, research is periodically conducted and tests are updated accordingly to ensure test content continues to reflect classroom instruction and remains a relevant predictor of college and career readiness. As a result, you

ACT endorses the Code of Fair Testing Practices in Education and the Code of Professional Responsibilities in Educational Measurement, guides to the conduct of those involved in educational testing. ACT is committed to ensuring that each of its testing programs upholds the guidelines in each Code. A copy of each Code may be obtained free of charge from ACT Customer Services (70), PO Box 1008, Iowa City, IA 52243-1008, 319.337.1429.

may notice subtle differences between this practice test and the test you actually take on test day.

# 1 General Preparation for the ACT Tests

## General Test-Taking Strategies for the ACT

The ACT contains multiple-choice tests in four areas: English, mathematics, reading, and science. Each of these tests contains questions that offer either four or five answer choices from which you are to choose the correct, or best, answer. The following suggestions apply to all four tests:

### ***Pace yourself.***

The time limits set for each test give nearly everyone enough time to finish all the questions. However, because the English, reading, and science tests contain a considerable amount of text, it is important to pace yourself so you will not spend too much time on one passage. Similarly, try not to spend too much time puzzling over an answer to a specific problem in the mathematics test. Go on to the other questions and come back if there is time. Your supervisor will announce when you have five minutes remaining on each test.

### ***Read the directions for each test carefully.***

Before you begin taking one of the tests, read the directions carefully. The English, reading, and science tests ask for the “best” answer. Do not respond as soon as you identify a correct answer. Read and consider all of the answer choices and choose the answer that *best* responds to the question.

The mathematics test asks for the “correct” answer. Read each question carefully to make sure you understand the type of answer required. Then, you may want to work out the answer you feel is correct and look for it among the choices given. If your answer is not among the choices provided, reread the question and consider all of the answer choices.

### ***Read each question carefully.***

It is important that you understand what each question asks. Some questions will require you to go through several steps to find the correct or best answer, while others can be answered more quickly.

### ***Answer the easy questions first.***

The best strategy for taking the tests is to answer the easy questions and skip the questions you find difficult. After answering all of the easy questions, go back and answer the more difficult questions if you have time.

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### **Use logic on more difficult questions.**

When you return to the more difficult questions, try to use logic to eliminate incorrect answers to a question. Compare the answer choices to each other and note how they differ. Such differences may provide clues as to what the question requires. Eliminate as many incorrect answers as you can, then make an educated guess from the remaining answers.

### **Answer every question.**

Your score on the tests will be based only on the number of questions that you answer correctly; **there is no penalty for guessing**. Thus, you should answer every question within the time allowed for each test.

### **Review your work.**

If there is time left after you have answered every question in a test, go back and check your work on that test. You will not be allowed to go back to any other test or mark responses to a test after time has been called on that test.

### **Be precise in marking your answer document.**

Be sure that you properly fill in the correct ovals on your answer document. Check to be sure that the number of the line of ovals on your answer document is the same as the number of the question you are answering and that you mark only one response for each question.

### **Erase completely.**

If you want to change a multiple-choice answer, be sure to use a soft eraser that will not leave smudges and erase the unintended mark completely. Do not cross out answers or use correction fluid or tape; you must erase. Correction fluid/tape, smudges, or unintended marks may cause errors in scoring.

### **To students approved to test at National test centers with extended time:**

You will be allowed up to 5 hours total to work on the multiple-choice tests at your own pace, including breaks between tests. If you are taking the ACT with writing, you will be allowed up to 6 hours total to work on all five tests.

## **General Test-Taking Strategies for the ACT Writing Test**

The ACT writing test lets you show your skill in composing an essay. It measures writing proficiencies that are taught in high school and are important for readiness to succeed in entry-level college composition courses.

The following general strategies will help if you take the ACT writing test.

### **Pace yourself.**

You will have 40 minutes to write your essay. It is important to pace yourself in the way that best suits your personal writing strategy. Many writers do best when they spend part of their time planning the essay, most of their time writing the essay, and the last part of their time reviewing the essay to make corrections and revisions. Budget your time based on your experience in taking essay tests in school and in other circumstances when you've done writing within a time limit. Your supervisor will announce when you have five minutes remaining on the writing test.

### **Read the directions carefully.**

In writing your essay, you will be expected to engage meaningfully with the issue and perspectives presented by the prompt. Before you begin to plan and write, read and consider all prompt material carefully.

### **Read the writing prompt carefully.**

It is important that you understand exactly what the writing prompt asks you to do. Be sure you have a clear understanding of the issue in the writing prompt and of the question you must respond to before you start to plan and write your essay.

### **Write (or print) legibly in the answer folder.**

If your readers cannot read what you have written, they will not be able to score your essay. You must write your essay using a **soft lead No. 2 pencil** (not a mechanical pencil or ink pen) on the lined pages in the answer folder. You may not need all the lined pages, but to ensure you have enough room to finish, do not skip lines.

### **Make corrections clear.**

If you make corrections, do so thoroughly and legibly. You may write corrections or additions neatly between the lines of your essay, but do not write in the margins.

## **Preparing for Test Day**

- Prepare well in advance for the tests.
  - Know what to expect on test day. Familiarize yourself with the information in this booklet, and at **www.actstudent.org**.
  - Most procedures in this booklet refer to testing on a National or International test date at an ACT test center. Procedures may differ slightly if you test at another location.
  - Take the practice tests in order and review your responses.
  - Get plenty of rest the night before the tests.
  - Carefully review the "Test Day Checklist" at **www.actstudent.org**.
- **Bring the following items with you to the test center:**
1. Your paper ticket (if you test on a National or International ACT test date). You will **not** be admitted to test without it.
  2. Acceptable photo identification. See details on your ticket or at **www.actstudent.org**. If you do not present acceptable photo identification with your ticket at check-in, you will **not** be admitted to test.
  3. Sharpened soft lead No. 2 pencils and good erasers (no mechanical pencils or ink pens). Do **not** bring any other writing instruments; you will not be allowed to use them.

4. A watch to pace yourself. Do **not** bring a watch with an alarm, because it will disturb other students. If your alarm sounds during testing, you will be dismissed and your answer document will not be scored. Your supervisor will announce when you have five minutes remaining on each test.
5. A **permitted calculator** may be used on the mathematics test only. It is your responsibility to know whether your calculator is permitted. For the most current information on the ACT calculator policy, visit [www.actstudent.org](http://www.actstudent.org) or call 800.498.6481 for a recorded message.

## 2 Strategies for Taking the ACT Tests

The ACT measures the knowledge, understanding, and skills that you have acquired throughout your education. Although the sum total of what a person has learned cannot be changed, your performance in a specific area can be affected by adequate preparation, especially if it has been some time since you have taken a course in that area.

There are three strategies that can help you to prepare yourself for the content included in the ACT:

### **Familiarize yourself with the content of the ACT tests.**

Review the information about the tests that is provided on the following pages. Note which content areas make up a large proportion of the tests and which do not. The specific topics included in each content area are examples of possible topics; they do not include all of the possibilities.

### **Refresh your knowledge and skills in the content areas.**

Review those content areas you have studied but are not fresh in your mind. Spend your time refreshing your knowledge and skills in the content areas that make up large portions of the tests.

### **Identify the content areas you have not studied.**

If unfamiliar content areas make up major portions of the tests, consider taking coursework to help you gain knowledge and skills in these areas before you take the ACT. Because the ACT measures knowledge and skills acquired over a period of time, it is unlikely that a “cram” course covering material that is unfamiliar to you will help you improve your scores. Longer-term survey courses will be most helpful to you, because they aim to improve your knowledge through sustained learning and practice.

## ACT English Test

The ACT English test is a 75-question, 45-minute test that measures your understanding of the conventions of standard written English (punctuation, grammar and usage, and sentence structure) and of rhetorical skills (strategy, organization, and style). Spelling, vocabulary, and rote recall of rules of grammar are not tested. The test consists of five essays, or passages, each of which is accompanied by a sequence of multiple-choice test questions. Different passage types are employed to provide a variety of rhetorical situations. Passages are chosen not only for their appropriateness in assessing writing skills but also to reflect students’ interests and experiences.

Some questions refer to underlined portions of the passage and offer several alternatives to the underlined portion. You must decide which choice is most appropriate in the context of the passage. Some questions ask about an underlined portion, a section of the passage, or the passage as a whole. You must decide which choice best answers the question posed. Many questions offer “NO CHANGE” to the passage as one of the choices. The questions are numbered consecutively. Each question number refers to a correspondingly numbered portion underlined in the passage or to a corresponding numeral in a box located at the appropriate point in the passage.

Three scores are reported for the ACT English test: a total test score based on all 75 questions, a subscore in Usage/Mechanics based on 40 questions, and a subscore in Rhetorical Skills based on 35 questions.

### **Tips for Taking the ACT English Test**

#### ***Pace yourself.***

The ACT English test contains 75 questions to be completed in 45 minutes. If you spend 1½ minutes skimming through each passage before responding to the questions, then you will have 30 seconds to answer each question. If possible, spend less time on each question and use the remaining time allowed for this test to review your work and return to the questions on this test that were most difficult for you.

#### ***Be aware of the writing style used in each passage.***

The five passages cover a variety of topics and are written in a variety of styles. It is important that you take into account the writing style used in each passage when you respond to the questions. In responding to a question, be sure to understand the context of the question. Consider how the sentence containing an underlined portion fits in with the surrounding sentences and into the passage as a whole.

#### ***Examine the underlined portions of the passage.***

Before responding to a question with an underlined portion, carefully examine what is underlined in the text. Consider the elements of writing that are included in each underlined portion. Some questions will ask you to base your decision on some specific element of writing, such as the tone or emphasis the text should convey. Some questions will ask you to choose the alternative to the underlined portion that is NOT or LEAST acceptable. The answer choices for each question will contain changes in one or more of those elements of writing.

#### ***Be aware of questions with no underlined portions.***

You will be asked some questions about a section of the passage or about the passage as a whole, in light of a given rhetorical situation. Questions of this type are often identified by a question number in a box located at the appropriate point in the passage. Questions about the entire passage are placed at the end of the passage and introduced by a horizontal box enclosing the following instruction: “Questions \_\_\_ and \_\_\_ ask about the preceding passage as a whole.”

#### ***Note the differences in the answer choices.***

Many of the questions in the test will involve more than one aspect of writing. Examine each answer choice and how it differs from the others. Be careful not to select an answer that corrects one error but causes a different error.

**Determine the best answer.**

Two approaches can be taken to determine the best answer to a question in which you are to choose the best alternative to an underlined portion. In the first approach, you can reread the sentence or sentences, substituting each of the possible answer choices for the underlined portion to determine the best choice. In the second approach, you can decide how the underlined portion might best be phrased in standard written English or in terms of the particular question posed. If you think the underlined portion is the best answer, you should select "NO CHANGE." If not, you should check to see whether your phrasing is one of the other answer choices. If you do not find your phrasing, you should choose the best of the answers presented. For questions cued by a number in a box, you must decide which choice is most appropriate in terms of the question posed or the stated rhetorical situation.

**Reread the sentence, using your selected answer.**

Once you have selected the answer you feel is best, reread the corresponding sentence(s) of the passage, inserting your selected answer at the appropriate place in the text to make sure it is the best answer within the context of the passage.

**Content Covered by the ACT English Test**

Six elements of effective writing are included in the English test: punctuation, grammar and usage, sentence structure, strategy, organization, and style. The questions covering punctuation, grammar and usage, and sentence structure make up the Usage/Mechanics subscore. The questions covering strategy, organization, and style make up the Rhetorical Skills subscore. A brief description and the approximate percentage of the test devoted to each element of effective writing are given below.

**USAGE/MECHANICS**

*Punctuation (10–15%).* Questions in this category test your knowledge of the conventions of internal and end-of-sentence punctuation, with emphasis on the relationship of punctuation to meaning (for example, avoiding ambiguity, indicating appositives).

*Grammar and Usage (15–20%).* Questions in this category test your understanding of agreement between subject and verb, between pronoun and antecedent, and between modifiers and the word modified; verb formation; pronoun case; formation of comparative and superlative adjectives and adverbs; and idiomatic usage.

*Sentence Structure (20–25%).* Questions in this category test your understanding of relationships between and among clauses, placement of modifiers, and shifts in construction.

**RHETORICAL SKILLS**

*Strategy (15–20%).* Questions in this category test how well you develop a given topic by choosing expressions appropriate to an essay's audience and purpose; judging the effect of adding, revising, or deleting supporting material; and judging the relevancy of statements in context.

*Organization (10–15%).* Questions in this category test how well you organize ideas and choose effective opening, transitional, and closing sentences.

*Style (15–20%).* Questions in this category test how well you choose precise and appropriate words and images, maintain the level of style and tone in an essay, manage sentence elements for rhetorical effectiveness, and avoid ambiguous pronoun references, wordiness, and redundancy.

**ACT Mathematics Test**

You may use a calculator on the mathematics test.

See [www.actstudent.org](http://www.actstudent.org) for details about prohibited models and features.

The ACT mathematics test is a 60-question, 60-minute test designed to assess the mathematical skills students have typically acquired in courses taken up to the beginning of grade 12. The test presents multiple-choice questions that require you to use reasoning skills to solve practical problems in mathematics. Most questions are self-contained. Some questions may belong to a set of several questions (e.g., several questions about the same graph or chart). Knowledge of basic formulas and computational skills are assumed as background for the problems, but recall of complex formulas and extensive computation is not required. The material covered on the test emphasizes the major content areas that are prerequisites to successful performance in entry-level courses in college mathematics.

Four scores are reported for the ACT mathematics test: a total test score based on all 60 questions, a subscore in Pre-Algebra/Elementary Algebra, a subscore in Intermediate Algebra/Coordinate Geometry, and a subscore in Plane Geometry/Trigonometry.

**Tips for Taking the ACT Mathematics Test****Pace yourself.**

The ACT mathematics test contains 60 questions to be completed in 60 minutes. You have an average of 1 minute per question. If possible, spend less time on each question and use the remaining time allowed for this test to review your work and return to the questions on this test that were most difficult for you.

**If you use a calculator, use it wisely.**

All of the mathematics problems can be solved without using a calculator. Many of the problems are best done without a calculator. Use good judgment in deciding when, and when not, to use a calculator. For example, for some problems you may wish to do scratch work to clarify your thoughts on the question before you begin using a calculator to do computations.

**Solve the problem.**

For working out the solutions to the problems, you will usually do scratch work in the space provided in the test booklet. You may wish to glance over the answer choices after reading the questions. However, working backwards from the answer choices provided can take a lot of time and may not be effective.

**Locate your solution among the answer choices.**

Once you have solved the problem, look for your answer among the choices. If your answer is not included among the choices, carefully reread the problem to see whether you missed important information. Pay careful attention to the question being asked. If an equation is to be selected, check to see whether the equation you think is best can be transformed into one of the answer choices provided.

**Make sure you answer the question.**

The solutions to many questions on the test will involve several steps. Make sure your answer accounts for all the necessary steps. Frequently, questions include answer choices that are based on incomplete solutions.

**Make sure your answer is reasonable.**

Sometimes an error in computation will result in an answer that is not practically possible for the situation described. Always think about your answer to determine whether it is reasonable.

**Check your work.**

You may arrive at an incorrect solution by making common errors in the problem-solving process. Thus, if there is time remaining before the end of the mathematics test, it is important that you reread the questions and check your answers to make sure they are correct.

**Content Covered by the ACT Mathematics Test**

Six content areas are included in the mathematics test: pre-algebra, elementary algebra, intermediate algebra, coordinate geometry, plane geometry, and trigonometry. The questions covering pre-algebra and elementary algebra make up the Pre-Algebra/Elementary Algebra subscore. The questions covering intermediate algebra and coordinate geometry make up the Intermediate Algebra/Coordinate Geometry subscore. The questions covering plane geometry and trigonometry make up the Plane Geometry/Trigonometry subscore. A brief description and the approximate percentage of the test devoted to each content area are given below.

**PRE-ALGEBRA/ELEMENTARY ALGEBRA**

*Pre-Algebra (20–25%).* Questions in this content area are based on basic operations using whole numbers, decimals, fractions, and integers; place value; square roots and approximations; the concept of exponents; scientific notation; factors; ratio, proportion, and percent; linear equations in one variable; absolute value and ordering numbers by value; elementary counting techniques and simple probability; data collection, representation, and interpretation; and understanding simple descriptive statistics.

*Elementary Algebra (15–20%).* Questions in this content area are based on properties of exponents and square roots, evaluation of algebraic expressions through substitution, using variables to express functional relationships, understanding algebraic operations, and the solution of quadratic equations by factoring.

**INTERMEDIATE ALGEBRA/COORDINATE GEOMETRY**

*Intermediate Algebra (15–20%).* Questions in this content area are based on an understanding of the quadratic formula, rational and radical expressions, absolute value equations and inequalities, sequences and patterns, systems of equations, quadratic inequalities, functions, modeling, matrices, roots of polynomials, and complex numbers.

*Coordinate Geometry (15–20%).* Questions in this content area are based on graphing and the relations between equations and graphs, including points, lines, polynomials, circles, and other curves; graphing inequalities; slope; parallel and perpendicular lines; distance; midpoints; and conics.

**PLANE GEOMETRY/TRIGONOMETRY**

*Plane Geometry (20–25%).* Questions in this content area are based on the properties and relations of plane figures, including angles and relations among perpendicular and parallel lines; properties of circles, triangles, rectangles, parallelograms, and trapezoids; transformations; the concept of proof and proof techniques; volume; and applications of geometry to three dimensions.

*Trigonometry (5–10%).* Questions in this content area are based on understanding trigonometric relations in right triangles; values and properties of trigonometric functions; graphing trigonometric functions; modeling using trigonometric functions; use of trigonometric identities; and solving trigonometric equations.

**ACT Reading Test**

The ACT reading test is a 40-question, 35-minute test that measures your reading comprehension. The test questions ask you to derive meaning from several texts by (1) referring to what is explicitly stated and (2) reasoning to determine implicit meanings. Specifically, questions will ask you to use referring and reasoning skills to determine main ideas; locate and interpret significant details; understand sequences of events; make comparisons; comprehend cause-effect relationships; determine the meaning of context-dependent words, phrases, and statements; draw generalizations; and analyze the author's or narrator's voice and method. The test comprises four sections, each containing one long or two shorter prose passages that are representative of the level and kinds of text commonly encountered in first-year college curricula. Each passage is preceded by a heading that identifies what type of passage it is (for example, "Literary Narrative"), names the author, and may include a brief note that helps in understanding the passage. Each section contains a set of multiple-choice test questions. These questions do not test the rote recall of facts from outside the passage, isolated vocabulary items, or rules of formal logic. In sections that contain two short passages, some of the questions involve both of the passages in the section.

Three scores are reported for the ACT reading test: a total test score based on all 40 questions, a subscore in Social Studies/Sciences reading skills (based on the 20 questions on the social studies and natural sciences passages), and a subscore in Arts/Literature reading skills (based on the 20 questions on the literary narrative and humanities passages).

### **Tips for Taking the ACT Reading Test**

#### ***Pace yourself.***

The ACT reading test contains 40 questions to be completed in 35 minutes. If you spend 2–3 minutes reading the passage(s) in each section, then you will have about 35 seconds to answer each question. If possible, spend less time on the passages and the questions and use the remaining time allowed for this test to review your work and return to the questions on this test that were most difficult for you.

#### ***Read each passage carefully.***

Before you begin answering a question, read the entire passage (or two short passages) carefully. Be conscious of relationships between or among ideas. You may make notes in the test booklet about important ideas in the passages.

#### ***Refer to the passages when answering the questions.***

Answers to some of the questions will be found by referring to what is explicitly stated in the text. Other questions will require you to determine implicit meanings and to draw conclusions, comparisons, and generalizations. Consider the text before you answer any question.

### **Content Covered by the ACT Reading Test**

The reading test is based on four types of reading selections: the social studies, the natural sciences, literary narrative, and the humanities. A subscore in Social Studies/Sciences reading skills is based on the questions on the social studies and the natural sciences passages, and a subscore in Arts/Literature reading skills is based on the questions on the literary narrative and humanities passages. A brief description and the approximate percentage of the test devoted to each type of reading selection are given below.

*Social Studies (25%).* Questions in this category are based on passages in the content areas of anthropology, archaeology, biography, business, economics, education, geography, history, political science, psychology, and sociology.

*Natural Sciences (25%).* Questions in this category are based on passages in the content areas of anatomy, astronomy, biology, botany, chemistry, ecology, geology, medicine, meteorology, microbiology, natural history, physiology, physics, technology, and zoology.

*Literary Narrative (25%) or Prose Fiction (25%).* Questions in the Literary Narrative category are based on passages from short stories, novels, memoirs, and personal essays. Questions in the Prose Fiction category are based on passages from short stories and novels.

*Humanities (25%).* Questions in this category are based on passages in the content areas of architecture, art, dance, ethics, film, language, literary criticism, music, philosophy, radio, television, and theater. Questions may be based on passages from memoirs and personal essays.

## **ACT Science Test**

The ACT science test is a 40-question, 35-minute test that measures the interpretation, analysis, evaluation, reasoning, and problem-solving skills required in the natural sciences.

The test presents several sets of scientific information, each followed by a number of multiple-choice test questions. The scientific information is conveyed in one of three different formats: data representation (graphs, tables, and other schematic forms), research summaries (descriptions of several related experiments), or conflicting viewpoints (expressions of several related hypotheses or views that are inconsistent with one another). The questions require you to recognize and understand the basic features of, and concepts related to, the provided information; to examine critically the relationship between the information provided and the conclusions drawn or hypotheses developed; and to generalize from given information to gain new information, draw conclusions, or make predictions.

You are **not permitted** to use a calculator on the ACT science test.

One score is reported for the ACT science test: a total test score based on all 40 questions.

### **Tips for Taking the ACT Science Test**

#### ***Pace yourself.***

The ACT science test contains 40 questions to be completed in 35 minutes. If you spend about 2 minutes reading each passage, then you will have about 30 seconds to answer each question. If possible, spend less time on the passages and the questions and use the remaining time allowed for this test to review your work and return to the questions on this test that were most difficult for you.

#### ***Read the passage carefully.***

Before you begin answering a question, read the scientific material provided. It is important that you read the entire text and examine any tables, graphs, or figures. You may want to make notes about important ideas in the information provided in the test booklet. Some of the information sets will describe experiments. You should consider the experimental design, including the controls and variables, because questions are likely to address this component of scientific research.

#### ***Note different viewpoints in passages.***

Some material will present conflicting points of view, and the questions will ask you to distinguish among the various viewpoints. It may be helpful for you to make notes summarizing each viewpoint next to that section in the test booklet.

### **Content Covered by the ACT Science Test**

The content of the science test includes biology, chemistry, physics, and the Earth/space sciences (for example, geology, astronomy, and meteorology). Advanced knowledge in these subjects is not required, but knowledge acquired in general, introductory science courses is needed to answer some of the questions. The test emphasizes scientific reasoning skills over recall of scientific content, skill in mathematics, or reading ability. The scientific information is conveyed in one of three different formats.

*Data Representation (30–40%).* This format presents graphic and tabular material similar to that found in science journals and texts. The questions associated with this format measure skills such as graph reading, interpretation of scatterplots, and interpretation of information presented in tables.

*Research Summaries (45–55%).* This format provides descriptions of one or more related experiments. The questions focus upon the design of experiments and the interpretation of experimental results.

*Conflicting Viewpoints (15–20%).* This format presents expressions of several hypotheses or views that, being based on differing premises or on incomplete data, are inconsistent with one another. The questions focus upon the understanding, analysis, and comparison of alternative viewpoints or hypotheses.

## **ACT Writing Test (Optional)**

If you register for the ACT with writing, you will take the ACT writing test (which must be completed in English) **after** you complete the four multiple-choice tests.

