

# CHEMISTRY TEST

portion of the page of the answer sheet that you will use to take the Chemistry Test must be filled in exactly as below. When your supervisor tells you to fill in the circle next to the name of the test you are about to take, mark your answer sheet as shown.

- |                                  |   |                                     |   |  |
|----------------------------------|---|-------------------------------------|---|--|
| <input type="radio"/> Literature | <input type="radio"/> Mathematics Level 1 | <input type="radio"/> German        | <input type="radio"/> Chinese Listening | <input type="radio"/> Japanese Listening |
| <input type="radio"/> Biology E  | <input type="radio"/> Mathematics Level 2 | <input type="radio"/> Italian       | <input type="radio"/> French Listening  | <input type="radio"/> Korean Listening   |
| <input type="radio"/> Biology M  | <input type="radio"/> U.S. History        | <input type="radio"/> Latin         | <input type="radio"/> German Listening  | <input type="radio"/> Spanish Listening  |
| <input type="radio"/> Chemistry  | <input type="radio"/> World History       | <input type="radio"/> Modern Hebrew |   |  |
| <input type="radio"/> Physics    | <input type="radio"/> French              | <input type="radio"/> Spanish       |   |  |

Background Questions: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

After filling in the circle next to the name of the test you are taking, locate the Background Questions section, which also appears at the top of your answer sheet (as shown above). This is where you will answer the following Background Questions on your answer sheet.

## BACKGROUND QUESTIONS

Please answer the four questions below by filling in the appropriate circle in the Background Questions box on your answer sheet.  
test score.

### Question I

How many semesters of chemistry have you taken in high school? (If you are taking chemistry this semester, count it as a full semester.) Fill in only one circle of circles 1-3.

- One semester or less —Fill in circle 1.
- Two semesters —Fill in circle 2.
- Three semesters or more —Fill in circle 3.

### Question II

How recently have you studied chemistry?

- I am currently enrolled in or have just completed a chemistry course. —Fill in circle 4
- I have not studied chemistry for 6 months or more. —Fill in circle 5.

### Question III

Which of the following best describes your preparation in algebra? (If you are taking an algebra course this semester, count it as a full semester.) Fill in only one circle of circles 6-8.

- One semester or less —Fill in circle 6.
- Two semesters —Fill in circle 7.
- Three semesters or more —Fill in circle 8.

### Question IV

Are you currently taking Advanced Placement Chemistry? If you are, fill in circle 9.

When the supervisor gives the signal, turn the page and begin the Chemistry Test. There is a total of 85 questions in the Chemistry Test (1-70 plus questions 101-115 that must be answered on the special section at the lower left-hand corner of the answer sheet)



# CHEMISTRY TEST



MATERIAL IN THE FOLLOWING TABLE MAY BE USEFUL IN ANSWERING THE QUESTIONS IN THIS EXAMINATION.

DO NOT DETACH FROM BOOK.

## PERIODIC TABLE OF THE ELEMENTS

1 H 1.0079	2 He 4.0026																																												
3 Li 6.941	4 Be 9.012	5 B 10.811	6 C 12.011	7 N 14.007	8 O 16.00	9 F 19.00	10 Ne 20.179																																						
11 Na 22.99	12 Mg 24.30	13 Al 26.98	14 Si 28.09	15 P 30.974	16 S 32.06	17 Cl 35.453	18 Ar 39.948																																						
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.938	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80																												
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.91	54 Xe 131.29																												
55 Cs 132.91	56 Ba 137.33	57 *La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.2	77 Ir 192.2	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)																												
87 Fr (223)	88 Ra 226.02	89 †Ac 227.03	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (271)	111 Rg (272)	112 § (277)																																		
																		§ Not yet named																											
																		*Lanthanide Series																											
																		†Actinide Series																											
																		58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.4	63 Eu 151.97	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97														
																		90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)														

# CHEMISTRY TEST

**Note:** For all questions involving solutions, assume that the solvent is water unless otherwise stated.

Throughout the test the following symbols have the definitions specified unless otherwise noted.

$H$ = enthalpy	atm = atmosphere(s)
$M$ = molar	$g$ = gram(s)
$n$ = number of moles	$J$ = joule(s)
$P$ = pressure	$kJ$ = kilojoule(s)
$R$ = molar gas constant	$L$ = liter(s)
$S$ = entropy	$mL$ = milliliter(s)
$T$ = temperature	$mm$ = millimeter(s)
$V$ = volume	$mol$ = mole(s)
	$V$ = volt(s)

## Part A

**Directions:** Each set of lettered choices below refers to the numbered statements or questions immediately following it. Select the one lettered choice that best fits each statement or answers each question and then fill in the corresponding circle on the answer sheet. A choice may be used once, more than once, or not at all in each set.

Questions 1-4 refer to the following compounds.

- (A)  $Al_2O_3$
- (B)  $NH_4NO_3$
- (C)  $CF_2Cl_2$
- (D)  $SO_3$
- (E)  $SiO_2$

Is the primary constituent of ordinary glass

Is important as a plant fertilizer

Produces acid rain when combined with atmospheric moisture

Implicated in the destruction of ozone in the stratosphere

Questions 5-7 refer to the following electron dot structures in which  $Z$  represents the symbol for an element.

- (A)  $Z\cdot$
- (B)  $:\ddot{Z}:$
- (C)  $\cdot\dot{Z}$
- (D)  $\cdot\ddot{Z}:$
- (E)  $:\dot{Z}:$

5. Which could represent the  $F^-$  ion?

6. Which could represent an atom of a member of the alkali metal family?

7. Which could represent an oxygen atom?

AC

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GO ON TO THE NEXT PAGE 



CHEMISTRY TEST—Continued



Questions 8-9 refer to the following molecular geometries.

- (A) Linear
- (B) Bent
- (C) Planar triangular
- (D) Tetrahedral
- (E) Square planar

8. The shape of a molecule of HBr

9. The shape of a molecule of CH<sub>4</sub>

Questions 10-13

- (A) Solid zinc is added to a Cu(NO<sub>3</sub>)<sub>2</sub> solution.
- (B) Solid calcium carbonate is added to a solution of hydrochloric acid.
- (C) Solutions of 0.1 M BaCl<sub>2</sub> and 0.1 M H<sub>2</sub>SO<sub>4</sub> are mixed.
- (D) A solution of ammonia is added to a Cu(NO<sub>3</sub>)<sub>2</sub> solution.
- (E) Solutions of 0.3 M NaOH and 0.1 M H<sub>3</sub>PO<sub>4</sub> are mixed.

10. An oxidation-reduction reaction takes place.

11. An acid-base reaction involving no visible change occurs.

12. A gas is evolved.

13. A complex ion is formed.

Questions 14-16 refer to the following compounds.

- (A) NH<sub>3</sub>
- (B) H<sub>2</sub>S
- (C) CH<sub>4</sub>
- (D) CO
- (E) CO<sub>2</sub>

14. Contains a triple bond

15. Contains two double bonds

16. Has one and only one unshared pair of electrons

Questions 17-18 refer to the following elements.

- (A) Aluminum
- (B) Germanium
- (C) Iron
- (D) Tungsten
- (E) Zinc

17. Is used to galvanize steel, and is a major component of the alloy brass

18. Is a metalloid that exhibits semiconductor behavior