The ACT writing test is a 40-minute essay test that measures your writing skills—specifically those writing skills emphasized in high school English classes and in entry-level college composition courses. The test describes an issue and provides three different perspectives on the issue. You are asked to “evaluate and analyze” the perspectives; to “state and develop” your own perspective; and to “explain the relationship” between your perspective and those given. Your score will not be affected by the perspective you take on the issue.

Taking the writing test will **not** affect your scores on the multiple-choice tests or your Composite score. Rather, you will receive a single subject-level writing score on a scale of 1–36 and five additional scores: an English Language Arts score on a scale of 1–36 and scores for four domains of writing competencies (Ideas and Analysis, Development and Support, Organization, and Language Use and Conventions) on a scale of 2–12.

Two trained readers will score your essay from 1-6 in each of four writing domains. Each domain score represents the sum of the two readers’ scores. Your Writing Score is calculated from your domain scores and is reported on a scale of 1–36. Your domain scores do not necessarily add up to your reported Writing Score.

## **Tips for Taking the ACT Writing Test**

### ***Pace yourself.***

The ACT writing test contains one question to be completed in 40 minutes. When asked to write a timed essay, most writers find it useful to do some planning before they write the essay, and to do a final check of the essay when it is finished. It is unlikely that you will have time to draft, revise, and recopy your essay.

### ***Plan.***

Before writing, carefully read and consider all prompt material. Be sure you understand the issue, its perspectives, and your essay task. The prewriting questions included with the prompt will help you analyze the perspectives and develop your own. Use these questions to think critically about the prompt and generate effective ideas in response. Ask yourself how your ideas and analysis can best be supported and organized in a written argument. Use the prewriting space in your test booklet to structure or outline your response.

### ***Write.***

Establish the focus of your essay by making clear your argument and its main ideas. Explain and illustrate your ideas with sound reasoning and meaningful examples. Discuss the significance of your ideas: what are the implications of what you have to say, and why is your argument important to consider? As you write, ask yourself if your logic is clear, you have supported your claims, and you have chosen precise words to communicate your ideas.

### ***Review your essay.***

Take a few minutes before time is called to read over your essay. Correct any mistakes. If you find any words that are hard to read, recopy them. Make corrections and revisions neatly, between the lines. Do not write in the margins. Your readers know you had only 40 minutes to compose and write your essay. Within that time limit, try to make your essay as polished as you can.

### ***Practice.***

There are many ways to prepare for the ACT writing test. These include reading newspapers and magazines, listening to news analyses on television or radio, and participating in discussions and debates.

One of the best ways to prepare for the ACT writing test is to practice writing with different purposes for different audiences. The writing you do in your classes will help you. So will writing essays, stories, editorials, a personal journal, or other writing you do on your own.

It is also a good idea to practice writing within a time limit. Taking the practice ACT writing test will give you a sense of how much additional practice you may need. You might want to take the practice ACT writing test even if you do not plan to take the ACT with writing, because this will help build skills that are important in college-level learning and in the world of work.



# 3 What to Expect on Test Day

## Reporting Time

For National and International test dates, you must report to the test center by the time stated on your ticket, normally 8:00 a.m. If you are late, you will not be admitted to test. If your ticket does not list a specific room, test center staff or posted signs will direct you.

## Requirements for Admission

**At check-in, you will be required to show both your paper ticket and acceptable photo ID or you will not be admitted to test.** See ID requirements on your ticket or at [www.actstudent.org](http://www.actstudent.org).

## In the Test Room

- The supervisor or proctor will direct you to a seat. If you need a left-handed desk, tell your supervisor as you enter.
- Do not leave the test room after you have been admitted.
- Only pencils, erasers, a permitted calculator, and your ticket will be allowed on your desk.
- You will be required to put all other personal belongings away.
- You may not use tobacco in any form or have food or drink (including water) in the test room. You may have snacks and drinks outside the test room during break.
- Testing will begin as soon as all examinees present at 8:00 a.m. are checked in and seated.
- Listen carefully to all directions read by your supervisor.
- It is important that you *follow all directions* carefully.
- On some test dates, ACT tries out questions to develop future versions of the tests. You may be asked to take a fifth test, the results of which will not be reflected in your reported scores. The fifth test could be multiple-choice or one for which you will create your own answers. Please try your best on these questions, because your participation can help shape the future of the ACT. If you are in a test room where the fifth test is administered, you will be dismissed at about 12:35 p.m.

## Prohibited Behavior at the Test Center

The following behaviors are prohibited. You will be dismissed and your answer document will not be scored if you are found:

- Filling in or altering responses on a test section on your answer sheet or continuing to complete the essay after time has been called on that test section. This means that you cannot make any changes to a test section outside of the designated time for that section, even to fix a stray mark or accidental keystroke.
- Looking back at a test section on which time has already been called.
- Looking ahead in the test booklet.

- Looking at another person's test booklet or answer document.
- Giving or receiving assistance by any means.
- Discussing or sharing of test content, test form identification numbers, or answers during test administration, during breaks, or after the test is prohibited.
- Using a prohibited calculator ([www.actstudent.org](http://www.actstudent.org)).
- Using a calculator on any test section other than Mathematics.
- Sharing a calculator with another person.
- Using a watch with recording, internet, or communication capabilities.
- Using any electronic device at any time during testing or during break other than an approved calculator or watch. **All** other electronic devices, including cell phones and wearable devices, must be turned off and placed out of reach from the time you are admitted to test until you are dismissed after testing concludes.
- Attempting to memorize test-related information or otherwise remove test materials, including questions or answers, from the test room in any way.
- Using highlight pens, colored pens or pencils, notes, dictionaries, or other aids.
- Using scratch paper (unless an exception applies).
  - Specific instructions will be provided on test day if ACT authorizes you to use scratch paper, including the section(s) on which ACT has authorized its use.
  - If you are permitted to use scratch paper, you may only use paper that ACT has authorized and/or provided to you.
- Not following instructions or abiding by the rules of the test center.
- Exhibiting confrontational, threatening, or unruly behavior; or violating any laws. If ACT suspects you are engaging in criminal activities, such activities will be reported to law enforcement agencies.
- Allowing an alarm to sound in the test room or creating any other disturbance.

All items brought into the test center, such as hats, purses, backpacks, cell phones, calculators, and other electronic devices may be searched at the discretion of ACT and its testing staff. ACT and its testing staff may confiscate and retain for a reasonable period of time any item suspected of having been used, or being capable of being used, in violation of this list of prohibited behaviors. ACT may also provide such items to third parties in connection with an investigation conducted by ACT or others. ACT and its testing staff shall not be responsible for lost, stolen, or damaged items.

## Voiding Your Answer Documents on Test Day

If you have to leave the test center before completing all your tests, you must decide whether or not you want your answer document scored and inform your supervisor of your decision. If you do not, your answer document will be scored.

Once you break the seal on your multiple-choice test booklet, you cannot request a Test Date Change. If you do not complete all your tests and want to test again, you will have to pay the full fee for your test option again. If you want to take the ACT again, see [www.actstudent.org](http://www.actstudent.org) for your options. Once you begin filling out your answer document, you cannot change from one test option to another.

## Testing More Than Once

You may not receive scores from more than one test taken during a scheduled National or International test date. For example, you may test on Saturday or on an authorized non-Saturday date or on a rescheduled test date—but not on more than one of those days. If you are admitted and allowed to test a second time, we will report only the scores from the first test. The second set of scores will be cancelled without refund.

## Test Information Release

On certain National test dates, if you test at a National test center, you may order (for an additional fee) a copy of the test questions, a copy of your answers, a list of correct answers, and scoring instructions. This service is not available for all test dates or for other testing programs (e.g., International, State and District, Special). If you want to request and pay for this service, check [www.actstudent.org](http://www.actstudent.org) to see which test dates offer this service.

# 4 Taking the Practice Tests

Take the practice tests under conditions as similar as possible to those you will experience on test day. The following tips will help you:

- The four multiple-choice tests require 2 hours and 55 minutes. Take them in order in one sitting, with a 10- to 15-minute break between Tests 2 and 3.
- You will need only sharpened No. 2 pencils with good erasers. Remove all other items from your desk. You will not be allowed to use scratch paper.
- If you plan to use a permitted calculator on the mathematics test, use the same one you will use on test day.
- Use a digital timer or clock to time yourself on each practice test. Set your timer for five minutes less than the time allowed for each test so you can get used to the verbal announcement of five minutes remaining.
- Give yourself only the time allowed for each test.
- Detach and use the sample multiple-choice answer document on pages 63–64.
- Read the test directions on the first page of the practice multiple-choice tests. These are the same directions that will appear on your test booklet on test day.
- Start your timer and begin with Test 1. Continue through Test 4, taking a 10- to 15-minute break between Tests 2 and 3. If you do not plan to take the ACT with writing, score your multiple-choice tests using the information beginning on page 56.
- If you plan to take the ACT with writing, read the directions on the first page of the practice ACT writing test (page 53). These are the same directions that will appear on your test booklet on test day. Start your timer, then read the prompt on page 54. After you understand what the prompt is asking you to do, plan your essay and then write it on lined paper. (On test day, your answer document will have lined pages for you to write your essay.) Score your essay using the information on pages 61–62.

# Practice Multiple-Choice Tests

## EXAMINEE STATEMENT, CERTIFICATION, AND SIGNATURE

1. Read the following **Statement**: By opening this test booklet, I agree to comply with and be bound by the *Terms and Conditions: Testing Rules and Policies for the ACT®* provided in the ACT registration materials for this assessment, including those concerning test security, score cancellation, examinee remedies, arbitration, and consent to the processing of my personally identifying information, including the collection, use, transfer and disclosure of information as described in the ACT Privacy Policy (available at [www.act.org/privacy.html](http://www.act.org/privacy.html)).

**International Examinees**: By my signature I am also providing my consent to ACT to transfer my personally identifying information to the United States to ACT, or a third party service provider for processing, where it will be subject to use and disclosure under the laws of the United States. I acknowledge and agree that it may also be accessible to law enforcement and national security authorities in the United States.

I understand that ACT owns the assessment questions and responses and affirm that I will not share any assessment questions or responses with anyone by any form of communication before, during, or after the assessment administration. I understand that assuming anyone else's identity to take this assessment is strictly prohibited and may violate the law and subject me to legal penalties.

2. Copy the **Certification** shown below (only the text in italics) on the lines provided. Write in your normal handwriting.  
**Certification**: *I agree to the Statement above and certify that I am the person whose name appears on this form.*

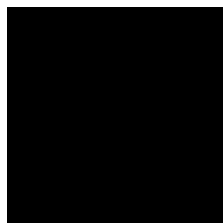
---

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3. Sign your name as you would any official document and enter today's date.

\_\_\_\_\_  
Your Signature

\_\_\_\_\_  
Today's Date



The **ACT**®

**Form 1572CPRE**

## Directions

This booklet contains tests in English, mathematics, reading, and science. These tests measure skills and abilities highly related to high school course work and success in college. **Calculators may be used on the mathematics test only.**

The questions in each test are numbered, and the suggested answers for each question are lettered. On the answer document, the rows of ovals are numbered to match the questions, and the ovals in each row are lettered to correspond to the suggested answers.

For each question, first decide which answer is best. Next, locate on the answer document the row of ovals numbered the same as the question. Then, locate the oval in that row lettered the same as your answer. Finally, fill in the oval completely. Use a soft lead pencil and make your marks heavy and black. **Do not use ink or a mechanical pencil.**

Mark only one answer to each question. If you change your mind about an answer, erase your first mark thoroughly before marking your new answer. For each question, make certain that you mark in the row of ovals with the same number as the question.

Only responses marked on your answer document will be scored. Your score on each test will be based only on the number of questions you answer correctly during the time allowed for that test. You will **not** be penalized for guessing. **It is to your advantage to answer every question even if you must guess.**

You may work on each test **only** when the testing staff tells you to do so. If you finish a test before time is called for that test, you should use the time remaining to reconsider questions you are uncertain about in that test. You may **not** look back to a test on which time has already been called, and you may **not** go ahead to another test. To do so will disqualify you from the examination.

Lay your pencil down immediately when time is called at the end of each test. You may **not** for any reason fill in or alter ovals for a test after time is called for that test. To do so will disqualify you from the examination.

Do not fold or tear the pages of your test booklet.

**DO NOT OPEN THIS BOOKLET  
UNTIL TOLD TO DO SO.**

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## ENGLISH TEST

45 Minutes—75 Questions

**DIRECTIONS:** In the five passages that follow, certain words and phrases are underlined and numbered. In the right-hand column, you will find alternatives for the underlined part. In most cases, you are to choose the one that best expresses the idea, makes the statement appropriate for standard written English, or is worded most consistently with the style and tone of the passage as a whole. If you think the original version is best, choose “NO CHANGE.” In some cases, you will find in the right-hand column a question about the underlined part. You are to choose the best answer to the question.

You will also find questions about a section of the passage, or about the passage as a whole. These questions do not refer to an underlined portion of the passage, but rather are identified by a number or numbers in a box.

For each question, choose the alternative you consider best and fill in the corresponding oval on your answer document. Read each passage through once before you begin to answer the questions that accompany it. For many of the questions, you must read several sentences beyond the question to determine the answer. Be sure that you have read far enough ahead each time you choose an alternative.

## PASSAGE I

## The Triangular Snowflake

[1]

Snowflakes form from tiny water droplets, following a specific process of chemical bonding as they freeze, which results in a six-sided figure. The rare “triangular” snowflake, similarly, confounded scientists for years because it apparently defied the basic laws of chemistry. [A] The seemingly triangular shape of those snowflakes suggests that forming through a different process of chemical bonding. [B] By re-creating snowflake formation, a discovery has revealed to scientists Kenneth Libbrecht and Hannah Arnold the cause of this apparent variation.

[2]

Snowflakes begin to form when water in the atmosphere freezes it causes the water molecules to bond into a hexagonal shape. During the flake’s descent from Earth’s upper atmosphere, other water vapor molecules bumps into the hexagonal structure.

- A. NO CHANGE  
 B. form, from tiny, water droplets,  
 C. form from tiny, water, droplets  
 D. form, from tiny water droplets
- F. NO CHANGE  
 G. for example,  
 H. additionally,  
 J. however,
- A. NO CHANGE  
 B. the manner in which formation  
 C. which had formed  
 D. that they form
- F. NO CHANGE  
 G. the discovery of the cause of this apparent variation has been made by scientists Kenneth Libbrecht and Hannah Arnold.  
 H. scientists Kenneth Libbrecht and Hannah Arnold have discovered the cause of this apparent variation.  
 J. the cause of this apparent variation has been discovered by scientists Kenneth Libbrecht and Hannah Arnold.
- A. NO CHANGE  
 B. freezes, causing  
 C. freezes, it causes  
 D. freezes, this causes
- F. NO CHANGE  
 G. has bumped  
 H. bumped  
 J. bump



Bypassing the liquid water phase, those molecules  
condense directly onto the established hexagonal pattern.

As a result, the flake grows outward into bigger and more complex hexagonal arrangements surrounding the original hexagonal shape at the center of the flake. [C]

[3]

In 2009, Libbrecht and Arnold's experiments revealed that triangular snowflakes begin with the same process of chemical bonding and forms a hexagonal shape. The triangular shape is an illusion resulting from

one significant addition to the process dust.

[4]

Triangular snowflakes begin to form when a tiny dust particle or other such impurity collides with the flake as it falls, thereby pushing one edge upward. [D] The downward edge of the snowflake encounters more wind resistance than the rest of the flake. The greater the pressure from the wind, causes bonds to form

quick at this edge than in the rest of the snowflake.

[5]

The resulting snowflake has three long sides and three sides that are so short they are difficult to detect. Although these snowflakes appear to have a triangular shape—they actually have a hexagonal pattern. Such snowflakes offer evidence that even when impurities

interfere, the basic laws of chemistry still apply.

7. If the writer were to delete the underlined portion (adjusting the capitalization as needed), the sentence would primarily lose:

- A. an explanation of the process water molecules undergo to change from liquid to vapor to solid.
- B. a detail that mentions a step some water molecules skip in changing from vapor to solid.
- C. a visual description of what water vapor molecules look like.
- D. an explanation of how molecules react to various air temperatures.

8. F. NO CHANGE  
G. were they to form  
H. if they formed  
J. form

9. A. NO CHANGE  
B. process is  
C. process:  
D. process;

10. F. NO CHANGE  
G. pressure from the wind, which  
H. the pressure, as the wind  
J. pressure from the wind

11. A. NO CHANGE  
B. more quickly  
C. most quickly  
D. quickest

12. F. NO CHANGE  
G. shape,  
H. shape;  
J. shape:

13. Which choice most effectively concludes the sentence and the essay?

- A. NO CHANGE
- B. scientists can be certain that a solution to even the most confusing event will be found.
- C. snowflakes will still fall if atmospheric conditions are favorable.
- D. snowflakes come in many different shapes and sizes.



Questions 14 and 15 ask about the preceding passage as a whole.

14. The writer is considering adding the following sentence to the essay:

This growth can take the form of either branching (which forms stable, symmetrical shapes) or faceting (which forms unstable, complex shapes).

If the writer were to add this sentence, it would most logically be placed at Point:

- F. A in Paragraph 1.
- G. B in Paragraph 1.
- H. C in Paragraph 2.
- J. D in Paragraph 4.

15. Suppose the writer's primary purpose had been to offer an example of a discovery that changed the way scientists viewed the basic laws of chemistry. Would this essay accomplish that purpose?

- A. Yes, because it describes how the observation of triangular snowflakes has led scientists to discover that their understanding of the basic laws of chemistry is flawed.
- B. Yes, because it describes how scientists have applied the knowledge they've gained through studying snowflakes to other areas of chemistry.
- C. No, because it focuses on how scientists are struggling to determine how triangular snowflakes are formed.
- D. No, because it explains that triangular snowflakes appeared to, but don't actually, violate the basic laws of chemistry.

## PASSAGE II

### Climbing Mt. Fuji

[1]

Bundled up in wool sweaters and thick

coats, and we watched the sun setting on Mt. Fuji

<sup>16</sup>

in Japan. It was August and our clothes were stifling,

but we would have needed the warmth from our bodies

<sup>17</sup>

sealed around us as we hiked into the high altitudes.

Three friends and I stepped away from the crowd of

other hikers and spoke our intention: "Sunset at the

base, sunrise at the top." [A]

[2]

As we hiked, a patchwork of clouds swept across

the darkening sky, hiding all traces of our surroundings

outside our flashlights' beams. The trail gradually changed

from compact dirt to a jumble of volcanic rocks. [B]

16. F. NO CHANGE  
 G. coats while watching  
 H. coats, we watched  
 J. coats watching
17. A. NO CHANGE  
 B. would need  
 C. will need  
 D. need



We tried to steady ourselves with our walking sticks but slipped and stumbled because of the jumbled rocks we were slipping on.

18  
[3]

Every thousand feet, we came to a small station constructed of tin and cement, barely able to block the wind. At each one, we noted the roof piled high on fallen rocks and felt both unsettled and reassured by this evidence of the station's protective ability. We rested uneasily for a moment as a clerk burned the station brand into our walking sticks which it was proof of our progress through the darkness.

19  
[4]

As we neared the summit, the whole group of hikers—thinly spread across the mountain for most of

the route—condensed, forming an illuminated line along

the trail. [C] Our pace slowed. Progressing along the trail, we reached the summit just five minutes before dawn. [D]

In the half-light of the rising sun: we began to make

out the dark lines of the cliffs' at the crater's edge.

18. F. NO CHANGE  
G. even though we used our walking sticks.  
H. despite any efforts to remain steady.  
J. with each step.

19. A. NO CHANGE  
B. piling high with  
C. piled high with  
D. piling high on

20. F. NO CHANGE  
G. sticks, it was proof of  
H. sticks, proof of  
J. sticks proved

21. A. NO CHANGE  
B. the most part  
C. majority  
D. more

22. F. NO CHANGE  
G. they formed  
H. there was  
J. we saw

23. Which choice emphasizes the slowness of the ascent and supports the idea that the narrator's group of friends did not set their own pace?  
A. NO CHANGE  
B. Able to advance only a few steps at a time,  
C. Moving forward with each step,  
D. Climbing higher in altitude,

24. F. NO CHANGE  
G. sun—  
H. sun,  
J. sun;

25. A. NO CHANGE  
B. cliff's at the craters'  
C. cliffs at the crater's  
D. cliffs at the craters



We crouched down on jutting pieces of rock and waited for the shifting clouds to clear. We waited for the sun. 26

[5]

Generally, a sudden gap in the clouds left us blinking

<sup>27</sup>

as the sunlight squelched out the severe landscape of gray volcanic rock. We leaned against each other, spent

<sup>28</sup>

Perhaps there is truth in the old Japanese saying: A wise man climbs Mt. Fuji, but only a fool climbs it twice.

Questions 29 and 30 ask about the preceding passage as a whole.

29. The writer wants to add the following sentence to the essay:

We clipped small flashlights onto our coats, picked up our walking sticks, and started up the trail with the other hikers as the sun dipped below the trees.

The sentence would most logically be placed at Point:

- A. A in Paragraph 1.
- B. B in Paragraph 2.
- C. C in Paragraph 4.
- D. D in Paragraph 4.

26. If the writer were to delete the preceding sentence, the paragraph would primarily lose:

- F. a restatement of an idea that emphasizes the hikers' anticipation when they reached the summit.
- G. a statement that introduces the idea of waiting, which is the focus of the following paragraph.
- H. an unnecessary detail that contradicts information presented earlier in the paragraph.
- J. a clear image that conveys what the hikers saw when they reached the summit.

27. A. NO CHANGE

- B. Furthermore,
- C. Once again,
- D. Finally,

28. Which choice most dramatically emphasizes the ruggedness of the landscape?

- F. NO CHANGE
- G. shattered over
- H. smothered
- J. went over

30. Suppose the writer's primary purpose had been to describe the experience of doing something difficult. Would this essay accomplish that purpose?

- F. Yes, because it tells about a variety of challenges the hikers faced along their journey.
- G. Yes, because it focuses primarily on the hikers' need for walking sticks and other tools to make it up the trail.
- H. No, because it focuses on the rewarding nature of the experience but does not describe the hike as challenging.
- J. No, because it focuses mainly on the beauty of the surrounding landscape.

---

**PASSAGE III**

**The Pottery of Mata Ortiz**

In the early 1950s, a twelve-year-old boy named, Juan Quezada, gathered firewood

<sup>31</sup>

in the mountains near the village of Mata Ortiz in Chihuahua, Mexico. Though he dreamed of becoming an artist, Quezada spent all of his free time selling firewood to help support his family.

31. A. NO CHANGE

- B. boy named Juan Quezada
- C. boy, named Juan Quezada
- D. boy named Juan Quezada,





In the mountains, Quezada found shards of pots, and an occasional complete pot, painted with intricate red and black designs. These were artifacts from his ancestors, the Paquimé (or Casas Grandes) Indians, who lived in the area from about AD 1000 to AD 1400. Fascinated by the geometric designs, Quezada wondered, if he could make pots like these?

33

**34** He dug the clay, soaked it, and tried to shape it into a pot. In time, he figured out how his ancestors had mixed the clay with volcanic ash to keep it from cracking and had used minerals found nearby to create paints. When it was time to paint his pots, Quezada designed his own complex geometric patterns.

As an adult, Quezada found a job with the railroad, but he always made time for his art. By 1976 he was selling pots to travelers and had taught several members of his family how to make pots. Three of Quezada's pots were discovered in a junk shop in New Mexico by anthropologist Spencer MacCallum, who at first thought they were prehistoric. **36**

His search for their creator led him to Mata

37

Ortiz and an eventual partnership with Quezada.

38

- 32.** Which of the following alternatives to the underlined portion would NOT be acceptable?
- F. pots—along with an occasional complete pot—  
 G. pots, along with an occasional complete pot,  
 H. pots, (and an occasional complete pot)  
 J. pots (and an occasional complete pot)
- 33.** A. NO CHANGE  
 B. wondered if he could make pots like these.  
 C. wondered, if he could make pots like these.  
 D. wondered if he could make pots like these?
- 34.** Which of the following true statements would provide the best transition from the preceding paragraph to this paragraph?
- F. The village of Mata Ortiz is only three streets wide but stretches for a mile between the Casas Grandes River and the railroad tracks.  
 G. The patterns on Mata Ortiz pottery that Quezada admired are based on the techniques of the ancient Paquimé.  
 H. Quezada began working with clay from the mountains.  
 J. Quezada's painted designs became increasingly complex.
- 35.** A. NO CHANGE  
 B. a dedication to teaching  
 C. a teacher of  
 D. has taught
- 36.** In the preceding sentence, the clause “who at first thought they were prehistoric” primarily serves to indicate:
- F. how closely Quezada had created his pots within the Paquimé tradition.  
 G. that Quezada's technique as a potter wasn't very well developed yet.  
 H. how strikingly simple Quezada's pots were in shape and design.  
 J. that the style of Quezada's pots was outmoded.
- 37.** A. NO CHANGE  
 B. lead himself  
 C. led himself  
 D. lead him
- 38.** Which choice most strongly suggests that Quezada's partnership with MacCallum was not formed right away upon MacCallum's arrival in Mata Ortiz?
- F. NO CHANGE  
 G. a circumstantial  
 H. a momentary  
 J. a timely

MacCallum showed Quezada's pots to art dealers in the United States, the places in which art galleries were soon<sup>39</sup> offering Quezada thousands of dollars for them.

[1] Quezada helped his village with the money he earned selling pottery, but he wanted to do more so.<sup>40</sup> [2] So he taught people from Mata Ortiz to make pots. [3] Today

there are more than four hundred potters around,<sup>41</sup> all of

which<sup>42</sup> make their pots by hand, following the traditions of the Paquimé Indians. [4] The village is thriving, and many museums proudly display the pottery of Mata Ortiz.

[5] Each artist brought something unique to they're<sup>43</sup>

creations. 44

39. A. NO CHANGE  
 B. and it would happen there that  
 C. where  
 D. DELETE the underlined portion.
40. F. NO CHANGE  
 G. more than that.  
 H. more of them.  
 J. more.
41. A. NO CHANGE  
 B. people creating art now,  
 C. potters in Mata Ortiz,  
 D. DELETE the underlined portion and place a comma after the word *hundred*.
42. F. NO CHANGE  
 G. whom  
 H. them  
 J. who
43. A. NO CHANGE  
 B. his or herself  
 C. hers or his  
 D. his or her
44. For the sake of the logic and coherence of this paragraph, Sentence 5 should be placed:  
 F. where it is now.  
 G. before Sentence 1.  
 H. after Sentence 1.  
 J. after Sentence 2.

Question 45 asks about the preceding passage as a whole.

45. Suppose the writer's primary purpose had been to write an essay summarizing the history of pottery making in Mexico. Would this essay accomplish that purpose?
- A. Yes, because it discusses ancient pottery shards and complete pots from the Paquimé Indians and compares that pottery to modern designs.  
 B. Yes, because it demonstrates the quality of the ancient pottery of the Mata Ortiz area.  
 C. No, because it focuses instead on how one artist based his creations on ancient pottery techniques and shared those techniques with other artists.  
 D. No, because it focuses instead on describing the Casas Grandes culture in ancient Mexico.



## PASSAGE IV

**Beaux Arts Architecture in the Spotlight**

On West 45th Street in New York City, wedged between buildings more than twice it's height, stands the Lyceum Theatre. Tourists and New Yorkers

alike regularly filling this theater to its 900-seat capacity. Most are there to attend a performance;

a few, for example, are likely to be architecture buffs

they come to admire the stunning building itself. Built in 1903, the theater exemplifies the Beaux Arts architectural style, which fuses elements of classical Greek and Roman design with Renaissance and Baroque details.

The Beaux Arts revival of classical Greek and Roman architecture is apparent on first view of the theater. The Lyceum's facade—the exterior front, or “face,” of the building—features half a dozen Corinthian columns. Above the columns extends a horizontal stone band called a frieze; carved into it are the classical theatrical

masks that represent comedy and tragedy. 51

46. F. NO CHANGE

G. they're

H. their

J. its

47. A. NO CHANGE

B. alike, regularly filling

C. alike, regularly fill

D. alike regularly fill

48. F. NO CHANGE

G. consequently,

H. however,

J. in fact,

49. A. NO CHANGE

B. there to

C. whom

D. they

50. F. NO CHANGE

G. frieze; into which are carved

H. frieze. Into which are carved

J. frieze, carved into it are

51. The writer is considering adding the following sentence:

Masks figured prominently in classical Greek theater performances, in part due to the fact that one actor would usually play several characters.

Should the writer make this addition here?

A. Yes, because it connects the paragraph's point about theatrical masks to the larger subject of classical Greek theater.

B. Yes, because it explains the masks' significance to classical Greek theater and architecture.

C. No, because it only addresses classical Greek theater and doesn't include information about Roman theater.

D. No, because it deviates from the paragraph's focus on the Lyceum Theatre's architecture.



Demonstrating the Beaux Arts infusion of Renaissance and Baroque details, tall, arched French windows, symmetrically placed between the columns, lighten the imposing gray limestone structure. [A] Above the windows and frieze, an exterior balcony spans the width of the gray building. [B] The balcony is fenced

52

with a balustrade, a stone railing supported by a row of waist-high, vase-shaped pillars. [C] The ornate interior of the building is consistent with its elaborate exterior. [D] Not just one but two marble-finished grand staircases lead from the foyer to the midlevel seating area, called the mezzanine. Inside the theater itself, elegant chandeliers illuminate rose-colored walls

54

that have gold accents. In keeping with sumptuous Beaux Arts style, curved rows of plush purple chairs

55

embrace the stage. [56] [57]

52. F. NO CHANGE  
G. gray limestone  
H. limestone  
J. DELETE the underlined portion.
53. A. NO CHANGE  
B. balustrade. Which is  
C. balustrade. It being  
D. balustrade, this is
54. F. NO CHANGE  
G. elegantly chandelier illuminates  
H. elegantly chandelier illuminate  
J. elegant chandeliers illuminates
55. Which choice maintains the essay's positive tone and most strongly mimics the elaborate style of decor being described at this point in the essay?  
A. NO CHANGE  
B. embellished with myriad gold accents.  
C. marred with gaudy accents of gold.  
D. accented with gold.
56. If the writer were to delete the preceding sentence, the essay would primarily lose details that:  
F. illustrate one of the Lyceum Theatre's features that deviates from Beaux Arts architecture.  
G. contribute to the description of the Lyceum Theatre's elaborate interior.  
H. support the essay's claim that Beaux Arts architecture was most popular in the twentieth century.  
J. clarify an unfamiliar architectural term used in the essay.
57. The writer wants to divide this paragraph into two in order to separate details about the building's outdoor features from details about its indoor features. The best place to begin the new paragraph would be at Point:  
A. A.  
B. B.  
C. C.  
D. D.



Patrons credit the handsome Beaux Arts aesthetic

58

with adding enhancement to their theatergoing experience.

59

Though smaller and more cramped than many newer theaters—audience members often note that legroom is limited—the Lyceum’s distinctive atmosphere continues to delight theater fans as well as architecture enthusiasts.

58. F. NO CHANGE  
 G. In the same manner, patrons  
 H. On one hand, patrons  
 J. For instance, patrons

59. A. NO CHANGE  
 B. adding enhancement to the experience of  
 C. adding to the experience of  
 D. enhancing

Question 60 asks about the preceding passage as a whole.

60. Suppose the writer’s primary purpose had been to explain how a building illustrates a particular architectural style. Would this essay accomplish that purpose?  
 F. Yes, because it describes the architectural styles of several New York theater buildings.  
 G. Yes, because it enumerates a number of the Lyceum Theatre’s Beaux Arts features.  
 H. No, because it focuses more specifically on the set design for the Lyceum Theatre’s productions.  
 J. No, because it focuses on more than one architectural style.

#### PASSAGE V

##### Mother Jones: True to the Spirit of Her Cause

The autobiography by Mary Harris Jones is riddled with factual inaccurate. Jones even fudges her date of

61

birth, she falsely lists May 1, International Workers’

62

Day, and ages herself by nearly a decade. These

untruths—whether deliberate exaggerations or

slips of the memory—ultimately matters very

63

little, for the autobiography isn’t about the life of

64

Mary Harris Jones. Jones became famous for her work.

65

61. A. NO CHANGE  
 B. factually inaccuracies.  
 C. factual inaccuracies.  
 D. factually inaccurate.

62. F. NO CHANGE  
 G. birth: she falsely lists  
 H. birth; falsely listing  
 J. birth, falsely listing:

63. A. NO CHANGE  
 B. has mattered  
 C. had mattered  
 D. matter

64. F. NO CHANGE  
 G. little. For  
 H. little; for  
 J. little,

65. Given that all the choices are true, which one provides the best transition into the rest of the essay?  
 A. NO CHANGE  
 B. Born in Cork, Ireland, in 1837, Jones immigrated to the United States in the mid-1800s.  
 C. Rather, it’s the story of her public persona, the radical labor activist “Mother Jones.”  
 D. Instead, this essay will show you why Jones’s role in history is so important.



When Mary Harris Jones got involved in labor politics in the 1860s, it was rare for a woman to attend, let alone address, union meetings. Jones, however, became one of the movement’s most powerful and controversial advocate’s.

She traveled the United States, from the coal mines of Appalachia to the railroad yards of the West, rallying workers to join unions and fight for better working conditions. Specifically, Jones helped organize efforts to ensure that employers complied with laws governing workday hours and child labor.

The moniker “Mother Jones” was conferred on Jones by members of the American Railway Union. She herself, adopted the name and, subsequently, a corresponding public persona. Her audiences came to expect “Mother Jones.” 68 By 1900, the white-haired, calico-frocked

figure was no longer known as Mary Harris Jones, the media, union leaders and workers, and even U.S. presidents referred to her as Mother Jones.

Embracing the very role used to confine women to the domestic sphere, Jones subversively redefined the boundaries of home and family.

66. F. NO CHANGE  
 G. movement’s most powerful and controversial advocates’.  
 H. movement’s most powerful and controversial advocates.  
 J. movements most powerful and controversial advocates.

67. A. NO CHANGE  
 B. She, herself,  
 C. She, herself  
 D. She herself

68. At this point, the writer is considering adding the following true statement:

To meet their expectations, Jones crafted her speech, dress, and mannerisms based on cultural notions of motherhood.

Should the writer make this addition here?

- F. Yes, because it highlights the contrast between Jones’s personal style and her audiences’.  
 G. Yes, because it adds details about what types of changes Jones made to create her public persona.  
 H. No, because it detracts from the focus of the paragraph by introducing unrelated details.  
 J. No, because it doesn’t indicate the effect Jones’s public persona had on audiences.
69. A. NO CHANGE  
 B. Jones, in fact,  
 C. Jones in fact  
 D. Jones;



“My address is like my shoes,” she said. “It travels with  
me wherever I go.” She was the matriarch who staunchly  
 protected workers.

protected workers. 71

And protect them she did: When workers  
 went on strike, Jones secured food donations and  
 temporary living arrangements. Where companies  
 prevented the formation of unions, she fought for  
 workers’ right to organize. Instead of these tireless

efforts on there behalf, workers trusted Mother Jones  
 and, by extension, the labor unions she represented.

70. If the writer were to delete the underlined portion, the paragraph would primarily lose a quotation that:
- F. questions the distinction between Mary Harris Jones and her public persona, Mother Jones.
  - G. reinforces the essay’s characterization of Mother Jones as a happy-go-lucky vagabond.
  - H. reiterates the point that Jones enjoyed the travel opportunities her work provided.
  - J. provides support for the claim that Jones redefined the boundaries of home.
71. In the preceding sentence, the writer is considering replacing “workers” with “her family of workers.” Should the writer make this revision?
- A. Yes, because it completes the metaphor comparing Jones to the head of a family.
  - B. Yes, because it makes clear that Jones cared most about workers who were family relatives.
  - C. No, because it unnecessarily repeats information established earlier in the essay.
  - D. No, because it introduces an unrelated comparison between workers and family.
72. F. NO CHANGE  
 G. protections, to name a few, included:  
 H. she defined protection as:  
 J. she did this by:
73. A. NO CHANGE  
 B. Because of  
 C. Without  
 D. Despite
74. F. NO CHANGE  
 G. they’re behalves,  
 H. their behalf,  
 J. their behalve’s,

Question 75 asks about the preceding passage as a whole.

75. Suppose the writer’s goal had been to summarize women’s contributions to early-twentieth-century labor law reform. Would this essay accomplish that goal?
- A. Yes, because it shows that Mother Jones was a well-known and respected labor agitator.
  - B. Yes, because it introduces a prominent figure in labor history.
  - C. No, because it focuses more specifically on labor law reform in the nineteenth century.
  - D. No, because it focuses more specifically on one figure in the labor movement.

**END OF TEST 1**

**STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.**



### MATHEMATICS TEST

60 Minutes—60 Questions

**DIRECTIONS:** Solve each problem, choose the correct answer, and then fill in the corresponding oval on your answer document.

Do not linger over problems that take too much time. Solve as many as you can; then return to the others in the time you have left for this test.

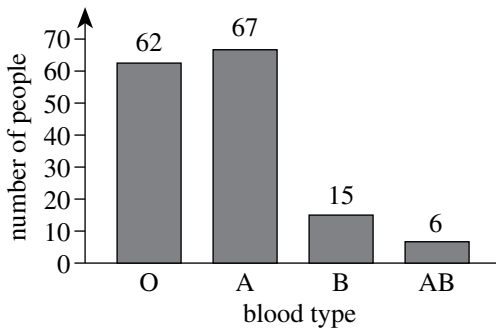
You are permitted to use a calculator on this test. You may use your calculator for any problems you choose,

but some of the problems may best be done without using a calculator.

Note: Unless otherwise stated, all of the following should be assumed.

1. Illustrative figures are NOT necessarily drawn to scale.
2. Geometric figures lie in a plane.
3. The word *line* indicates a straight line.
4. The word *average* indicates arithmetic mean.

1. The blood types of 150 people were determined for a study as shown in the figure below.



If 1 person from this study is randomly selected, what is the probability that this person has either Type A or Type AB blood?

- A.  $\frac{62}{150}$
  - B.  $\frac{66}{150}$
  - C.  $\frac{68}{150}$
  - D.  $\frac{73}{150}$
  - E.  $\frac{84}{150}$
2. The monthly fees for single rooms at 5 colleges are \$370, \$310, \$380, \$340, and \$310, respectively. What is the mean of these monthly fees?
- F. \$310
  - G. \$340
  - H. \$342
  - J. \$350
  - K. \$380

3. On a particular road map,  $\frac{1}{2}$  inch represents 18 miles. About how many miles apart are 2 towns that are  $2\frac{1}{2}$  inches apart on this map?

- A. 18
- B.  $22\frac{1}{2}$
- C. 36
- D. 45
- E. 90

4. Given  $f = cd^3$ ,  $f = 450$ , and  $d = 10$ , what is  $c$ ?

- F. 0.45
- G. 4.5
- H. 15
- J. 45
- K. 150

5. If  $f(x) = (3x + 7)^2$ , then  $f(1) = ?$

- A. 10
- B. 16
- C. 58
- D. 79
- E. 100

6. Jorge's current hourly wage for working at Denti Smiles is \$12.00. Jorge was told that at the beginning of next month, his new hourly wage will be an increase of 6% of his current hourly wage. What will be Jorge's new hourly wage?

- F. \$12.06
- G. \$12.60
- H. \$12.72
- J. \$18.00
- K. \$19.20





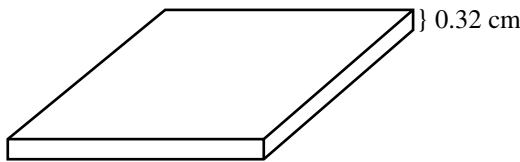
7. The first term is 1 in the geometric sequence  $1, -3, 9, -27, \dots$ . What is the SEVENTH term of the geometric sequence?
- A. -243
  - B. -30
  - C. 81
  - D. 189
  - E. 729

8. The shipping rate for customers of Ship Quick consists of a fee per box and a price per pound for each box. The table below gives the fee and the price per pound for customers shipping boxes of various weights.

Weight of box (pounds)	Fee	Price per pound
Less than 10	\$ 5.00	\$1.00
10–25	\$10.00	\$0.65
More than 25	\$20.00	\$0.30

Gregg wants Ship Quick to ship 1 box that weighs 15 pounds. What is the shipping rate for this box?

- F. \$ 9.75
  - G. \$16.50
  - H. \$19.75
  - J. \$20.00
  - K. \$24.50
9. A computer chip 0.32 cm thick is made up of layers of silicon. If the top and bottom layers are each 0.03 cm thick and the inner layers are each 0.02 cm thick, how many inner layers are there?



- A. 13
- B. 15
- C. 16
- D. 52
- E. 64

10. The table below shows the number of cars Jing sold each month last year. What is the median of the data in the table?

Month	Number of cars sold
January	25
February	15
March	22
April	19
May	16
June	13
July	19
August	25
September	26
October	27
November	28
December	29

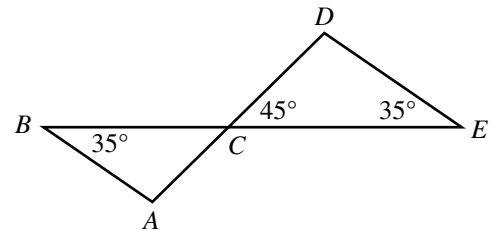
- F. 13
- G. 16
- H. 19
- J. 20.5
- K. 23.5

11. Students studying motion observed a cart rolling at a constant rate along a straight line. The table below gives the distance,  $d$  feet, the cart was from a reference point at 1-second intervals from  $t = 0$  seconds to  $t = 5$  seconds.

$t$	0	1	2	3	4	5
$d$	14	20	26	32	38	44

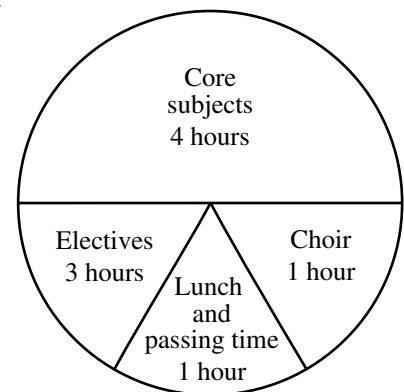
Which of the following equations represents this relationship between  $d$  and  $t$ ?

- A.  $d = t + 14$
  - B.  $d = 6t + 8$
  - C.  $d = 6t + 14$
  - D.  $d = 14t + 6$
  - E.  $d = 34t$
12. The length of a rectangle with area 54 square centimeters is 9 centimeters. What is the perimeter of the rectangle, in centimeters?
- F. 6
  - G. 12
  - H. 15
  - J. 24
  - K. 30
13. In the figure below,  $C$  is the intersection of  $\overline{AD}$  and  $\overline{BE}$ . If it can be determined, what is the measure of  $\angle BAC$ ?



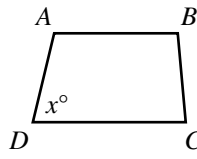
- A.  $80^\circ$
- B.  $100^\circ$
- C.  $110^\circ$
- D.  $115^\circ$
- E. Cannot be determined from the given information

14. Antwan drew the circle graph below describing his time spent at school in 1 day. His teacher said that the numbers of hours listed were correct, but that the central angle measures for the sectors were not correct. What should be the central angle measure for the Core subjects sector?



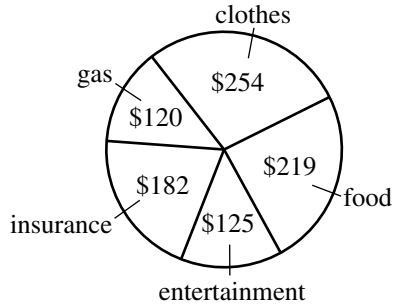
- F.  $72^\circ$
- G.  $80^\circ$
- H.  $160^\circ$
- J.  $200^\circ$
- K.  $288^\circ$



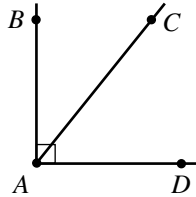
15. This month, Kami sold 70 figurines in 2 sizes. The large figurines sold for \$12 each, and the small figurines sold for \$8 each. The amount of money he received from the sales of the large figurines was equal to the amount of money he received from the sales of the small figurines. How many large figurines did Kami sell this month?
- A. 20  
B. 28  
C. 35  
D. 42  
E. 50
16. A car accelerated from 88 feet per second (fps) to 220 fps in exactly 3 seconds. Assuming the acceleration was constant, what was the car's acceleration, in feet per second per second, from 88 fps to 220 fps ?
- F.  $\frac{1}{44}$   
G.  $29\frac{1}{3}$   
H. 44  
J.  $75\frac{1}{3}$   
K.  $102\frac{2}{3}$
17. In a plane, the distinct lines  $\overleftrightarrow{AB}$  and  $\overleftrightarrow{CD}$  intersect at  $A$ , where  $A$  is between  $C$  and  $D$ . The measure of  $\angle BAC$  is  $47^\circ$ . What is the measure of  $\angle BAD$  ?
- A.  $43^\circ$   
B.  $47^\circ$   
C.  $94^\circ$   
D.  $133^\circ$   
E.  $137^\circ$
18. In which of the following are  $\frac{1}{2}$ ,  $\frac{5}{6}$ , and  $\frac{5}{8}$  arranged in ascending order?
- F.  $\frac{1}{2} < \frac{5}{8} < \frac{5}{6}$   
G.  $\frac{5}{6} < \frac{1}{2} < \frac{5}{8}$   
H.  $\frac{5}{6} < \frac{5}{8} < \frac{1}{2}$   
J.  $\frac{5}{8} < \frac{1}{2} < \frac{5}{6}$   
K.  $\frac{5}{8} < \frac{5}{6} < \frac{1}{2}$
19. In scientific notation,  $670,000,000 + 700,000,000 = ?$
- A.  $1.37 \times 10^{-9}$   
B.  $1.37 \times 10^7$   
C.  $1.37 \times 10^8$   
D.  $1.37 \times 10^9$   
E.  $137 \times 10^{15}$
20. For trapezoid  $ABCD$  shown below,  $\overline{AB} \parallel \overline{DC}$ , the measures of the interior angles are distinct, and the measure of  $\angle D$  is  $x^\circ$ . What is the degree measure of  $\angle A$  in terms of  $x$  ?
- F.  $(180 - x)^\circ$   
G.  $(180 - 0.5x)^\circ$   
H.  $(180 + 0.5x)^\circ$   
J.  $(180 + x)^\circ$   
K.  $x^\circ$
- 
21. To get a driver's license, an applicant must pass a written test and a driving test. Past records show that 80% of the applicants pass the written test and 60% of those who have passed the written test pass the driving test. Based on these figures, how many applicants in a random group of 1,000 applicants would you expect to get driver's licenses?
- A. 200  
B. 480  
C. 600  
D. 750  
E. 800
22. If  $a$ ,  $b$ , and  $c$  are positive integers such that  $a^b = x$  and  $c^b = y$ , then  $xy = ?$
- F.  $ac^b$   
G.  $ac^{2b}$   
H.  $(ac)^b$   
J.  $(ac)^{2b}$   
K.  $(ac)^{b^2}$
23. Which of the following expressions is equivalent to  $\frac{1}{2}y^2(6x + 2y + 12x - 2y)$  ?
- A.  $9xy^2$   
B.  $18xy$   
C.  $3xy^2 + 12x$   
D.  $9xy^2 - 2y^3$   
E.  $3xy^2 + 12x - y^3 - 2y$
24. An artist makes a profit of  $(500p - p^2)$  dollars from selling  $p$  paintings. What is the fewest number of paintings the artist can sell to make a profit of at least \$60,000 ?
- F. 100  
G. 150  
H. 200  
J. 300  
K. 600



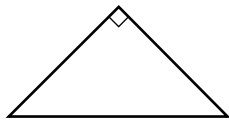
25. Last month, Lucie had total expenditures of \$900. The pie chart below breaks down these expenditures by category. The category in which Lucie's expenditures were greatest is what percent of her total expenditures, to the nearest 1%?



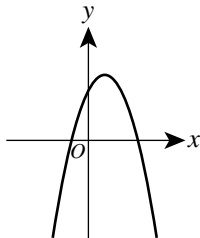
- A. 24%  
 B. 28%  
 C. 32%  
 D. 34%  
 E. 39%
26. In the figure shown below, the measure of  $\angle BAC$  is  $(x + 20)^\circ$  and the measure of  $\angle BAD$  is  $90^\circ$ . What is the measure of  $\angle CAD$ ?



- F.  $(x - 70)^\circ$   
 G.  $(70 - x)^\circ$   
 H.  $(70 + x)^\circ$   
 J.  $(160 - x)^\circ$   
 K.  $(160 + x)^\circ$
27. What is the perimeter, in inches, of the isosceles right triangle shown below, whose hypotenuse is  $8\sqrt{2}$  inches long?



- A. 8  
 B.  $8 + 8\sqrt{2}$   
 C.  $8 + 16\sqrt{2}$   
 D. 16  
 E.  $16 + 8\sqrt{2}$
28. The equation  $y = ax^2 + bx + c$  is graphed in the standard  $(x,y)$  coordinate plane below for real values of  $a$ ,  $b$ , and  $c$ . When  $y = 0$ , which of the following best describes the solutions for  $x$ ?

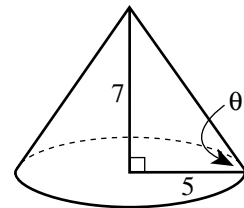


- F. 2 distinct positive real solutions  
 G. 2 distinct negative real solutions  
 H. 1 positive real solution and 1 negative real solution  
 J. 2 real solutions that are not distinct  
 K. 2 distinct solutions that are not real

29. What is the product of the complex numbers  $(-3i + 4)$  and  $(3i + 4)$ ?

- A. 1  
 B. 7  
 C. 25  
 D.  $-7 + 24i$   
 E.  $7 + 24i$

30. The radius of the base of the right circular cone shown below is 5 inches, and the height of the cone is 7 inches. Solving which of the following equations gives the measure,  $\theta$ , of the angle formed by a slant height of the cone and a radius?



- F.  $\tan \theta = \frac{5}{7}$   
 G.  $\tan \theta = \frac{7}{5}$   
 H.  $\sin \theta = \frac{5}{7}$   
 J.  $\sin \theta = \frac{7}{5}$   
 K.  $\cos \theta = \frac{7}{5}$

31. To make a 750-piece jigsaw puzzle more challenging, a puzzle company includes 5 extra pieces in the box along with the 750 pieces, and those 5 extra pieces do not fit anywhere in the puzzle. If you buy such a puzzle box, break the seal on the box, and immediately select 1 piece at random, what is the probability that it will be 1 of the extra pieces?

- A.  $\frac{1}{5}$   
 B.  $\frac{1}{755}$   
 C.  $\frac{1}{750}$   
 D.  $\frac{5}{755}$   
 E.  $\frac{5}{750}$

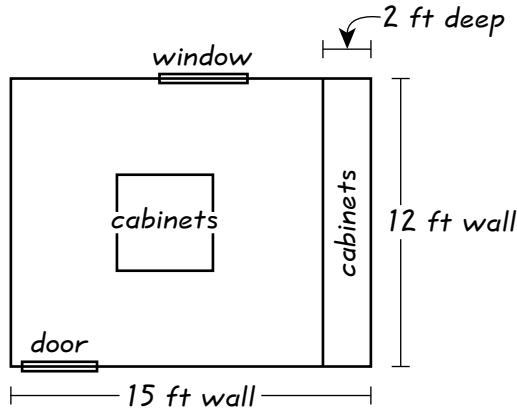
32. What fraction lies exactly halfway between  $\frac{2}{3}$  and  $\frac{3}{4}$ ?

- F.  $\frac{3}{5}$   
 G.  $\frac{5}{6}$   
 H.  $\frac{7}{12}$   
 J.  $\frac{9}{16}$   
 K.  $\frac{17}{24}$



Use the following information to answer questions 33–35.

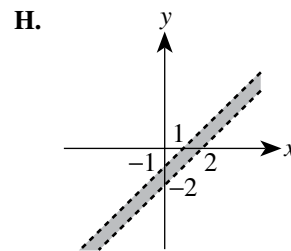
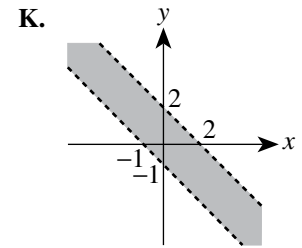
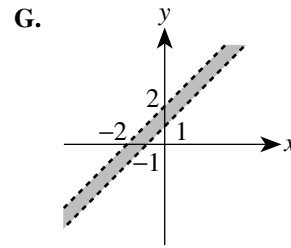
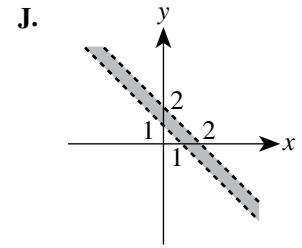
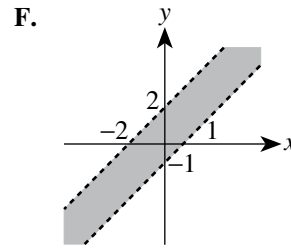
Gianna is converting a 12-foot-by-15-foot room in her house to a craft room. Gianna will install tile herself but will have CC Installations build and install the cabinets. The scale drawing shown below displays the location of the cabinets in the craft room (0.25 inch represents 2 feet).



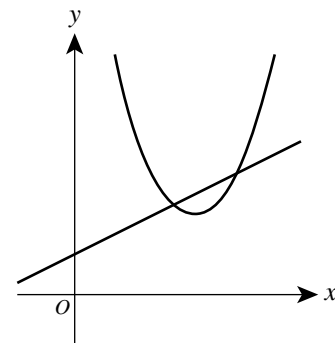
Cabinets will be installed along one of the 12-foot walls from floor to ceiling, and 4 cabinets that are each 3 feet tall will be installed in the middle of the room. These are the only cabinets that will be installed, and each of them will be 2 feet wide and 2 feet deep. CC Installations has given Gianna an estimate of \$2,150.00 for building and installing the cabinets.

33. A 15-foot wall is how many inches long in the scale drawing?
- A. 1.5  
B. 1.875  
C. 3  
D. 3.375  
E. 3.75
34. Gianna will install tile on the portion of the floor that will NOT be covered by cabinets. What is the area, in square feet, of the portion of the floor that will NOT be covered by cabinets?
- F. 72  
G. 90  
H. 140  
J. 156  
K. 164
35. CC Installations' estimate consists of a \$650.00 charge for labor, plus a fixed charge per cabinet. The labor charge and the charge per cabinet remain the same for any number of cabinets built and installed. CC Installations would give Gianna what estimate if the craft room were to have twice as many cabinets as Gianna is planning to have?
- A. \$2,800.00  
B. \$3,000.00  
C. \$3,450.00  
D. \$3,650.00  
E. \$4,300.00

36. Which of the following is the graph of the region  $1 < x + y < 2$  in the standard  $(x,y)$  coordinate plane?



37. What is the difference between the mean and the median of the set  $\{3, 8, 10, 15\}$ ?
- A. 0  
B. 1  
C. 4  
D. 9  
E. 12
38. Which of the following describes a true relationship between the functions  $f(x) = (x - 3)^2 + 2$  and  $g(x) = \frac{1}{2}x + 1$  graphed below in the standard  $(x,y)$  coordinate plane?



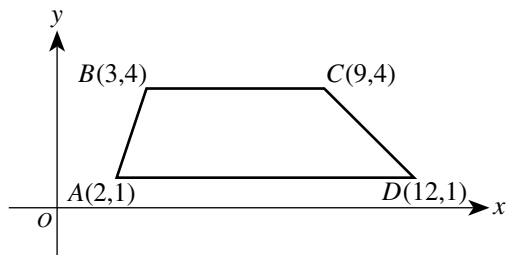
- F.  $f(x) = g(x)$  for exactly 2 values of  $x$   
G.  $f(x) = g(x)$  for exactly 1 value of  $x$   
H.  $f(x) < g(x)$  for all  $x$   
J.  $f(x) > g(x)$  for all  $x$   
K.  $f(x)$  is the inverse of  $g(x)$

GO ON TO THE NEXT PAGE.



Use the following information to answer questions 39–41.

Trapezoid  $ABCD$  is graphed in the standard  $(x,y)$  coordinate plane below.



39. What is the slope of  $\overline{CD}$ ?

- A.  $-3$
- B.  $-1$
- C.  $1$
- D.  $\frac{5}{21}$
- E.  $\frac{3}{2}$

40. When  $ABCD$  is reflected over the  $y$ -axis to  $A'B'C'D'$ , what are the coordinates of  $D'$ ?

- F.  $(-12, 1)$
- G.  $(-12, -1)$
- H.  $(12, -1)$
- J.  $(1, 12)$
- K.  $(1, -12)$

41. Which of the following vertical lines cuts  $ABCD$  into 2 trapezoids with equal areas?

- A.  $x = 2.5$
- B.  $x = 3.5$
- C.  $x = 4.5$
- D.  $x = 5.5$
- E.  $x = 6.5$

42. Given  $f(x) = x - \frac{1}{x}$  and  $g(x) = \frac{1}{x}$ , what is  $f\left(g\left(\frac{1}{2}\right)\right)$ ?

- F.  $-3$
- G.  $-\frac{3}{2}$
- H.  $-\frac{2}{3}$
- J.  $0$
- K.  $\frac{3}{2}$

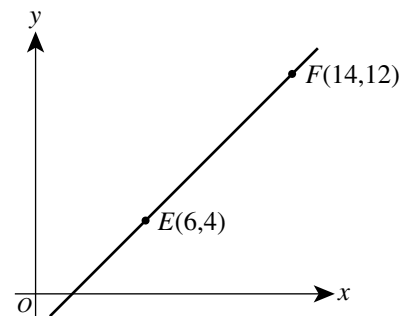
43. A formula to estimate the monthly payment,  $p$  dollars, on a short-term loan is

$$p = \frac{\frac{1}{2}ary + a}{12y}$$

where  $a$  dollars is the amount of the loan,  $r$  is the annual interest rate expressed as a decimal, and  $y$  years is the length of the loan. When  $a$  is multiplied by 2, what is the effect on  $p$ ?

- A.  $p$  is divided by 6
- B.  $p$  is divided by 2
- C.  $p$  does not change
- D.  $p$  is multiplied by 2
- E.  $p$  is multiplied by 4

44. The points  $E(6,4)$  and  $F(14,12)$  lie in the standard  $(x,y)$  coordinate plane shown below. Point  $D$  lies on  $\overline{EF}$  between  $E$  and  $F$  such that the length of  $\overline{EF}$  is 4 times the length of  $\overline{DE}$ . What are the coordinates of  $D$ ?



- F.  $(7, 5)$
- G.  $(8, 6)$
- H.  $(8, 8)$
- J.  $(10, 8)$
- K.  $(12, 10)$

45. Given that  $a \begin{bmatrix} 2 & 6 \\ 1 & 4 \end{bmatrix} = \begin{bmatrix} x & 27 \\ y & z \end{bmatrix}$  for some real number  $a$ , what is  $x + z$ ?

- A.  $\frac{4}{3}$
- B.  $\frac{27}{2}$
- C.  $26$
- D.  $27$
- E.  $48$

46. A container is  $\frac{1}{8}$  full of water. After 10 cups of water are added, the container is  $\frac{3}{4}$  full. What is the volume of the container, in cups?

- F.  $13\frac{1}{3}$
- G.  $13\frac{1}{2}$
- H.  $15$
- J.  $16$
- K.  $40$



47. Only tenth-, eleventh-, and twelfth-grade students attend Washington High School. The ratio of tenth graders to the school's total student population is 86:255, and the ratio of eleventh graders to the school's total student population is 18:51. If 1 student is chosen at random from the entire school, which grade is that student most likely to be in?
- A. Tenth  
B. Eleventh  
C. Twelfth  
D. All grades are equally likely.  
E. Cannot be determined from the given information

48.  $\frac{4}{\sqrt{2}} + \frac{2}{\sqrt{3}} = ?$

F.  $\frac{4\sqrt{3} + 2\sqrt{2}}{\sqrt{5}}$

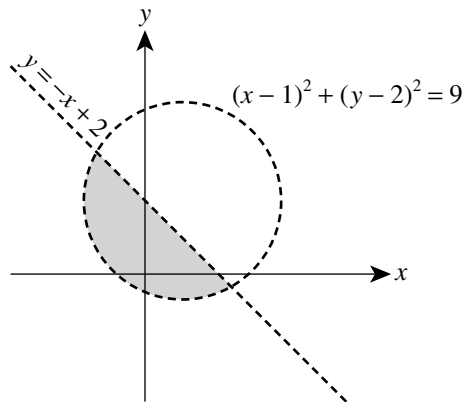
G.  $\frac{4\sqrt{3} + 2\sqrt{2}}{\sqrt{6}}$

H.  $\frac{6}{\sqrt{2} + \sqrt{3}}$

J.  $\frac{6}{\sqrt{5}}$

K.  $\frac{8}{\sqrt{6}}$

49. The shaded region in the graph below represents the solution set to which of the following systems of inequalities?



A.  $\begin{cases} y < -x + 2 \\ (x - 1)^2 + (y - 2)^2 < 9 \end{cases}$

B.  $\begin{cases} y > -x + 2 \\ (x - 1)^2 + (y - 2)^2 < 9 \end{cases}$

C.  $\begin{cases} y > -x + 2 \\ (x - 1)^2 + (y - 2)^2 > 9 \end{cases}$

D.  $\begin{cases} y < -x + 2 \\ (x - 1)^2 + (y - 2)^2 > 9 \end{cases}$

E.  $\begin{cases} (y - 2) < 3 \\ (x - 1) > 3 \end{cases}$

50. You can find the volume of an irregularly shaped solid object by completely submerging it in water and calculating the volume of water the object displaces. You completely submerge a solid object in a rectangular tank that has a base 40 centimeters by 30 centimeters and is filled with water to a depth of 20 centimeters. The object sinks to the bottom, and the water level goes up 0.25 centimeters. What is the volume, in cubic centimeters, of the object?

F. 300

G. 240

H. 200

J. 150

K. 75

51. If  $x:y = 5:2$  and  $y:z = 3:2$ , what is the ratio of  $x:z$ ?

A. 3:1

B. 3:5

C. 5:3

D. 8:4

E. 15:4

52. Which of the following is the solution statement for the inequality shown below?

$$-5 < 1 - 3x < 10$$

F.  $-5 < x < 10$

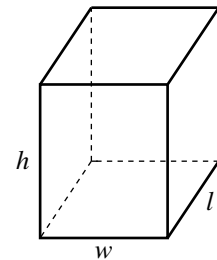
G.  $-3 < x$

H.  $-3 < x < 2$

J.  $-2 < x < 3$

K.  $x < -3$  or  $x > 2$

53. A formula for the surface area ( $A$ ) of the rectangular solid shown below is  $A = 2lw + 2lh + 2wh$  where  $l$  represents length;  $w$ , width; and  $h$ , height. By doubling each of the dimensions ( $l$ ,  $w$ , and  $h$ ), the surface area will be multiplied by what factor?



A. 2

B. 4

C. 6

D. 8

E. 12

54. A dog eats 7 cans of food in 3 days. At this rate, how many cans of food does the dog eat in  $3 + d$  days?

F.  $\frac{7}{3} + d$

G.  $\frac{7}{3} + \frac{d}{3}$

H.  $\frac{7}{3} + \frac{7d}{3d}$

J.  $7 + \frac{d}{3}$

K.  $7 + \frac{7d}{3}$



55. Kelly asked 120 students questions about skiing. The results of the poll are shown in the table below.

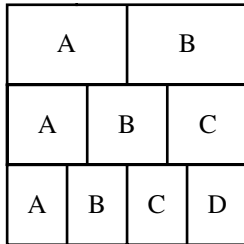
Question	Yes	No
1. Have you skied either cross-country or downhill?	65	55
2. If you answered Yes to Question 1, did you ski downhill?	28	37
3. If you answered Yes to Question 1, did you ski cross-country?	45	20

After completing the poll, Kelly wondered how many of the students polled had skied both cross-country *and* downhill. How many of the students polled indicated that they had skied both cross-country and downhill?

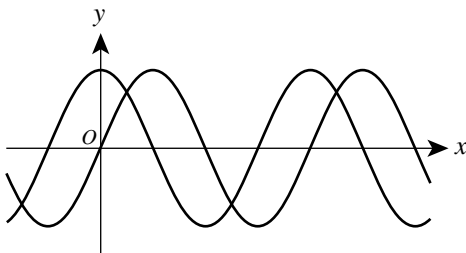
- A. 73
- B. 65
- C. 47
- D. 18
- E. 8

56. The square below is divided into 3 rows of equal area. In the top row, the region labeled A has the same area as the region labeled B. In the middle row, the 3 regions have equal areas. In the bottom row, the 4 regions have equal areas. What fraction of the square's area is in a region labeled A?

- F.  $\frac{1}{9}$
- G.  $\frac{3}{9}$
- H.  $\frac{6}{9}$
- J.  $\frac{13}{12}$
- K.  $\frac{13}{36}$



57. The functions  $y = \sin x$  and  $y = \sin(x + a) + b$ , for constants  $a$  and  $b$ , are graphed in the standard  $(x,y)$  coordinate plane below. The functions have the same maximum value. One of the following statements about the values of  $a$  and  $b$  is true. Which statement is it?



- A.  $a < 0$  and  $b = 0$
- B.  $a < 0$  and  $b > 0$
- C.  $a = 0$  and  $b > 0$
- D.  $a > 0$  and  $b < 0$
- E.  $a > 0$  and  $b > 0$

58. Which of the following number line graphs shows the solution set to the inequality  $|x - 5| < -1$ ?

- F.
- G.
- H.
- J.
- K.

59. As part of a probability experiment, Elliott is to answer 4 multiple-choice questions. For each question, there are 3 possible answers, only 1 of which is correct. If Elliott randomly and independently answers each question, what is the probability that he will answer the 4 questions correctly?

- A.  $\frac{27}{81}$
- B.  $\frac{12}{81}$
- C.  $\frac{4}{81}$
- D.  $\frac{3}{81}$
- E.  $\frac{1}{81}$

60. The sides of an acute triangle measure 14 cm, 18 cm, and 20 cm, respectively. Which of the following equations, when solved for  $\theta$ , gives the measure of the smallest angle of the triangle?

(Note: For any triangle with sides of length  $a$ ,  $b$ , and  $c$  that are opposite angles  $A$ ,  $B$ , and  $C$ , respectively,  $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$  and  $c^2 = a^2 + b^2 - 2ab \cos C$ .)

- F.  $\frac{\sin \theta}{14} = \frac{1}{18}$
- G.  $\frac{\sin \theta}{14} = \frac{1}{20}$
- H.  $\frac{\sin \theta}{20} = \frac{1}{14}$
- J.  $14^2 = 18^2 + 20^2 - 2(18)(20)\cos \theta$
- K.  $20^2 = 14^2 + 18^2 - 2(14)(18)\cos \theta$

END OF TEST 2

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

DO NOT RETURN TO THE PREVIOUS TEST.

## READING TEST

35 Minutes—40 Questions

**DIRECTIONS:** There are several passages in this test. Each passage is accompanied by several questions. After reading a passage, choose the best answer to each question and fill in the corresponding oval on your answer document. You may refer to the passages as often as necessary.

## Passage I

**PROSE FICTION:** This passage is adapted from the novel *The Ground Beneath Her Feet* by Salman Rushdie (©1999 by Salman Rushdie).

Art Deco is an architectural and decorative style that was popular in the first half of the twentieth century.

When you grow up, as I did, in a great city, during what just happens to be its golden age, you think of it as eternal. Always was there, always will be. The grandeur of the metropolis creates the illusion of permanence. The peninsular Bombay into which I was born certainly seemed perennial to me. Malabar and Cumballa hills were our Capitol and Palatine, the Brabourne Stadium was our Colosseum, and as for the glittering Art Deco sweep of Marine Drive, well, that was something not even Rome could boast. I actually grew up believing Art Deco to be the “Bombay style,” a local invention, its name derived, in all probability, from the imperative of the verb “to see.” *Art dekho*. Lo and behold art. (When I began to be familiar with images of New York, I at first felt a sort of anger. The Americans had so much; did they have to possess our “style” as well? But in another, more secret part of my heart, the Art Deco of Manhattan, built on a scale so much grander than our own, only increased America’s allure, made it both familiar and awe-inspiring, our little Bombay writ large.)

In reality that Bombay was almost brand-new when I knew it; what’s more, my parents’ construction firm of Merchant & Merchant had been prominent in its making. In the ten years before my own coming into the world, the city had been a gigantic building site; as if it were in a hurry to become, as if it knew it had to provide itself in finished condition by the time I was able to start paying attention to it . . . No, no, I don’t really think along such solipsistic lines. I’m not over-attached to history, or Bombay. Me, I’m the under-attached type.

But let me confess that, even as a child, I was insanely jealous of the city in which I was raised, because it was my parents’ other love. They loved each other (good), they loved me (very good), and they loved her (not so good). Bombay was my rival. It was on account of their romance with the city that they drew up that weekly rota (list) of shared parental responsibilities. When my mother wasn’t with me—when I was riding on my father’s shoulders, or staring,

with him, at the fish in the Taraporewala Aquarium—she was out there with *her*, with Bombay; out there bringing her into being. (For of course construction work never stops completely, and supervising such work was Ameer’s particular genius. My mother the master builder. Like her father before her.) And when my father handed me over to her, he went off, wearing his local-history hat and a khaki jacket full of pockets, to dig in the foundations of building sites for the secrets of the city’s past, or else sat hatless and coatless at a designing board and dreamed his lo-and-behold dreams.

Maps of the early town afforded my father great joy, and his collection of old photographs of the edifices and *objets* of the vanished city was second to none. In these faded images were resurrected the demolished Fort, the “breakfast bazaar” market outside the Teen Darvaza or Bazaargate, and the humble mutton shops and umbrella hospitals of the poor, as well as the fallen palaces of the great. The early city’s relics filled his imagination as well as his photo albums. It was from my father that I learned of Bombay’s first great photographers, Raja Deen Dayal and A. R. Haseler, whose portraits of the city became my first artistic influences, if only by showing me what I did not want to do. Dayal climbed the Rajabai tower to create his sweeping panoramas of the birth of the city; Haseler went one better and took to the air. Their images were awe-inspiring, unforgettable, but they also inspired in me a desperate need to get back down to ground level. From the heights you see only pinnacles. I yearned for the city streets, the knife grinders, the water carriers, the pavement moneylenders, the peremptory soldiers, the railway hordes, the chess players in the Irani restaurants, the snake-buckled schoolchildren, the beggars, the fishermen, the moviemakers, the dockers, the book sewers, the loom operators, the priests. I yearned for life.

When I said this to my father he showed me photos, still lives of storefronts and piers, and told me I was too young to understand. “See where people lived and worked and shopped,” he clarified, with a rare flash of irritation, “and it becomes plain what they were like.” For all his digging, Vivvy Merchant was content with the surfaces of his world. I, his photographer son, set out to prove him wrong, to show that a camera can see beyond the surface, beyond the trappings of the actual, and penetrate to its flesh and heart.



1. The passage as a whole can primarily be characterized as the narrator's:
  - A. explanation of the relationship the narrator and his parents had with the city of Bombay.
  - B. description of important buildings and locations in Bombay.
  - C. argument for Bombay's prominence in the world of architecture.
  - D. concerns about the emotional environment in which the narrator was raised.
2. The narrator describes the photos by Bombay's first great photographers as primarily inspiring the narrator to:
  - F. turn away from a career in photography.
  - G. create grand panoramas of the new Bombay.
  - H. produce images that his father would add to his collection.
  - J. photograph subjects that depict everyday life on Bombay's streets.
3. In lines 25–31, the narrator muses over, then rejects, the notion that:
  - A. Merchant & Merchant played an important role in the building of Bombay.
  - B. he started paying attention to Bombay at a young age.
  - C. his anticipated birth was one of the causes of the rush to finish the building of Bombay.
  - D. Bombay had been a gigantic building site in the years before he was born.
4. In lines 32–43, the narrator uses which of the following literary devices to describe Bombay?
  - F. Alliteration
  - G. Allusion
  - H. Personification
  - J. Simile
5. Which of the following statements best captures how the narrator's parents balanced their parental duties with their work at the construction company?
  - A. The narrator's mother did the majority of the work at the construction company, while the narrator's father took care of the narrator.
  - B. The narrator's parents traded off responsibility for taking care of the narrator and working at the construction company.
  - C. The narrator's father worked at his designing board, while the narrator's mother took the narrator along to building sites.
  - D. The narrator's parents both worked at the construction company, while the narrator stayed home with a babysitter.
6. As it is used in line 9, the word *sweep* most nearly means:
  - F. overwhelming victory.
  - G. wide-ranging search.
  - H. complete removal.
  - J. broad area.
7. In the context of the passage, the primary function of lines 6–10 is to:
  - A. compare architectural landmarks in Bombay to those elsewhere.
  - B. help illustrate how the term “art deco” was derived.
  - C. contradict the idea that Bombay was in its golden age when the narrator was a child.
  - D. provide examples of “Bombay style” architecture in Rome.
8. The narrator as a child viewed the work his parents did for Merchant & Merchant with a strong sense of:
  - F. joy; the work provided the family with enough money to live extravagant lives.
  - G. fear; the narrator knew his parents were often so exhausted they were careless about safety.
  - H. jealousy; the work pulled the narrator's parents away from him and directed their attention to the city.
  - J. respect; his parents were known for their quality workmanship throughout the city.
9. As it is used in line 38, the phrase *drew up* most nearly means:
  - A. extended.
  - B. prepared.
  - C. approached.
  - D. straightened.
10. In the last paragraph, the narrator's father shows the narrator the photos of storefronts and piers in order to:
  - F. teach the narrator about the commercial progress the people who work in Bombay have made.
  - G. convince the narrator that Dayal and Haseler were Bombay's first great photographers.
  - H. clarify his claim that his photo collection was not about modern-day Bombay but rather about the early twentieth century.
  - J. illustrate that photos of places can reveal as much about the people who spent time there as photos of the people themselves.

## Passage II

**SOCIAL SCIENCE:** This passage is adapted from *Great Waters: An Atlantic Passage* by Deborah Cramer (©2001 by Deborah Cramer).

The Sargasso Sea is a part of the northern Atlantic Ocean.

As the *Cramer* idles through the Sargasso Sea, waiting for the wind to rise, the sea is flat and empty. Nothing demarcates or divides the smooth expanse of water dissolving into the horizon. This vast, unrough-  
5 ened surface, this breadth of uniform sea, deceives. But for a few lonely oceanic islands, the unperturbed surface offers no hint of the grand and sweeping energies hidden below.

Only one thousand miles offshore, the *Cramer* has  
10 already sailed through some of Atlantic’s deepest waters. Contrary to what one might guess, Atlantic’s deepest waters, like those in other oceans, are along her edges. As we continue east, toward the middle of the sea, the bottom rises. The unmarked plains of the abyss,  
15 here flattened by layers of sediment, give way to rising foothills and then to mountains. The first maps of Atlantic seafloor noted, albeit crudely, this rise. Early efforts to plumb Atlantic’s depths proved outrageously inaccurate: one naval officer paid out eight miles (thir-  
20 teen kilometers) of hemp rope from a drifting ship and concluded the sea had no bottom. Eventually, sailors more or less successfully calculated depth by heaving overboard cannonballs tied to bailing twine. When they hit bottom, the sailors measured and snipped the twine  
25 and then moved on, leaving a trail of lead strung out across the seafloor. These crude soundings, forming the basis of the first map of Atlantic’s basin, published in 1854, identified a prominent rise halfway between Europe and America.

For many years no one could explain why the  
30 basin of Atlantic, unlike a bowl, deepened at its edges and shoaled in its center. People assumed that this “Middle Ground,” “Telegraph Plateau,” or “Dolphin Rise,” as it was variously called, was an ancient and  
35 drowned land bridge, or a lost continent, but sailors repairing transatlantic telegraph cable unknowingly produced evidence to prove otherwise. Wrestling with the broken cable, they accidentally twisted off a piece of the “plateau” and dredged up a twenty-one-pound  
40 (ten-kilogram) chunk of dense black volcanic rock. It was some of the youngest, freshest rock on earth, and it was torn not from a piece of continent sunk beneath the waves, but from the very foundation of the sea.

Today, highly sophisticated sound waves bring the  
45 hazy images of those early soundings into sharp focus, revealing that one of the largest and most salient geographic features on the planet lies on the floor of the ocean. Hidden beneath the waves is an immense sub-merged mountain range, the backbone of the sea. More  
50 extensive, rugged, and imposing than the Andes, Rockies, or Himalayas, it covers almost as much of earth’s surface as the dry land of continents. Winding like the seam of a baseball, it circles the planet in a long, sinu-

ous path, running the entire length of Atlantic, slashing  
55 the basin neatly in two. Its mountains are stark and black, as black as the sea itself, lit only at their peaks by a thin, patchy covering of white, the skeletal remains of tiny microscopic animals that once lived at the surface. Peaks as high as Mount St. Helens sit in a watery  
60 world of blackness, more than a mile below the surface, beyond the reach of light, beyond the sight of sailors.

A great valley, eclipsing any comparable feature on dry land, runs through these mountains. Arizona’s Grand Canyon, one of earth’s most spectacular places,  
65 extends for about 280 miles (450 kilometers). A lesser-known canyon of similar depth but considerably greater length lies hidden in the mountains of the ridge. Although offset in many places by breaks in the moun-  
70 tains, the rift valley, as the canyon is called, extends the length of Atlantic for 11,000 miles (17,700 kilometers). Here in this bleak and forbidding place, where the water is almost freezing, subterranean fires have lifted mounds of fresh lava onto the seafloor. Scientists visit-  
75 ing the rift valley for the first time named the volcanic hills in this otherworldly setting after distant, lifeless planets.

Yet, what had seemed so foreign to scientists is an integral part of earth’s very being, for at the ridge our own planet gives birth. The floor of the rift valley is  
80 torn; from the gashes has sprung the seafloor underlying all of Atlantic. Here the youngest, newest pieces are made. Earth is still cooling from her tumultuous birth four and a half billion years ago. Heat, leaking from the molten core and from radioactive decay deep inside the  
85 planet, rises toward earth’s surface, powering the volcanoes that deliver the ridge to the sea.

11. The author’s attitude toward the main subject of the passage can best be described as:
- A. awe and fascination.
  - B. disbelief and cynicism.
  - C. amusement and nostalgia.
  - D. boredom and indifference.
12. The passage makes clear that “Middle Ground,” “Telegraph Plateau,” and “Dolphin Rise” were names that people gave to what was actually:
- F. an island in Atlantic.
  - G. a transatlantic telegraph cable.
  - H. an ancient and drowned land bridge.
  - J. the immense mountain range in Atlantic’s basin.

13. In the first paragraph, the author describes the stillness of the Sargasso Sea as the *Cramer* passes through it primarily to emphasize that the stillness:
- A. won't last long, for the sea will become rough when the wind rises.
  - B. makes it easy for a passenger on the *Cramer* to spot oceanic islands that break the water's surface.
  - C. is in dramatic contrast to the power of what exists on and under the seafloor far below.
  - D. makes it seem as if the *Cramer's* wake is dividing the unbroken expanse of water into two.
14. The passage states that compared to Arizona's Grand Canyon, the canyon that lies within the mountains in Atlantic's basin is considerably:
- F. deeper.
  - G. older.
  - H. wider.
  - J. longer.
15. The main purpose of the information in lines 71–76 is to:
- A. describe in detail scientists' expectations for their first trip to the rift valley.
  - B. characterize the rift valley as an alien, seemingly barren place.
  - C. provide statistics about several geographic properties of the rift valley.
  - D. list the names that scientists gave to the volcanic hills in the rift valley.
16. One of the main purposes of the last paragraph is to state that the:
- F. gashes in the rift valley continue to increase in width.
  - G. seafloor of Atlantic has cooled.
  - H. entire Atlantic seafloor has issued from the gashes in the rift valley.
  - J. volcanoes on Earth's dry land have created the newest, youngest pieces of Atlantic seafloor.
17. The author most strongly implies that people commonly assume the deepest waters of an ocean are:
- A. about one thousand miles offshore.
  - B. at the middle of the ocean.
  - C. dotted with islands.
  - D. located in trenches.
18. As it is used in line 19, the phrase *paid out* most nearly means:
- F. dispensed.
  - G. ascertained.
  - H. suggested.
  - J. compensated.
19. According to the passage, the mountain range in Atlantic's basin covers nearly the same amount of Earth's surface as does:
- A. Mount St. Helens.
  - B. the Himalayas.
  - C. the Pacific Ocean.
  - D. the dry land of continents.
20. According to the passage, the white cover on the peaks of the mountains in Atlantic's basin is:
- F. skeletal remains of microscopic animals.
  - G. thin layers of sedimentary volcanic ash.
  - H. patches of ice.
  - J. salt deposits.

### Passage III

**HUMANITIES:** Passage A is adapted from the essay “Just This Side of Byzantium” by Ray Bradbury (©1975 by Ray Bradbury), which is the introduction to a later edition of Bradbury’s 1957 novel *Dandelion Wine*. Passage B is adapted from *Dandelion Wine* (©1957 by Ray Bradbury).

#### Passage A by Ray Bradbury

I began to learn the nature of surprises, thankfully, when I was fairly young as a writer. Before that, like every beginner, I thought you could beat, pummel, and thrash an idea into existence. Under such treatment, of course, any decent idea folds up its paws, turns on its back, fixes its eyes on eternity, and dies.

It was with great relief, then, that in my early twenties I floundered into a word-association process in which I simply got out of bed each morning, walked to my desk, and put down any word or series of words that happened along in my head.

I would then take arms against the word, or for it, and bring on an assortment of characters to weigh the word and show me its meaning in my own life. An hour or two hours later, to my amazement, a new story would be finished and done. The surprise was total and lovely. I soon found that I would have to work this way for the rest of my life.

First I rummaged my mind for words that could describe my personal nightmares, fears of night and time from my childhood, and shaped stories from these.

Then I took a long look at the green apple trees and the old house I was born in and the house next door where lived my grandparents, and all the lawns of the summers I grew up in, and I began to try words for all that.

I had to send myself back, with words as catalysts, to open the memories out and see what they had to offer.

So from the age of twenty-four to thirty-six hardly a day passed when I didn’t stroll myself across a recollection of my grandparents’ northern Illinois grass, hoping to come across some old half-burnt firecracker, a rusted toy, or a fragment of letter written to myself in some young year hoping to contact the older person I became to remind him of his past, his life, his people, his joys, and his drenching sorrows.

Along the way I came upon and collided, through word-association, with old and true friendships. I borrowed my friend John Huff from my childhood in Arizona and shipped him East to Green Town so that I could say good-bye to him properly.

Along the way, I sat me down to breakfasts, lunches, and dinners with the long dead and much loved.

Thus I fell into surprise. I came on the old and best ways of writing through ignorance and experiment and

was startled when truths leaped out of bushes like quail before gunshot. I blundered into creativity as any child learning to walk and see. I learned to let my senses and my Past tell me all that was somehow true.

#### Passage B by Ray Bradbury

The facts about John Huff, aged twelve, are simple and soon stated. He could pathfind more trails than anyone since time began, could leap from the sky like a chimpanzee from a vine, could live underwater two minutes and slide fifty yards downstream from where you last saw him. The baseballs you pitched him he hit in the apple trees, knocking down harvests. He ran laughing. He sat easy. He was not a bully. He was kind. He knew the names of all the wild flowers and when the moon would rise and set. He was, in fact, the only god living in the whole of Green Town, Illinois, during the twentieth century that Douglas Spaulding knew of.

And right now he and Douglas were hiking out beyond town on another warm and marble-round day, the sky blue blown-glass reaching high, the creeks bright with mirror waters fanning over white stones. It was a day as perfect as the flame of a candle.

Douglas walked through it thinking it would go on this way forever. The sound of a good friend whistling like an oriole, pegging the softball, as you horse-danced, key-jingled the dusty paths; things were at hand and would remain.

It was such a fine day and then suddenly a cloud crossed the sky, covered the sun, and did not move again.

John Huff had been speaking quietly for several minutes. Now Douglas stopped on the path and looked over at him.

“John, say that again.”

“You heard me the first time, Doug.”

“Did you say you were—going away?”

John took a yellow and green train ticket solemnly from his pocket and they both looked at it.

“Tonight!” said Douglas. “My gosh! Tonight we were going to play Red Light, Green Light and Statues! How come, all of a sudden? You been here in Green Town all my life. You just don’t pick up and leave!”

“It’s my father,” said John. “He’s got a job in Milwaukee. We weren’t sure until today . . .”

They sat under an old oak tree on the side of the hill looking back at town. Out beyond, in sunlight, the town was painted with heat, the windows all gaping. Douglas wanted to run back in there where the town, by its very weight, its houses, their bulk, might enclose and prevent John’s ever getting up and running off.

Questions 21–25 ask about Passage A.

21. When Bradbury claims, “Thus I fell into surprise” (line 46), he’s most nearly referring to the:
- A. discovery that for him the secret to a creative outpouring was to use a word-association method to write fiction.
  - B. long-forgotten experiences he would remember when he would talk with his childhood friends in person.
  - C. realization that he wrote more effectively about his current experiences than about his past.
  - D. several methods other writers taught him to help him write honest, authentic stories.
22. Passage A indicates that Bradbury believes all beginning writers think that they can:
- F. learn the nature of surprises.
  - G. force an idea into creation.
  - H. use one word as a catalyst for a story.
  - J. become a good writer through experiment.
23. Bradbury’s claim “I would then take arms against the word, or for it” (line 12) most strongly suggests that during his writing sessions, Bradbury would:
- A. attempt to find the one word that for him was the key to understanding John Huff.
  - B. often reject a word as not being a catalyst for meaningful writing.
  - C. deliberately choose to write only about a word that inspired his fears.
  - D. feel as though he were struggling to find a word’s significance to him.
24. In the seventh paragraph of Passage A (lines 30–37), Bradbury explains his habit, over many years as a writer, of almost daily:
- F. looking at and writing about objects from his childhood that he had saved.
  - G. wishing he had kept more letters from his childhood to trigger his memories.
  - H. driving past his grandparents’ property, hoping to notice something that would remind him of his past.
  - J. thinking about his grandparents’ property, hoping to remember something that would bring his past into focus.
25. Passage A explains that when writing about the character John Huff, Bradbury had:
- A. placed John in a town in Arizona, where Bradbury himself had grown up.
  - B. included John in stories about a town in Arizona and in stories about Green Town.
  - C. “moved” John to a town other than the town in which the real-life John Huff had grown up.
  - D. “borrowed” John to use as a minor character in many of his stories.

Questions 26 and 27 ask about Passage B.

26. In the first paragraph of Passage B (lines 52–63), the narrator describes John Huff in a manner that:
- F. emphasizes John’s physical strength and intelligence, to indicate John’s view of himself.
  - G. exaggerates John’s characteristics and actions, to reflect Douglas’s idolization of John.
  - H. highlights John’s reckless behavior, to show that Douglas was most fond of John’s rebelliousness.
  - J. showcases John’s talents, to make clear why both children and adults admired John.
27. Within Passage B, the image in lines 74–76 functions figuratively to suggest that:
- A. John’s leaving on a stormy night was fitting, given Douglas’s sadness.
  - B. John’s disappointment about moving was reflected in his mood all day.
  - C. the mood of the day changed dramatically and irreversibly once John shared his news.
  - D. the sky in Green Town became cloudy at the moment John told Douglas he was moving.

Questions 28–30 ask about both passages.

28. Both Passage A and Passage B highlight Bradbury’s use of:
- F. a first person omniscient narrator to tell a story.
  - G. satire and irony to develop characters.
  - H. allegory to present a complex philosophical question.
  - J. sensory details and imaginative description to convey ideas.
29. Based on Bradbury’s description in Passage A of his writing process, which of the following methods hypothetically depicts a way Bradbury might have begun to write the story in Passage B?
- A. Taking notes while interviewing old friends after first deciding to write a story about two boys
  - B. Forming two characters, determining that he would like to tell a story about loss, and then beginning to write a scene
  - C. Writing down the words *train ticket* and then spending an hour writing whatever those words brought to his mind
  - D. Outlining the plot of a story about two boys that would end with one boy leaving on a train



30. Elsewhere in the essay from which Passage A is adapted, Bradbury writes:

Was there a real boy named John Huff?

There was. And that was truly his name. But he didn't go away from me, I went away from him.

How do these statements apply to both the information about Bradbury's approach as a storyteller provided in Passage A and the story of John Huff provided in Passage B?

- F. They reveal that Bradbury believed that to surprise readers is a fiction writer's most important task.
- G. They reinforce that Bradbury used his life experiences to create fiction but also altered those experiences as he pleased.
- H. They prove that Bradbury felt such pain over leaving John that he had to reverse events to be able to write the story.
- J. They indicate that Bradbury rarely used his life experiences to create fiction.

#### Passage IV

**NATURAL SCIENCE:** This passage is adapted from the article "The Jaws That Jump" by Adam Summers (©2006 by Natural History Magazine, Inc.).

Recently I was reminded of just how powerful ants can be when inflicting damage on intruders. A team of biomechanists has studied the incredibly speedy bite of a group of Central and South American ants. The team  
5 clocked the bite as the fastest on the planet—and discovered that it also gives the ants the unique ability to jump with their jaws, adding to an impressive array of already known defenses.

Trap-jaw ants nest in leaf litter, rather than under-  
10 ground or in mounds. There they often feed on well-armored and elusive prey, including other species of ants. As they stalk their dinner, the trap-jaws hold their mandibles wide apart, often cocked open at 180 degrees or more by a latch mechanism. When minute trigger  
15 hairs on the inner edge of the mandible come in contact with something, the jaws snap shut at speeds now known to reach 145 miles per hour. No passerby could outpace that. The astoundingly high speed gives the jaws, despite their light weight, enough force to crack  
20 open the armor of most prey and get at the tasty meat inside.

The key to the jaws' speed (and their even more amazing acceleration) is that the release comes from stored energy produced by the strong but slow muscles  
25 of the jaw. Think how an archer slowly draws an arrow in a bowstring against the flex of a bow: nearly all the energy from the archer's muscles pours into the flexing of the bow. When released, the energy stored in the bow wings the arrow toward its target much faster than the  
30 archer could by throwing the arrow like a javelin. The biomechanics of energy storage is the domain of Sheila

N. Patek and Joseph E. Baio, both biomechanists at the University of California, Berkeley. They teamed up with two ant experts, Brian L. Fisher of the California  
35 Academy of Sciences in San Francisco and Andrew V. Suarez of the University of Illinois at Urbana-Champaign, to look at the trap-jaw ant *Odontomachus bauri*.

Fisher, Suarez, and other field biologists had  
40 already noted that catching *O. bauri* was like grabbing for popping popcorn—and very hot popcorn at that, because a painful sting goes with an ant's trap-jaw bite. The insects bounced around in a dizzying frenzy and propelled themselves many times their body length  
45 when biologists or smaller intruders approached them. Patek and Baio made high-speed video images of their movements, and discovered that the secret of their self-propulsion was the well-executed "firing" of their mandibles. They also observed that mandibles started to  
50 decelerate before they meet—possibly to avoid self-inflicted damage. Most important, the ants had two distinct modes of aerial locomotion.

In the so-called escape jump, an ant orients its head and jaws perpendicular to the ground, then slams  
55 its face straight down. That triggers the cocked mandibles to release with a force 400 times the ant's body weight, launching the insect ten or more body lengths nearly straight into the air. The ant doesn't seem to go in any particular direction, but the jump is  
60 presumably fast and unpredictable enough to help the insect evade, say, the probing tongue of a lizard. Not only can the jumping ant gain height and sow confusion, but it may also get to a new vantage point from which to relaunch an attack.

The second kind of jaw-propelled locomotion is even more common than escape jumping. If an intruder enters the ants' nest, one of the ants bangs its jaws against the intruder, which triggers the trap-jaw and propels the interloper (if small enough) in one direc-  
70 tion, out of the nest, and the ant in the other. Often the force sends the ant skimming an inch off the ground for nearly a foot. The attack, for obvious reasons, is known as the "bouncer defense." In the wild, gangs of defending ants team up to attack hostile strangers, sending  
75 them head over heels out of the nest.

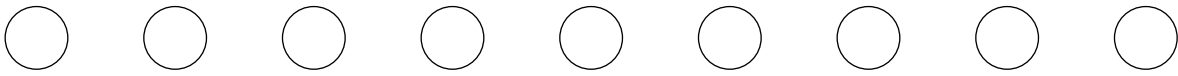
From an evolutionary point of view, the trap-jaws are an intriguing story. The ants clearly evolved an entirely new function, propulsion, for a system that was already useful—chewing up prey. Several lineages of  
80 trap-jaw ants have independently hit on the tactic of storing energy in their jaws to penetrate well-defended prey. In *Odontomachus*, the horizontal, bouncer-defense jump could have arisen out of attempts to bite intruders, but the high, escape jump—with jaws aimed  
85 directly at the ground—must have arisen from a different, perhaps accidental kind of behavior. Such a serendipitous event would have been a rare instance in which banging one's head against the ground got good results.

31. The primary purpose of the passage is to:
- provide an overview of the mechanics and key operations of the jaws of trap-jaw ants.
  - analyze Patek and Baio's techniques for filming two defensive maneuvers of trap-jaw ants.
  - compare the jaws of *Odontomachus bauri* to the jaws of other species of ants.
  - describe the evolution of the ability of trap-jaw ants to perform an escape jump.
32. The sentence in lines 73–75 and the last sentence of the passage are examples of the author's rhetorical technique of:
- weaving sarcasm into a mostly casual and playful article.
  - interjecting a lighthearted tone into a primarily technical article.
  - integrating a slightly combative tone into an article that mostly praises two scientists' work.
  - incorporating personal anecdotes into an article that mostly reports data.
33. As it is used in lines 81–82, the phrase *well-defended prey* most nearly refers to prey that:
- have a hard outer shell.
  - attack with a lethal bite.
  - travel and attack in groups.
  - move quickly.
34. The passage makes clear that the main source of the speed of the jaws of the trap-jaw ant is the:
- ease of movement of the hinge of the jaw.
  - continuous, steady firing of the jaw's mandibles.
  - light weight of the jaw in relation to the ant's body weight.
  - release of energy stored by muscles of the jaw.
35. The author uses the analogy of trying to grab popcorn as it pops in order to describe the trap-jaw ants' ability to:
- generate heat with their jaw movements.
  - move to high ground in order to attack prey.
  - attack intruders by tossing them out of the nest.
  - bounce around frantically when intruders approach.
36. One main purpose of the last paragraph is to suggest that unlike their bouncer-defense jump, the trap-jaw ants' escape jump may have arisen through:
- the ants' trying and failing to bite intruders.
  - a change in the structure of the mandibles of several lineages of ants.
  - an accidental behavior of the ants.
  - the ants' experiencing a positive outcome when they would attack in a large group.
37. As it is used in line 31, the word *domain* most nearly means:
- living space.
  - area of expertise.
  - taxonomic category.
  - local jurisdiction.
38. The passage points to which of the following as a characteristic of trap-jaw ants' mandibles that prevents the ants from harming themselves with their powerful bite?
- A hinge prevents the mandibles from snapping together forcefully.
  - Mandibles with cushioned inner edges provide a buffer when the mandibles snap shut.
  - A latch mechanism prevents the mandibles from closing completely.
  - The mandibles begin to decelerate before they meet.
39. As described in the passage, one benefit of the trap-jaw ant's escape jump is that it allows an ant to:
- land in position to launch a new attack on a predator.
  - confuse a predator with a quick, sudden sting.
  - signal to other ants using a predictable movement.
  - point itself in whichever direction it chooses to escape.
40. When a trap-jaw ant uses the bouncer-defense jump effectively on an intruder, which creature(s), if any, will be propelled either out of the nest or in another direction?
- The intruder only
  - The attacking ant only
  - The attacking ant and the intruder
  - Neither the attacking ant nor the intruder

**END OF TEST 3**

**STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.**

**DO NOT RETURN TO A PREVIOUS TEST.**



**SCIENCE TEST**

35 Minutes—40 Questions

**DIRECTIONS:** There are several passages in this test. Each passage is followed by several questions. After reading a passage, choose the best answer to each question and fill in the corresponding oval on your answer document. You may refer to the passages as often as necessary.

You are NOT permitted to use a calculator on this test.

**Passage I**

Researchers studied how diet and the ability to smell food can affect the life span of normal fruit flies (Strain N) and fruit flies unable to detect many odors (Strain X).

*Study 1*

Three tubes (Tubes 1–3), each with 15% sugar yeast (SY) medium (a diet with 15% sugar and 15% killed yeast), were prepared. Then, 200 virgin female Strain N fruit flies less than 24 hr old were added to each tube. No additional substance was added to Tube 1. Additional odors from live yeast were added to Tube 2, and live yeast was added to Tube 3. The percent of fruit flies alive was determined every 5 days for 75 days (see Figure 1).

*Study 2*

Three tubes (Tubes 4–6), each with 5% SY medium (a diet with 5% sugar and 5% killed yeast), were prepared. Then, 200 virgin female Strain N fruit flies less than 24 hr old were added to each tube. No additional substance was added to Tube 4. Additional odors from live yeast were added to Tube 5, and live yeast was added to Tube 6. The percent of fruit flies alive was determined every 5 days for 75 days (see Figure 2).

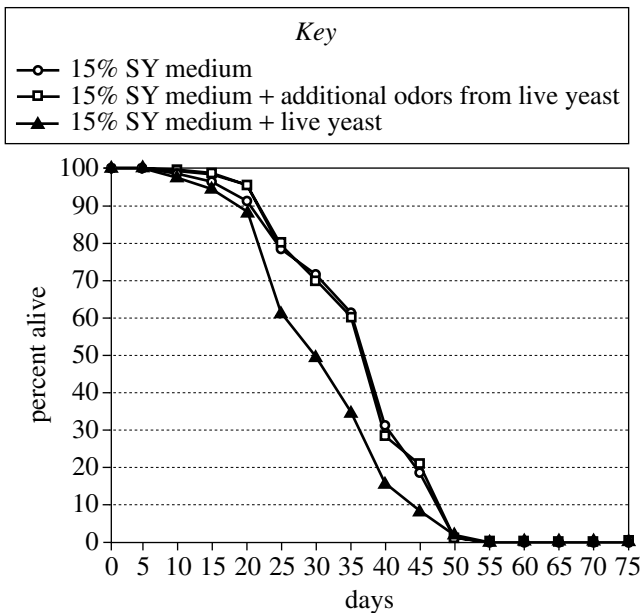


Figure 1

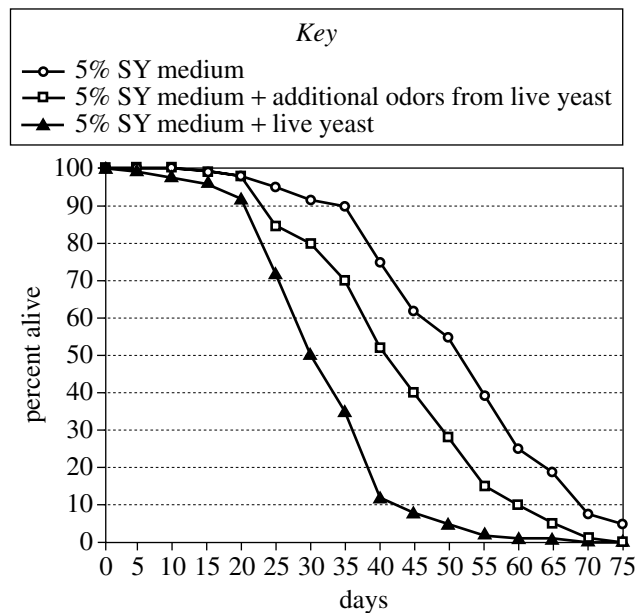


Figure 2



**Study 3**

Strain N fruit flies were modified to produce Strain X fruit flies. Strain X fruit flies lack *Or83b* (a protein required to detect a wide range of odors); therefore, they cannot detect many odors. The average life span was determined for virgin female Strain N and virgin female Strain X fruit flies fed with various SY media (see Table 1).

Strain	SY medium		Average life span (days)
	% sugar	% killed yeast	
Strain N	3	3	50.1
	5	5	50.1
	7.5	7.5	43.9
	10	10	44.8
	15	15	41.6
Strain X	3	3	61.6
	5	5	62.5
	7.5	7.5	58.9
	10	10	58.6
	15	15	55.6

Table and figures adapted from Sergiy Libert et al., "Regulation of *Drosophila* Life Span by Olfaction and Food-Derived Odors." ©2007 by the American Association for the Advancement of Science.

- In which of Studies 1 and 2 did some of the fruit flies live for more than 75 days, and what diet were those fruit flies fed?
  - Study 1; 5% SY medium
  - Study 1; 15% SY medium
  - Study 2; 5% SY medium
  - Study 2; 15% SY medium
- During Studies 1 and 2, why did the size of the fruit fly population in each tube decrease rather than increase?
  - The birthrate was 0, because the initial population contained only males.
  - The birthrate was 0, because the initial population contained only virgin females.
  - The death rate was 0, because the initial population contained only males.
  - The death rate was 0, because the initial population contained only virgin females.
- Study 1 differed from Study 2 in which of the following ways?
  - Female fruit flies were tested in Study 1, whereas male fruit flies were tested in Study 2.
  - Male fruit flies were tested in Study 1, whereas female fruit flies were tested in Study 2.
  - The SY medium tested in Study 1 contained a lower percent of sugar than did the SY medium tested in Study 2.
  - The SY medium tested in Study 1 contained a higher percent of sugar than did the SY medium tested in Study 2.
- Suppose that an additional trial in Study 3 had been performed using a 12% SY medium (a diet with 12% sugar and 12% killed yeast). The average life span of the Strain X fruit flies in this trial would most likely have been:
  - less than 55.6 days.
  - between 55.6 days and 58.6 days.
  - between 58.6 days and 61.6 days.
  - greater than 61.6 days.
- The researchers had predicted that decreasing a fruit fly's ability to detect odors would increase its life span. Are the results of Study 3 consistent with this prediction?
  - No; for each SY medium tested, the average life span of Strain X fruit flies was longer than the average life span of Strain N fruit flies.
  - No; for each SY medium tested, the average life span of Strain N fruit flies was longer than the average life span of Strain X fruit flies.
  - Yes; for each SY medium tested, the average life span of Strain X fruit flies was longer than the average life span of Strain N fruit flies.
  - Yes; for each SY medium tested, the average life span of Strain N fruit flies was longer than the average life span of Strain X fruit flies.
- Suppose the researchers wanted to determine whether a defect in the ability to detect odors would change the life span of fruit flies fed 15% SY medium when live yeast is added to the diet or when additional odors from live yeast are added to the diet. Which of the following experiments should be performed?
  - Repeat Study 1 except with Strain X fruit flies
  - Repeat Study 1 except with Strain N fruit flies
  - Repeat Study 2 except with Strain X fruit flies
  - Repeat Study 2 except with Strain N fruit flies
- The results for which 2 tubes should be compared to determine how a reduced calorie diet affects life span in the absence of live yeast and additional odors from live yeast?
  - Tube 1 and Tube 4
  - Tube 1 and Tube 2
  - Tube 2 and Tube 5
  - Tube 5 and Tube 6

**Passage II**

In the fall, monarch butterflies (*Danaus plexippus*) in eastern North America migrate to Mexico, where they overwinter in high-altitude forests of *oyamel fir* (an evergreen conifer). The butterflies store (accumulate) body lipids to use as a source of energy at a later time. Consider the following 3 hypotheses pertaining to when the butterflies store lipids and when the energy from the stored lipids is used, with respect to migration and overwintering.

*Hypothesis 1*

Monarch butterflies require energy from stored lipids for migration and during the overwintering period. The butterflies first store lipids before they begin their migration. During migration, as stored lipids are converted to energy, lipid mass continuously decreases. When the butterflies reach the overwintering sites, ending their migration, they must store lipids again before beginning the overwintering period.

*Hypothesis 2*

Monarch butterflies require energy from stored lipids for migration but not during the overwintering period. The butterflies store lipids before they begin their migration. During migration, as stored lipids are converted to energy, lipid mass continuously decreases. Because energy from stored lipids is not required during the overwintering period, the butterflies do not store lipids while at the overwintering sites.

*Hypothesis 3*

Monarch butterflies require energy from stored lipids during the overwintering period but not for migration. The butterflies do not store lipids before they begin their migration. Instead, lipids are stored during migration; therefore, lipid mass continuously increases from the beginning of migration until the end of migration. The butterflies arrive at the overwintering sites with enough lipids to provide themselves with energy during the overwintering period, so they do not store lipids while at the overwintering sites.

8. Which hypothesis, if any, asserts that monarch butterflies store lipids during 2 distinct periods?

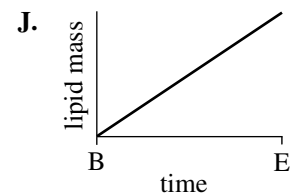
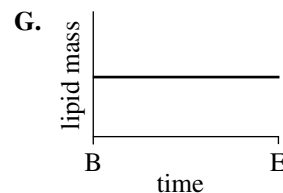
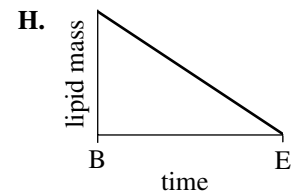
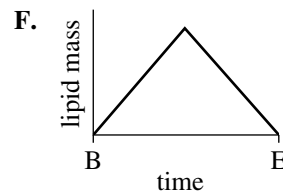
- F. Hypothesis 1
- G. Hypothesis 2
- H. Hypothesis 3
- J. None of the hypotheses

9. Which hypothesis, if any, asserts that monarch butterflies require energy from stored lipids neither for migration nor during the overwintering period?

- A. Hypothesis 1
- B. Hypothesis 2
- C. Hypothesis 3
- D. None of the hypotheses

10. Based on Hypothesis 3, which of the following figures best depicts the change in the lipid mass of a monarch butterfly from the beginning of migration to the end of migration?

(Note: In each figure, B represents the beginning of migration and E represents the end of migration.)



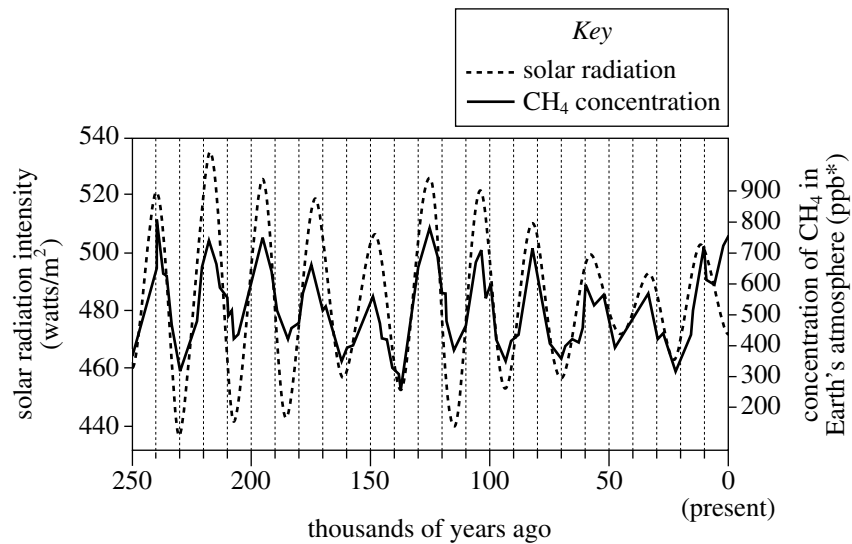


11. Assume that changes in the body mass of a monarch butterfly are caused only by changes in the mass of the butterfly's stored lipids. The statement "The percent of a monarch butterfly's body mass that is made up of lipids is greater at the beginning of migration than at the end of migration" is supported by which of the hypotheses?
- A. Hypothesis 1 only
  - B. Hypothesis 2 only
  - C. Hypotheses 1 and 2 only
  - D. Hypotheses 1, 2, and 3
12. To store lipids, monarch butterflies convert sugar from nectar they have consumed into lipids. A supporter of which hypothesis, if any, would be likely to claim that to ensure the butterflies can store lipids for the overwintering period, nectar must be present at the butterflies' overwintering sites?
- F. Hypothesis 1
  - G. Hypothesis 2
  - H. Hypothesis 3
  - J. None of the hypotheses
13. Which of the following statements about lipids in monarch butterflies is consistent with all 3 hypotheses?
- A. The butterflies' lipid masses do not change during the overwintering period.
  - B. The butterflies' lipid masses change during migration.
  - C. The butterflies use energy from stored lipids during the overwintering period.
  - D. The butterflies use energy from stored lipids for migration.
14. When the monarch butterflies use their stored lipids, the lipids must be broken down to produce energy-rich molecules that can be readily used by cells. Which of the following molecules is produced as a direct result of the breakdown of the lipids?
- F. ATP
  - G. Starch
  - H. DNA
  - J. Amino acids



### Passage III

Greenhouse gases such as methane ( $\text{CH}_4$ ) warm Earth's climate. Figure 1 shows the concentration of  $\text{CH}_4$  in Earth's atmosphere and the solar radiation intensity at Earth's surface for tropical Europe and Asia over the past 250,000 years. As the figure shows, the  $\text{CH}_4$  concentration and the solar radiation intensity have increased and decreased at the same times over most of this period. Figure 2 shows the same types of data for the same region over the past 11,000 years. This figure is consistent with the hypothesis that the greenhouse gases from human activities may have begun warming Earth's climate thousands of years earlier than once thought.



\*ppb = parts per billion

Figure 1

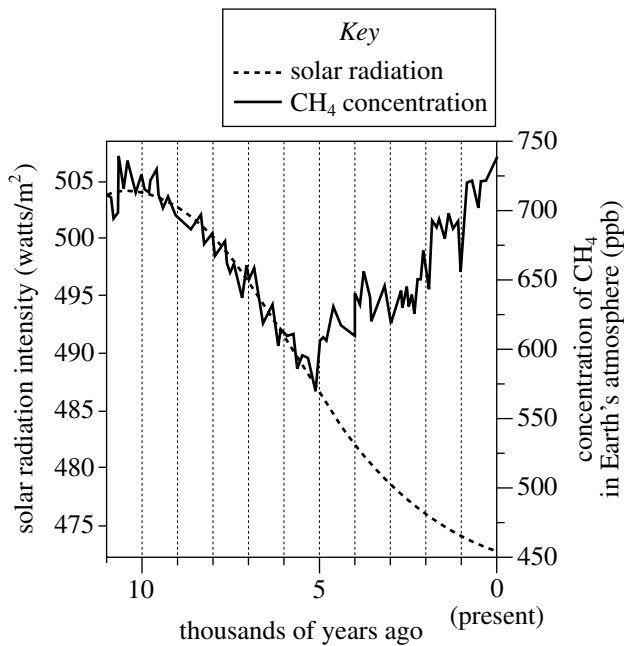


Figure 2

Figures adapted from William Ruddiman, *Plows, Plagues & Petroleum*. ©2005 by Princeton University Press.

15. According to Figure 2, the solar radiation intensity 8,000 years ago was closest to which of the following?
- 490 watts/m<sup>2</sup>
  - 495 watts/m<sup>2</sup>
  - 500 watts/m<sup>2</sup>
  - 505 watts/m<sup>2</sup>
16. According to Figure 2, if the trend in the CH<sub>4</sub> concentration had continued to match the trend in the solar radiation intensity, the CH<sub>4</sub> concentration at present would most likely be:
- less than 550 ppb.
  - between 550 ppb and 600 ppb.
  - between 600 ppb and 650 ppb.
  - greater than 650 ppb.
17. Suppose that whenever the CH<sub>4</sub> concentration increases, a corresponding, immediate increase in average global temperature occurs, and that whenever the CH<sub>4</sub> concentration decreases, a corresponding, immediate decrease in average global temperature occurs. Based on Figure 2, which of the following graphs best represents a plot of average global temperature over the past 11,000 years?
- - 
  - 
  -
18. Based on Figure 1, the average solar radiation intensity over the past 250,000 years was closest to which of the following?
- 400 watts/m<sup>2</sup>
  - 440 watts/m<sup>2</sup>
  - 480 watts/m<sup>2</sup>
  - 520 watts/m<sup>2</sup>
19. One *solar radiation cycle* is the time between a maximum in the solar radiation intensity and the next maximum in the solar radiation intensity. According to Figure 1, the average length of a solar radiation cycle during the past 250,000 years was:
- less than 15,000 years.
  - between 15,000 years and 35,000 years.
  - between 35,000 years and 55,000 years.
  - greater than 55,000 years.
20. Which of the following statements best describes the primary effect of CH<sub>4</sub> on Earth's climate?
- CH<sub>4</sub> gives off visible light to space, cooling Earth's climate.
  - CH<sub>4</sub> gives off ultraviolet radiation to space, warming Earth's climate.
  - CH<sub>4</sub> absorbs heat as it enters Earth's atmosphere from space, cooling Earth's climate.
  - CH<sub>4</sub> absorbs heat that comes up from Earth's surface, warming Earth's climate.

**Passage IV**

In 2 experiments, a student pulled each of 3 blocks in a straight line across a flat, horizontal surface.

In Experiment 1, the student measured the *pulling force* (the force required to move each block at a constant speed) and plotted the pulling force, in newtons (N), versus block mass, in kilograms (kg). The results are shown in Figure 1.

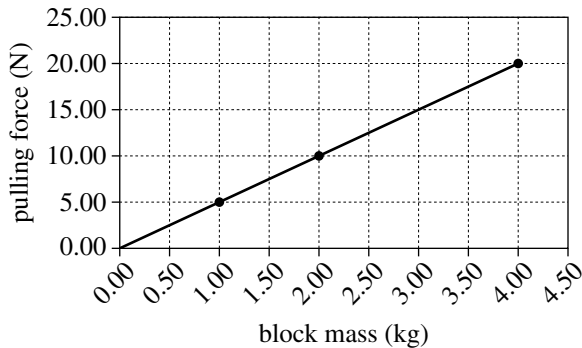


Figure 1

In Experiment 2, the student measured the speed versus time of a 2.00 kg block, a 2.50 kg block, and a 3.00 kg block as each block was pulled across the surface with a constant 30 N force. The results are shown in Figure 2.

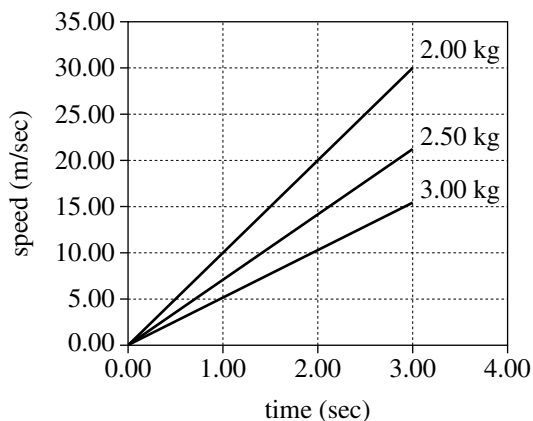


Figure 2

21. If a block was pulled toward the east, the frictional force exerted on the block by the surface was directed toward the:

- A. north.
- B. south.
- C. east.
- D. west.

22. Based on Figure 2, what is the order of the 3 blocks, from the block that required the shortest time to reach 15 m/sec to the block that required the longest time to reach 15 m/sec ?

- F. 2.00 kg block, 2.50 kg block, 3.00 kg block
- G. 2.00 kg block, 3.00 kg block, 2.50 kg block
- H. 3.00 kg block, 2.00 kg block, 2.50 kg block
- J. 3.00 kg block, 2.50 kg block, 2.00 kg block

23. Based on Figure 2, what was the approximate value of the acceleration of the 3.00 kg block?

- A. 0.0 m/sec<sup>2</sup>
- B. 5.0 m/sec<sup>2</sup>
- C. 15.0 m/sec<sup>2</sup>
- D. 20.0 m/sec<sup>2</sup>

24. Based on Figure 1, the results of Experiment 1 are best modeled by which of the following equations?

- F. Block speed (m/sec) = 0.2 × time (sec)
- G. Block speed (m/sec) = 5.0 × time (sec)
- H. Pulling force (N) = 0.2 × block mass (kg)
- J. Pulling force (N) = 5.0 × block mass (kg)

**4****4**

25. At each of the times plotted in Figure 2 (except 0.00 sec), as block mass increased, block speed:

- A. increased only.
- B. decreased only.
- C. varied, but with no general trend.
- D. remained the same.

26. Based on Figure 1, an applied force of 30.00 N would most likely have been required to maintain the constant speed of a block having a mass of:

- F. 4.00 kg.
- G. 5.00 kg.
- H. 6.00 kg.
- J. 7.00 kg.

**Passage V**

A typical *acid-base indicator* is a compound that will be one color over a certain lower pH range but will be a different color over a certain higher pH range. In the small range between these pH ranges—the *transition range*—the indicator's color will be an intermediate of its other 2 colors.

Students studied 5 acid-base indicators using colorless aqueous solutions of different pH and a *well plate* (a plate containing a matrix of round depressions—*wells*—that can hold small volumes of liquid).

*Experiment 1*

The students added a pH = 0 solution to 5 wells in the first column of the well plate, then added a pH = 1 solution to the 5 wells in the next column, and so on, up to pH = 7. Next, they added a drop of a given indicator (in solution) to each of the wells in a row, and then repeated this process, adding a different indicator to each row. The color of the resulting solution in each well was then recorded in Table 1 (B = blue, G = green, O = orange, P = purple, R = red, Y = yellow).

Indicator	Color in solution with a pH of:							
	0 1 2 3 4 5 6 7							
	Metanil yellow	R	R	O	Y	Y	Y	Y
Resorcin blue	R	R	R	R	R	P	P	B
Curcumin	Y	Y	Y	Y	Y	Y	Y	Y
Hessian bordeaux	B	B	B	B	B	B	B	B
Indigo carmine	B	B	B	B	B	B	B	B

*Experiment 2*

Experiment 1 was repeated with solutions that had a pH of 8 or greater (see Table 2).

Indicator	Color in solution with a pH of:						
	8 9 10 11 12 13 14						
	Metanil yellow	Y	Y	Y	Y	Y	Y
Resorcin blue	B	B	B	B	B	B	B
Curcumin	O	R	R	R	R	R	R
Hessian bordeaux	B	R	R	R	R	R	R
Indigo carmine	B	B	B	B	G	Y	Y

*Experiment 3*

Students were given 4 solutions (Solutions I–IV) of unknown pH. The well plate was used to test samples of each solution with 4 of the 5 indicators (see Table 3).

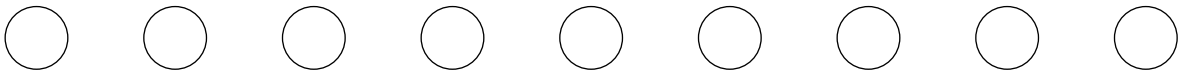
Indicator	Color in Solution:			
	I II III IV			
	Metanil yellow	Y	Y	Y
Resorcin blue	B	B	R	R
Curcumin	R	R	Y	Y
Indigo carmine	B	Y	B	B

Tables adapted from David R. Lide, ed., *CRC Handbook of Chemistry and Physics*, 78th ed. ©1997 by CRC Press LLC.





27. One way Experiment 2 differed from Experiment 3 was that in Experiment 2:
- A. the solutions to which indicators were added were of known pH.
  - B. the solutions to which indicators were added were of unknown pH.
  - C. metanil yellow was used.
  - D. metanil yellow was not used.
28. Based on the description of the well plate and how it was used, the empty well plate would most likely have been which of the following colors?
- F. Black
  - G. Blue
  - H. Red
  - J. White
29. Based on the results of Experiments 1 and 2, which of the following is a possible transition range for curcumin?
- A. pH = 3.9 to pH = 7.3
  - B. pH = 4.2 to pH = 6.6
  - C. pH = 7.4 to pH = 8.6
  - D. pH = 8.4 to pH = 9.5
30. A chemist has 2 solutions, one of pH = 1 and one of pH = 6. Based on the results of Experiments 1 and 2, could indigo carmine be used to distinguish between these solutions?
- F. No; indigo carmine is blue at both pH = 1 and pH = 6.
  - G. No; indigo carmine is blue at pH = 1 and is yellow at pH = 6.
  - H. Yes; indigo carmine is blue at both pH = 1 and pH = 6.
  - J. Yes; indigo carmine is blue at pH = 1 and is yellow at pH = 6.
31. The indicator *propyl red* has a transition range of pH = 4.6 to pH = 6.8. If propyl red had been included in Experiments 1 and 2, it would have produced results most similar to those produced by which of the 5 indicators?
- A. Metanil yellow
  - B. Resorcin blue
  - C. Curcumin
  - D. Indigo carmine
32. A student claimed that Solution III has a pH of 7.3. Are the results of Experiments 1–3 consistent with this claim?
- F. No, because in Solution III metanil yellow was yellow.
  - G. No, because in Solution III resorcin blue was red.
  - H. Yes, because in Solution III metanil yellow was yellow.
  - J. Yes, because in Solution III resorcin blue was red.
33. Based on the results of Experiments 1–3, which of Solutions I–IV has the *lowest* pH ?
- A. Solution I
  - B. Solution II
  - C. Solution III
  - D. Solution IV



**Passage VI**

*Drilling mud* (DM) is a suspension of clay particles in water. When a well is drilled, DM is injected into the hole to lubricate the drill. After this use, the DM is brought back up to the surface and then disposed of by spraying it on adjacent land areas.

A cover of DM on plants and soil can affect the *albedo* (proportion of the total incoming solar radiation that is reflected from a surface), which in turn can affect the soil temperature. The effect of a cover of DM on the albedo and the soil temperature of an unsloped, semiarid grassland area was studied from July 1 to August 9 of a particular year.

On June 30, 3 plots (Plots 1–3), each 10 m by 40 m, were established in the grassland area. For all the plots, the types of vegetation present were the same, as was the density of the vegetation cover. At the center of each plot, a soil temperature sensor was buried in the soil at a depth of 2.5 cm. An instrument that measures incoming and reflected solar radiation was suspended 60 cm above the center of each plot.

An amount of DM equivalent to 40 cubic meters per hectare (m<sup>3</sup>/ha) was then sprayed evenly on Plot 2. (One hectare equals 10,000 m<sup>2</sup>.) An amount equivalent to 80 m<sup>3</sup>/ha was sprayed evenly on Plot 3. No DM was sprayed on Plot 1.

For each plot, the albedo was calculated for each cloudless day during the study period using measurements of incoming and reflected solar radiation taken at noon on those days (see Figure 1).

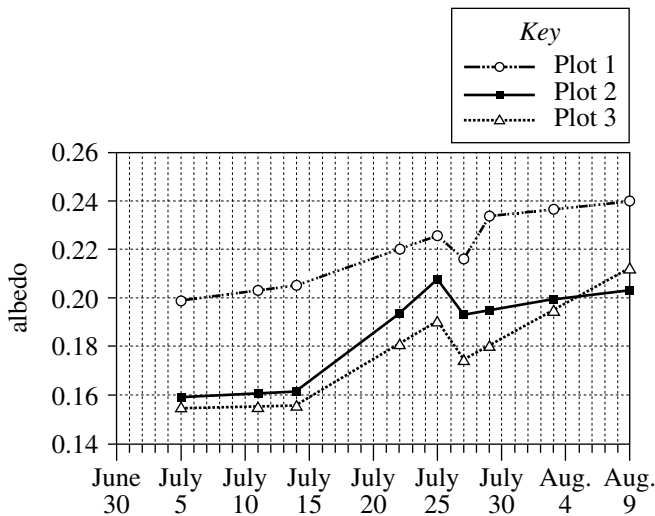


Figure 1

For each plot, the sensor recorded the soil temperature every 5 sec over the study period. From these data, the average soil temperature of each plot was determined for each day (see Figure 2).

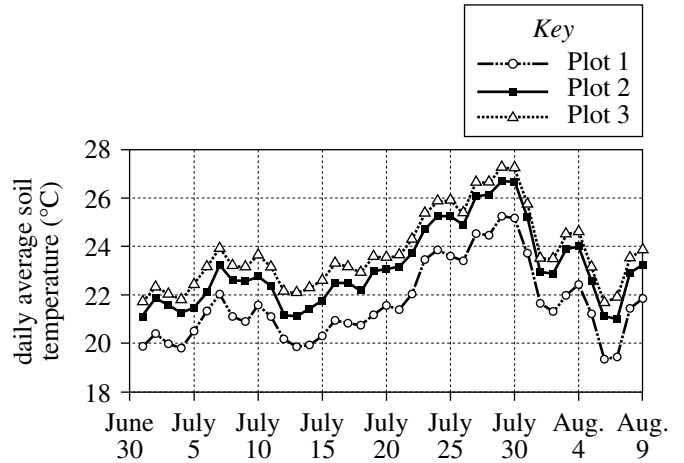


Figure 2

Figures adapted from Francis Zvomuya et al., “Surface Albedo and Soil Heat Flux Changes Following Drilling Mud Application to a Semiarid, Mixed-Grass Prairie.” ©2008 by the Soil Science Society of America.

34. Albedo was measured at noon because that time of day is when solar radiation reaching the ground is:
- F. 100% reflected.
  - G. 100% absorbed.
  - H. least intense.
  - J. most intense.
35. Why was the study designed so that the 3 plots had the same types of vegetation present and the same density of vegetation cover? These conditions ensured that any variations in albedo and soil temperature would most likely be attributable only to variations among the plots in the:
- A. amount of DM sprayed.
  - B. type of soil present.
  - C. plot area.
  - D. plot slope.



36. On one day of the study period, a measurable rainfall occurred in the study area. The albedo calculated for the cloudless day just after the rainy day was lower than the albedo calculated for the cloudless day just before the rainy day. On which day did a measurable rainfall most likely occur in the study area?
- F. July 10  
G. July 12  
H. July 26  
J. July 28
37. For each plot, the number of temperature readings recorded by the soil temperature sensor every minute was closest to which of the following?
- A. 5  
B. 12  
C. 50  
D. 60
38. According to Figure 1 and the description of the study, was July 20 a cloudless day?
- F. No, because albedo data were not collected on that day.  
G. No, because albedo data were collected on that day.  
H. Yes, because albedo data were not collected on that day.  
J. Yes, because albedo data were collected on that day.
39. According to the results of the study, did the presence of a cover of DM increase or decrease the albedo, and did the presence of a cover of DM increase or decrease the soil temperature?
- |    | <u>albedo</u> | <u>soil temperature</u> |
|----|---------------|-------------------------|
| A. | increase      | increase                |
| B. | increase      | decrease                |
| C. | decrease      | decrease                |
| D. | decrease      | increase                |
40. Based on Figure 1, on August 3, what percent of incoming solar radiation was NOT reflected from Plot 2 ?
- F. 20%  
G. 40%  
H. 60%  
J. 80%

**END OF TEST 4**

**STOP! DO NOT RETURN TO ANY OTHER TEST.**

**[See Note on page 52.]**

**If you plan to take the ACT with writing, sharpen your pencils and continue with the writing test on page 53.**

**If you do not plan to take the ACT with writing, skip to page 56 for instructions on scoring your multiple-choice tests.**

## Practice Writing Test

Your Signature: \_\_\_\_\_  
(Do not print.)

Print Your Name Here: \_\_\_\_\_

Your Date of Birth:									
<input type="text"/>	<input type="text"/>	-	<input type="text"/>	<input type="text"/>	-	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Month			Day			Year			

# Form 15AA51

The **ACT**<sup>®</sup>

# WRITING TEST BOOKLET

**You must take the multiple-choice tests before you take the writing test.**

## Directions

This is a test of your writing skills. You will have **forty** (40) minutes to read the prompt, plan your response, and write an essay in English. Before you begin working, read all material in this test booklet carefully to understand exactly what you are being asked to do.

You will write your essay on the lined pages in the **answer document** provided. Your writing on those pages will be scored. You may use the unlined pages in this test booklet to plan your essay. Your work on these pages will not be scored.

Your essay will be evaluated based on the evidence it provides of your ability to:

- analyze and evaluate multiple perspectives on a complex issue
- state and develop your own perspective on the issue
- explain and support your ideas with logical reasoning and detailed examples
- clearly and logically organize your ideas in an essay
- effectively communicate your ideas in standard written English

Lay your pencil down immediately when time is called.

**DO NOT OPEN THIS BOOKLET UNTIL TOLD TO DO SO.**

**ACT**<sup>®</sup>

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## Public Health and Individual Freedom

Most people want to be healthy, and most people want as much freedom as possible to do the things they want. Unfortunately, these two desires sometimes conflict. For example, smoking is prohibited from most public places, which restricts the freedom of some individuals for the sake of the health of others. Likewise, car emissions are regulated in many areas in order to reduce pollution and its health risks to others, which in turn restricts some people's freedom to drive the vehicles they want. In a society that values both health and freedom, how do we best balance the two? How should we think about conflicts between public health and individual freedom?

*Read and carefully consider these perspectives. Each suggests a particular way of thinking about the conflict between public health and individual freedom.*

### Perspective One

Our society should strive to achieve the greatest good for the greatest number of people. When the freedom of the individual interferes with that principle, freedom must be restricted.

### Perspective Two

Nothing in society is more valuable than freedom. Perhaps physical health is sometimes improved by restricting freedom, but the cost to the health of our free society is far too great to justify it.

### Perspective Three

The right to avoid health risks is a freedom, too. When we allow individual behavior to endanger others, we've damaged both freedom and health.

### Essay Task

Write a unified, coherent essay in which you evaluate multiple perspectives on the conflict between public health and individual freedom. In your essay, be sure to:

- analyze and evaluate the perspectives given
- state and develop your own perspective on the issue
- explain the relationship between your perspective and those given

Your perspective may be in full agreement with any of the others, in partial agreement, or wholly different. Whatever the case, support your ideas with logical reasoning and detailed, persuasive examples.

## Planning Your Essay

*Your work on these prewriting pages will not be scored.*

Use the space below and on the back cover to generate ideas and plan your essay. You may wish to consider the following as you think critically about the task:

Strengths and weaknesses of the three given perspectives

- What insights do they offer, and what do they fail to consider?
- Why might they be persuasive to others, or why might they fail to persuade?

Your own knowledge, experience, and values

- What is your perspective on this issue, and what are its strengths and weaknesses?
- How will you support your perspective in your essay?

### Note

- For your practice essay, you will need scratch paper to plan your essay and four lined sheets of paper for your response.
- On test day, you will receive a test booklet with space to plan your essay and four lined pages on which to write your response.
- Read pages 61–62 for information and instructions on scoring your practice writing test.

# 5 Scoring Your Tests

## How to Score the Multiple-Choice Tests

Follow the instructions below and on the following pages to score your practice multiple-choice tests and review your performance.

### Raw Scores

The number of questions you answered correctly on each test and in each subscore area is your raw score. Because there are many forms of the ACT, each with different questions, some forms will be slightly easier (and some slightly harder) than others. A raw score of 67 on one form of the English test, for example, may be about as difficult to earn as a raw score of 70 on another form of that test.

To compute your raw scores, check your answers with the scoring keys on pages 57–58. Count the number of correct answers for each of the four tests and seven subscore areas, and enter the number in the blanks provided on those pages. These numbers are your raw scores on the tests and subscore areas.

### Scale Scores

To adjust for the small differences that occur among different forms of the ACT, the raw scores for tests and subscore areas are converted into *scale scores*. Scale scores are printed on the reports sent to you and your college and scholarship choices.

When your raw scores are converted into scale scores, it becomes possible to compare your scores with those of examinees who took different test forms. For example, a scale score of 26 on the English test has the same meaning regardless of the form of the ACT on which it is based.

To determine the scale scores corresponding to your raw scores on the practice test, use the tables explaining procedures used to obtain scale scores from raw scores on pages 59–60. Table 1 on page 59 shows the raw-to-scale score conversions for each test, and Table 2 on page 60 shows the raw-to-scale score conversions for the subscore areas. Because each form of the ACT is unique, each form has somewhat different conversion tables. Consequently, these tables provide only approximations of the raw-to-scale score conversions that would apply if a different form of the ACT were taken. Therefore, the scale scores obtained from the practice tests don't match precisely the scale scores received from an actual administration of the ACT.

### Computing the Composite Score

The Composite score is the average of the four scale scores in English, mathematics, reading, and science. If you left any of these tests blank, do not calculate a Composite score. If you take the ACT with writing, your writing results do **not** affect your Composite score.

### Comparing Your Scores

Information about comparing your scores on the practice multiple-choice tests with the scores of recent high school graduates who took the ACT can be found at [www.actstudent.org](http://www.actstudent.org).

Your scores and percent at or below are only *estimates* of the scores that you will receive during an actual administration of the ACT. Test scores are only one indicator of your level of learning. Consider your scores in connection with your grades, your performance in outside activities, and your career interests.

### ACT College and Career Readiness Standards

The ACT College and Career Readiness Standards describe the types of skills, strategies, and understandings you will need to make a successful transition from high school to college. For English, mathematics, reading, and science, standards are provided for six score ranges that reflect the progression and complexity of the skills in each of the academic areas measured by the ACT tests. For writing, standards are provided for five score ranges. The ACT College and Career Readiness Standards and benchmark scores for each test can be found at [www.act.org](http://www.act.org).

## Reviewing Your Performance on the Practice Multiple-Choice Tests

Consider the following as you review your scores.

- Did you run out of time? Reread the information in this booklet on pacing yourself. You may need to adjust the way you use your time in responding to the questions.
- Did you spend too much time trying to understand the directions for the tests? The directions for the practice tests are the same directions that will appear in your test booklet on test day. Make sure you understand them before test day.
- Review the questions that you missed. Did you select a response that was an incomplete answer or that did not directly respond to the question being asked? Try to figure out what you overlooked in answering the questions.
- Did a particular type of question confuse you? Did the questions you missed come from a particular subscore area? In reviewing your responses, check to see whether a particular type of question or a particular subscore area was more difficult for you.



### Scoring Keys for the ACT Practice Tests

Use the scoring key for each test to score your answer document for the multiple-choice tests. Mark a “1” in the blank for each question you answered correctly. Add up the numbers in each subscore area and enter the total number correct for each subscore area in the blanks provided. Also enter the total number correct for each test in the blanks provided. The total number correct for each test is the sum of the number correct in each subscore area.

#### Test 1: English—Scoring Key

Key	Subscore Area*		Key	Subscore Area*	
	UM	RH		UM	RH
1. A	___		39. C		
2. J		___	40. J	___	
3. D	___		41. C		
4. H	___		42. G	___	
5. B	___		43. D	___	
6. J	___		44. J		___
7. B		___	45. C		___
8. J	___		46. J	___	
9. C	___		47. D	___	
10. J	___		48. H		___
11. B	___		49. B	___	
12. G	___		50. F	___	
13. A		___	51. D		___
14. H		___	52. J		___
15. D		___	53. A	___	
16. H	___		54. F	___	
17. B	___		55. B		___
18. J		___	56. G		___
19. C	___		57. C		___
20. H	___		58. F		___
21. A	___		59. D		___
22. F	___		60. G		___
23. B		___	61. C	___	
24. H	___		62. G	___	
25. C	___		63. D	___	
26. F		___	64. F	___	
27. D		___	65. C		___
28. G		___	66. H	___	
29. A		___	67. D	___	
30. F		___	68. G		___
31. B	___		69. D	___	
32. H	___		70. J		___
33. B	___		71. A		___
34. H		___	72. F		___
35. A	___		73. B		___
36. F		___	74. H	___	
37. A	___		75. D		___
38. F		___			

Number Correct (Raw Score) for:	
Usage/Mechanics (UM) Subscore Area	_____ (40)
Rhetorical Skills (RH) Subscore Area	_____ (35)
Total Number Correct for English Test (UM + RH)	_____ (75)

\*UM = Usage/Mechanics  
RH = Rhetorical Skills

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#### Test 2: Mathematics—Scoring Key

Key	Subscore Area*			Key	Subscore Area*		
	EA	AG	GT		EA	AG	GT
1. D	___			31. D	___		
2. H	___			32. K	___		
3. E	___			33. B	___		
4. F	___			34. H			___
5. E		___		35. D	___		
6. H	___			36. J		___	
7. E		___		37. A	___		
8. H	___			38. F		___	
9. A	___			39. B		___	
10. K	___			40. F		___	
11. C		___		41. E			___
12. K			___	42. K		___	
13. B			___	43. D		___	
14. H			___	44. G		___	
15. B		___		45. D		___	
16. H	___			46. J	___		
17. D			___	47. B	___		
18. F	___			48. G	___		
19. D	___			49. A		___	
20. F			___	50. F			___
21. B	___			51. E	___		
22. H		___		52. H		___	
23. A	___			53. B			___
24. H	___			54. K	___		
25. B	___			55. E		___	
26. G			___	56. K	___		
27. E			___	57. A			___
28. H		___		58. K		___	
29. C		___		59. E	___		
30. G			___	60. J			___

Number Correct (Raw Score) for:	
Pre-Alg./Elem. Alg. (EA) Subscore Area	_____ (27)
Inter. Alg./Coord. Geo. (AG) Subscore Area	_____ (19)
Plane Geo./Trig. (GT) Subscore Area	_____ (14)
Total Number Correct for Math Test (EA + AG + GT)	_____ (60)

\*EA = Pre-Algebra/Elementary Algebra  
AG = Intermediate Algebra/Coordinate Geometry  
GT = Plane Geometry/Trigonometry

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**Test 3: Reading—Scoring Key**

Key	Subscore Area*		Key	Subscore Area*	
	SS	AL		SS	AL
1. A		___	21. A		___
2. J		___	22. G		___
3. C		___	23. D		___
4. H		___	24. J		___
5. B		___	25. C		___
6. J		___	26. G		___
7. A		___	27. C		___
8. H		___	28. J		___
9. B		___	29. C		___
10. J		___	30. G		___
11. A	___		31. A	___	
12. J	___		32. G	___	
13. C	___		33. A	___	
14. J	___		34. J	___	
15. B	___		35. D	___	
16. H	___		36. H	___	
17. B	___		37. B	___	
18. F	___		38. J	___	
19. D	___		39. A	___	
20. F	___		40. H	___	

**Test 4: Science—Scoring Key**

Key		Key	
1. C	___	21. D	___
2. G	___	22. F	___
3. D	___	23. B	___
4. G	___	24. J	___
5. C	___	25. B	___
6. F	___	26. H	___
7. A	___	27. A	___
8. F	___	28. J	___
9. D	___	29. C	___
10. J	___	30. F	___
11. C	___	31. B	___
12. F	___	32. G	___
13. B	___	33. D	___
14. F	___	34. J	___
15. C	___	35. A	___
16. F	___	36. H	___
17. B	___	37. B	___
18. H	___	38. F	___
19. B	___	39. D	___
20. J	___	40. J	___

Number Correct (Raw Score) for:	
Social Studies/Sciences (SS) Subscore Area	_____ (20)
Arts/Literature (AL) Subscore Area	_____ (20)
Total Number Correct for Reading Test (SS + AL)	_____ (40)

Number Correct (Raw Score) for:	
Total Number Correct for Science Test	_____ (40)

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\*SS = Social Studies/Sciences  
AL = Arts/Literature  
1572CPRE

**TABLE 1****Explanation of Procedures Used to Obtain Scale Scores from Raw Scores**

On each of the four multiple-choice tests on which you marked any responses, the total number of correct responses yields a raw score. Use the table below to convert your raw scores to scale scores. For each test, locate and circle your raw score or the range of raw scores that includes it in the table below. Then, read across to either outside column of the table and circle the scale score that corresponds to that raw score. As you determine your scale scores, enter them in the blanks provided on the right. The highest possible scale score for each test is 36. The lowest possible scale score for any test on which you marked any responses is 1.

Next, compute the Composite score by averaging the four scale scores. To do this, add your four scale scores and divide the sum by 4. If the resulting number ends in a fraction, round it to the nearest whole number. (Round down any fraction less than one-half; round up any fraction that is one-half or more.) Enter this number in the blank. This is your Composite score. The highest possible Composite score is 36. The lowest possible Composite score is 1.

<b>ACT Test 1572CPRE</b>	<b>Your Scale Score</b>
English	_____
Mathematics	_____
Reading	_____
Science	_____
<hr/>	
<b>Sum of scores</b>	_____
<b>Composite score (sum ÷ 4)</b>	_____
<b>Writing</b>	_____

NOTE: If you left a test completely blank and marked no items, do not list a scale score for that test. If any test was completely blank, do not calculate a Composite score.

To calculate your writing score, use the rubric on pages 61–62.

<b>Scale Score</b>	<b>Raw Scores</b>					<b>Scale Score</b>
	<b>Test 1 English</b>	<b>Test 2 Mathematics</b>	<b>Test 3 Reading</b>	<b>Test 4 Science</b>	<b>Writing</b>	
<b>36</b>	75	60	40	40	47-48	<b>36</b>
<b>35</b>	72-74	58-59	39	39	46	<b>35</b>
<b>34</b>	71	57	38	38	44-45	<b>34</b>
<b>33</b>	70	55-56	37	37	42-43	<b>33</b>
<b>32</b>	68-69	54	35-36	—	41	<b>32</b>
<b>31</b>	67	52-53	34	36	40	<b>31</b>
<b>30</b>	66	50-51	33	35	38-39	<b>30</b>
<b>29</b>	65	48-49	32	34	37	<b>29</b>
<b>28</b>	63-64	45-47	31	33	35-36	<b>28</b>
<b>27</b>	62	43-44	30	32	34	<b>27</b>
<b>26</b>	60-61	40-42	29	30-31	33	<b>26</b>
<b>25</b>	58-59	38-39	28	28-29	32	<b>25</b>
<b>24</b>	56-57	36-37	27	26-27	31	<b>24</b>
<b>23</b>	53-55	34-35	25-26	24-25	29-30	<b>23</b>
<b>22</b>	51-52	32-33	24	22-23	28	<b>22</b>
<b>21</b>	48-50	30-31	22-23	21	26-27	<b>21</b>
<b>20</b>	45-47	29	21	19-20	25	<b>20</b>
<b>19</b>	43-44	27-28	19-20	17-18	24	<b>19</b>
<b>18</b>	41-42	24-26	18	16	23	<b>18</b>
<b>17</b>	39-40	21-23	17	14-15	21-22	<b>17</b>
<b>16</b>	36-38	17-20	15-16	13	20	<b>16</b>
<b>15</b>	32-35	13-16	14	12	—	<b>15</b>
<b>14</b>	29-31	11-12	12-13	11	18-19	<b>14</b>
<b>13</b>	27-28	8-10	11	10	17	<b>13</b>
<b>12</b>	25-26	7	9-10	9	16	<b>12</b>
<b>11</b>	23-24	5-6	8	8	—	<b>11</b>
<b>10</b>	20-22	4	6-7	7	14-15	<b>10</b>
<b>9</b>	18-19	—	—	5-6	13	<b>9</b>
<b>8</b>	15-17	3	5	—	12	<b>8</b>
<b>7</b>	12-14	—	4	4	—	<b>7</b>
<b>6</b>	10-11	2	3	3	10-11	<b>6</b>
<b>5</b>	8-9	—	—	2	9	<b>5</b>
<b>4</b>	6-7	1	2	—	—	<b>4</b>
<b>3</b>	4-5	—	—	1	—	<b>3</b>
<b>2</b>	2-3	—	1	—	—	<b>2</b>
<b>1</b>	0-1	0	0	0	8	<b>1</b>

# TABLE 2

## Explanation of Procedures Used to Obtain Scale Subscores from Raw Scores

ACT Test 1572CPRE Your Scale Subscore

### English

For each of the seven subscore areas, the total number of correct responses yields a raw score. Use the table below to convert your raw scores to scale subscores. For each of the seven subscore areas, locate and circle either the raw score or the range of raw scores that includes it in the table below. Then, read across to either outside column of the table and circle the scale subscore that corresponds to that raw score. As you determine your scale subscores, enter them in the blanks provided on the right. The highest possible scale subscore is 18. The lowest possible scale subscore is 1.

If you left a test completely blank and marked no responses, do not list any scale subscores for that test.

Usage/Mechanics \_\_\_\_\_

Rhetorical Skills \_\_\_\_\_

### Mathematics

Pre-Algebra/Elementary Algebra \_\_\_\_\_

Algebra/Coord. Geometry \_\_\_\_\_

Plane Geometry/Trigonometry \_\_\_\_\_

### Reading

Social Studies/Sciences \_\_\_\_\_

Arts/Literature \_\_\_\_\_

Scale Subscore	Raw Scores										Scale Subscore
	Test 1 English			Test 2 Mathematics				Test 3 Reading			
	Usage/ Mechanics	Rhetorical Skills	Pre-Algebra/ Elem. Algebra	Algebra/ Coord. Geometry	Plane Geometry/ Trigonometry	Social Studies/ Sciences	Arts/ Literature	Social Studies/ Sciences	Arts/ Literature	Scale Subscore	
18	38-40	35	26-27	19	14	20	19-20	20	19-20	18	18
17	36-37	34	24-25	18	—	19	18	19	18	17	17
16	35	32-33	22-23	17	12-13	17-18	17	17-18	17	16	16
15	33-34	31	21	15-16	11	16	16	16	16	15	15
14	32	29-30	20	14	10	15	15	15	15	14	14
13	31	27-28	18-19	12-13	9	13-14	14	13-14	14	13	13
12	29-30	25-26	17	10-11	8	12	13	12	13	12	12
11	27-28	22-24	15-16	9	7	11	11	11	11	11	11
10	25-26	20-21	14	7-8	6	9-10	12	9-10	11	10	10
9	23-24	17-19	13	6	5	8	10	8	10	9	9
8	20-22	15-16	11-12	4-5	4	7	9	7	9	8	8
7	18-19	13-14	8-10	—	3	5-6	8	4	8	7	7
6	16-17	11-12	6-7	3	2	4	6-7	2	6-7	6	6
5	13-15	9-10	5	2	—	3	5	3	5	5	5
4	10-12	7-8	3-4	1	1	2	3-4	2	3-4	4	4
3	8-9	5-6	2	—	—	—	2	—	2	3	3
2	5-7	2-4	1	—	—	—	1	—	1	2	2
1	0-4	0-1	0	0	0	0	0	0	0	1	1

1572CPRE

## How to Score the Writing Test

It is difficult to be objective about one's own work. However, it is to your advantage to read your own writing critically, as doing so can help you grow as a writer and as a reader. It may also be helpful for you to give your practice essay to another reader, such as a classmate, parent, or teacher. To rate your essay, you and your reader(s) should review the guidelines and sample essays at [www.actstudent.org](http://www.actstudent.org) and then use the scoring rubric below to assign your practice essay a score of 1 (low) through 6 (high) in each of the four writing domains (Ideas and Analysis, Development and Support, Organization, Language Use).

## Scoring Rubric (below)

The rubric presents the standards by which your essay will be evaluated. Readers will use this rubric to assign your essay four unique scores, one per writing domain. To score your essay, determine which scorepoint, in each domain, best describes the features of your writing. Because each domain receives its own score, the four scores you assign need not be identical. For example, you may find that your essay exhibits stronger skill in organization than in the development of ideas. In this case, you may determine that your essay should receive a higher score in Organization than in Development and Support.

## The ACT Writing Test Scoring Rubric

	<i>Ideas and Analysis</i>	<i>Development and Support</i>	<i>Organization</i>	<i>Language Use</i>
<b>Score 6:</b> <b>Responses at this scorepoint demonstrate effective skill in writing an argumentative essay.</b>	The writer generates an argument that critically engages with multiple perspectives on the given issue. The argument's thesis reflects nuance and precision in thought and purpose. The argument establishes and employs an insightful context for analysis of the issue and its perspectives. The analysis examines implications, complexities and tensions, and/or underlying values and assumptions.	Development of ideas and support for claims deepen insight and broaden context. An integrated line of skillful reasoning and illustration effectively conveys the significance of the argument. Qualifications and complications enrich and bolster ideas and analysis.	The response exhibits a skillful organizational strategy. The response is unified by a controlling idea or purpose, and a logical progression of ideas increases the effectiveness of the writer's argument. Transitions between and within paragraphs strengthen the relationships among ideas.	The use of language enhances the argument. Word choice is skillful and precise. Sentence structures are consistently varied and clear. Stylistic and register choices, including voice and tone, are strategic and effective. While a few minor errors in grammar, usage, and mechanics may be present, they do not impede understanding.
<b>Score 5:</b> <b>Responses at this scorepoint demonstrate well-developed skill in writing an argumentative essay.</b>	The writer generates an argument that productively engages with multiple perspectives on the given issue. The argument's thesis reflects precision in thought and purpose. The argument establishes and employs a thoughtful context for analysis of the issue and its perspectives. The analysis addresses implications, complexities and tensions, and/or underlying values and assumptions.	Development of ideas and support for claims deepen understanding. A mostly integrated line of purposeful reasoning and illustration capably conveys the significance of the argument. Qualifications and complications enrich ideas and analysis.	The response exhibits a productive organizational strategy. The response is mostly unified by a controlling idea or purpose, and a logical sequencing of ideas contributes to the effectiveness of the argument. Transitions between and within paragraphs consistently clarify the relationships among ideas.	The use of language works in service of the argument. Word choice is precise. Sentence structures are clear and varied often. Stylistic and register choices, including voice and tone, are purposeful and productive. While minor errors in grammar, usage, and mechanics may be present, they do not impede understanding.
<b>Score 4:</b> <b>Responses at this scorepoint demonstrate adequate skill in writing an argumentative essay.</b>	The writer generates an argument that engages with multiple perspectives on the given issue. The argument's thesis reflects clarity in thought and purpose. The argument establishes and employs a relevant context for analysis of the issue and its perspectives. The analysis recognizes implications, complexities and tensions, and/or underlying values and assumptions.	Development of ideas and support for claims clarify meaning and purpose. Lines of clear reasoning and illustration adequately convey the significance of the argument. Qualifications and complications extend ideas and analysis.	The response exhibits a clear organizational strategy. The overall shape of the response reflects an emergent controlling idea or purpose. Ideas are logically grouped and sequenced. Transitions between and within paragraphs clarify the relationships among ideas.	The use of language conveys the argument with clarity. Word choice is adequate and sometimes precise. Sentence structures are clear and demonstrate some variety. Stylistic and register choices, including voice and tone, are appropriate for the rhetorical purpose. While errors in grammar, usage, and mechanics are present, they rarely impede understanding.

## The ACT Writing Test Scoring Rubric

	<i>Ideas and Analysis</i>	<i>Development and Support</i>	<i>Organization</i>	<i>Language Use</i>
<b>Score 3:</b> <b>Responses at this scorepoint demonstrate some developing skill in writing an argumentative essay.</b>	The writer generates an argument that responds to multiple perspectives on the given issue. The argument's thesis reflects some clarity in thought and purpose. The argument establishes a limited or tangential context for analysis of the issue and its perspectives. Analysis is simplistic or somewhat unclear.	Development of ideas and support for claims are mostly relevant but are overly general or simplistic. Reasoning and illustration largely clarify the argument but may be somewhat repetitive or imprecise.	The response exhibits a basic organizational structure. The response largely coheres, with most ideas logically grouped. Transitions between and within paragraphs sometimes clarify the relationships among ideas.	The use of language is basic and only somewhat clear. Word choice is general and occasionally imprecise. Sentence structures are usually clear but show little variety. Stylistic and register choices, including voice and tone, are not always appropriate for the rhetorical purpose. Distracting errors in grammar, usage, and mechanics may be present, but they generally do not impede understanding.
<b>Score 2:</b> <b>Responses at this scorepoint demonstrate weak or inconsistent skill in writing an argumentative essay.</b>	The writer generates an argument that weakly responds to multiple perspectives on the given issue. The argument's thesis, if evident, reflects little clarity in thought and purpose. Attempts at analysis are incomplete, largely irrelevant, or consist primarily of restatement of the issue and its perspectives.	Development of ideas and support for claims are weak, confused, or disjointed. Reasoning and illustration are inadequate, illogical, or circular, and fail to fully clarify the argument.	The response exhibits a rudimentary organizational structure. Grouping of ideas is inconsistent and often unclear. Transitions between and within paragraphs are misleading or poorly formed.	The use of language is inconsistent and often unclear. Word choice is rudimentary and frequently imprecise. Sentence structures are sometimes unclear. Stylistic and register choices, including voice and tone, are inconsistent and are not always appropriate for the rhetorical purpose. Distracting errors in grammar, usage, and mechanics are present, and they sometimes impede understanding.
<b>Score 1:</b> <b>Responses at this scorepoint demonstrate little or no skill in writing an argumentative essay.</b>	The writer fails to generate an argument that responds intelligibly to the task. The writer's intentions are difficult to discern. Attempts at analysis are unclear or irrelevant.	Ideas lack development, and claims lack support. Reasoning and illustration are unclear, incoherent, or largely absent.	The response does not exhibit an organizational structure. There is little grouping of ideas. When present, transitional devices fail to connect ideas.	The use of language fails to demonstrate skill in responding to the task. Word choice is imprecise and often difficult to comprehend. Sentence structures are often unclear. Stylistic and register choices are difficult to identify. Errors in grammar, usage, and mechanics are pervasive and often impede understanding.

### Calculating Your Writing Subject Score

Complete these steps to calculate your Writing Subject Score (1–36 scale).

1. Locate the four domain scores (1–6) and enter them in the first column below. Double each score and enter in the Domain Score column to the right.

			Domain Score
Ideas and Analysis	_____	x 2 =	_____
Development and Support	_____	x 2 =	_____
Organization	_____	x 2 =	_____
Language Use and Conventions	_____	x 2 =	_____

2. Enter the sum of the second-column scores here \_\_\_\_\_. This is your raw score (value between 8 and 48).
3. Use Table 1 on page 59 to find the scaled Writing Subject Score that corresponds to your raw score.

# The ACT® 2015–2016 Answer Sheet (No Writing)

**A NAME, MAILING ADDRESS, AND TELEPHONE**  
(Please print.)

\_\_\_\_\_  
Last Name                      First Name                      MI (Middle Initial)

\_\_\_\_\_  
House Number & Street (Apt. No.); or PO Box & No.; or RR & No.

\_\_\_\_\_  
City                                      State/Province                      ZIP/Postal Code

\_\_\_\_\_  
Area Code                      Number                      Country

**B MATCH NAME**  
(First 5 letters of last name)

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A	A	A	A	A
B	B	B	B	B
C	C	C	C	C
D	D	D	D	D
E	E	E	E	E
F	F	F	F	F
G	G	G	G	G
H	H	H	H	H
I	I	I	I	I
J	J	J	J	J
K	K	K	K	K
L	L	L	L	L
M	M	M	M	M
N	N	N	N	N
O	O	O	O	O
P	P	P	P	P
Q	Q	Q	Q	Q
R	R	R	R	R
S	S	S	S	S
T	T	T	T	T
U	U	U	U	U
V	V	V	V	V
W	W	W	W	W
X	X	X	X	X
Y	Y	Y	Y	Y
Z	Z	Z	Z	Z

**C MATCH NUMBER**

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9
0	0	0	0	0	0	0	0	0	0

**D DATE OF BIRTH**

Month	Day	Year
<input type="radio"/> Jan.		
<input type="radio"/> Feb.		
<input type="radio"/> March	<input type="radio"/> 1	<input type="radio"/> 1
<input type="radio"/> April	<input type="radio"/> 2	<input type="radio"/> 2
<input type="radio"/> May	<input type="radio"/> 3	<input type="radio"/> 3
<input type="radio"/> June	<input type="radio"/> 4	<input type="radio"/> 4
<input type="radio"/> July	<input type="radio"/> 5	<input type="radio"/> 5
<input type="radio"/> Aug.	<input type="radio"/> 6	<input type="radio"/> 6
<input type="radio"/> Sept.	<input type="radio"/> 7	<input type="radio"/> 7
<input type="radio"/> Oct.	<input type="radio"/> 8	<input type="radio"/> 8
<input type="radio"/> Nov.	<input type="radio"/> 9	<input type="radio"/> 9
<input type="radio"/> Dec.	<input type="radio"/> 0	<input type="radio"/> 0

**ACT, Inc.—Confidential Restricted when data present**

**ALL** examinees must complete block A – please print.

Blocks B, C, and D are required for all examinees. Find the MATCHING INFORMATION on your ticket. Enter it EXACTLY the same way, even if any of the information is missing or incorrect. Fill in the corresponding ovals. If you do not complete these blocks to match your previous information EXACTLY, your scores will be **delayed up to 8 weeks**.

Do NOT mark in this shaded area.



**USE A SOFT LEAD NO. 2 PENCIL ONLY.**  
(Do NOT use a mechanical pencil, ink, ballpoint, correction fluid, or felt-tip pen.)

**EXAMINEE STATEMENT, CERTIFICATION, AND SIGNATURE**

1. Read the following **Statement**: By submitting this answer sheet, I agree to comply with and be bound by the *Terms and Conditions: Testing Rules and Policies for the ACT®* provided in the ACT registration materials for this assessment, including those concerning test security, score cancellation, examinee remedies, arbitration, and consent to the processing of my personally identifying information, including the collection, use, transfer and disclosure of information as described in the ACT Privacy Policy ([www.act.org/privacy.html](http://www.act.org/privacy.html)).

**International Examinees**: By my signature I am also providing my consent to ACT to transfer my personally identifying information to the United States to ACT, or a third party service provider for processing, where it will be subject to use and disclosure under the laws of the United States. I acknowledge and agree that it may also be accessible to law enforcement and national security authorities in the United States.

I understand that ACT owns the assessment questions and responses and affirm that I will not share any assessment questions or responses with anyone by any form of communication before, during, or after the assessment administration. I understand that assuming anyone else's identity to take this assessment is strictly prohibited and may violate the law and subject me to legal penalties.

2. Copy the **Certification** shown below (only the text in italics) on the lines provided. Write in your normal handwriting.

**Certification**: *I agree to the Statement above and certify that I am the person whose name and address appear on this answer sheet.*

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
Your Signature

\_\_\_\_\_  
Today's Date



PO BOX 168, IOWA CITY, IOWA 52243-0168

Cut Here

**Marking Directions:** Mark only **one** oval for each question. Fill in response completely. Erase errors cleanly without smudging.

**Correct mark:**

**Do NOT use these incorrect or bad marks.**

- Incorrect marks:
- Overlapping mark:
- Cross-out mark:
- Smudged erasure:
- Mark is too light:

**BOOKLET NUMBER**

1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9
0	0	0	0	0	0

**FORM**

--	--	--

Print your 3-character **Test Form** in the boxes above and fill in the corresponding oval at the right.

**BE SURE TO FILL IN THE CORRECT FORM OVAL.**

PRE

**TEST 1**

- |              |              |              |              |              |              |
|--------------|--------------|--------------|--------------|--------------|--------------|
| 1 (A B C D)  | 14 (F G H J) | 27 (A B C D) | 40 (F G H J) | 53 (A B C D) | 66 (F G H J) |
| 2 (F G H J)  | 15 (A B C D) | 28 (F G H J) | 41 (A B C D) | 54 (F G H J) | 67 (A B C D) |
| 3 (A B C D)  | 16 (F G H J) | 29 (A B C D) | 42 (F G H J) | 55 (A B C D) | 68 (F G H J) |
| 4 (F G H J)  | 17 (A B C D) | 30 (F G H J) | 43 (A B C D) | 56 (F G H J) | 69 (A B C D) |
| 5 (A B C D)  | 18 (F G H J) | 31 (A B C D) | 44 (F G H J) | 57 (A B C D) | 70 (F G H J) |
| 6 (F G H J)  | 19 (A B C D) | 32 (F G H J) | 45 (A B C D) | 58 (F G H J) | 71 (A B C D) |
| 7 (A B C D)  | 20 (F G H J) | 33 (A B C D) | 46 (F G H J) | 59 (A B C D) | 72 (F G H J) |
| 8 (F G H J)  | 21 (A B C D) | 34 (F G H J) | 47 (A B C D) | 60 (F G H J) | 73 (A B C D) |
| 9 (A B C D)  | 22 (F G H J) | 35 (A B C D) | 48 (F G H J) | 61 (A B C D) | 74 (F G H J) |
| 10 (F G H J) | 23 (A B C D) | 36 (F G H J) | 49 (A B C D) | 62 (F G H J) | 75 (A B C D) |
| 11 (A B C D) | 24 (F G H J) | 37 (A B C D) | 50 (F G H J) | 63 (A B C D) |              |
| 12 (F G H J) | 25 (A B C D) | 38 (F G H J) | 51 (A B C D) | 64 (F G H J) |              |
| 13 (A B C D) | 26 (F G H J) | 39 (A B C D) | 52 (F G H J) | 65 (A B C D) |              |

**TEST 2**

- |                |                |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|
| 1 (A B C D E)  | 11 (A B C D E) | 21 (A B C D E) | 31 (A B C D E) | 41 (A B C D E) | 51 (A B C D E) |
| 2 (F G H J K)  | 12 (F G H J K) | 22 (F G H J K) | 32 (F G H J K) | 42 (F G H J K) | 52 (F G H J K) |
| 3 (A B C D E)  | 13 (A B C D E) | 23 (A B C D E) | 33 (A B C D E) | 43 (A B C D E) | 53 (A B C D E) |
| 4 (F G H J K)  | 14 (F G H J K) | 24 (F G H J K) | 34 (F G H J K) | 44 (F G H J K) | 54 (F G H J K) |
| 5 (A B C D E)  | 15 (A B C D E) | 25 (A B C D E) | 35 (A B C D E) | 45 (A B C D E) | 55 (A B C D E) |
| 6 (F G H J K)  | 16 (F G H J K) | 26 (F G H J K) | 36 (F G H J K) | 46 (F G H J K) | 56 (F G H J K) |
| 7 (A B C D E)  | 17 (A B C D E) | 27 (A B C D E) | 37 (A B C D E) | 47 (A B C D E) | 57 (A B C D E) |
| 8 (F G H J K)  | 18 (F G H J K) | 28 (F G H J K) | 38 (F G H J K) | 48 (F G H J K) | 58 (F G H J K) |
| 9 (A B C D E)  | 19 (A B C D E) | 29 (A B C D E) | 39 (A B C D E) | 49 (A B C D E) | 59 (A B C D E) |
| 10 (F G H J K) | 20 (F G H J K) | 30 (F G H J K) | 40 (F G H J K) | 50 (F G H J K) | 60 (F G H J K) |

**TEST 3**

- |             |              |              |              |              |              |
|-------------|--------------|--------------|--------------|--------------|--------------|
| 1 (A B C D) | 8 (F G H J)  | 15 (A B C D) | 22 (F G H J) | 29 (A B C D) | 36 (F G H J) |
| 2 (F G H J) | 9 (A B C D)  | 16 (F G H J) | 23 (A B C D) | 30 (F G H J) | 37 (A B C D) |
| 3 (A B C D) | 10 (F G H J) | 17 (A B C D) | 24 (F G H J) | 31 (A B C D) | 38 (F G H J) |
| 4 (F G H J) | 11 (A B C D) | 18 (F G H J) | 25 (A B C D) | 32 (F G H J) | 39 (A B C D) |
| 5 (A B C D) | 12 (F G H J) | 19 (A B C D) | 26 (F G H J) | 33 (A B C D) | 40 (F G H J) |
| 6 (F G H J) | 13 (A B C D) | 20 (F G H J) | 27 (A B C D) | 34 (F G H J) |              |
| 7 (A B C D) | 14 (F G H J) | 21 (A B C D) | 28 (F G H J) | 35 (A B C D) |              |

**TEST 4**

- |             |              |              |              |              |              |
|-------------|--------------|--------------|--------------|--------------|--------------|
| 1 (A B C D) | 8 (F G H J)  | 15 (A B C D) | 22 (F G H J) | 29 (A B C D) | 36 (F G H J) |
| 2 (F G H J) | 9 (A B C D)  | 16 (F G H J) | 23 (A B C D) | 30 (F G H J) | 37 (A B C D) |
| 3 (A B C D) | 10 (F G H J) | 17 (A B C D) | 24 (F G H J) | 31 (A B C D) | 38 (F G H J) |
| 4 (F G H J) | 11 (A B C D) | 18 (F G H J) | 25 (A B C D) | 32 (F G H J) | 39 (A B C D) |
| 5 (A B C D) | 12 (F G H J) | 19 (A B C D) | 26 (F G H J) | 33 (A B C D) | 40 (F G H J) |
| 6 (F G H J) | 13 (A B C D) | 20 (F G H J) | 27 (A B C D) | 34 (F G H J) |              |
| 7 (A B C D) | 14 (F G H J) | 21 (A B C D) | 28 (F G H J) | 35 (A B C D) |              |

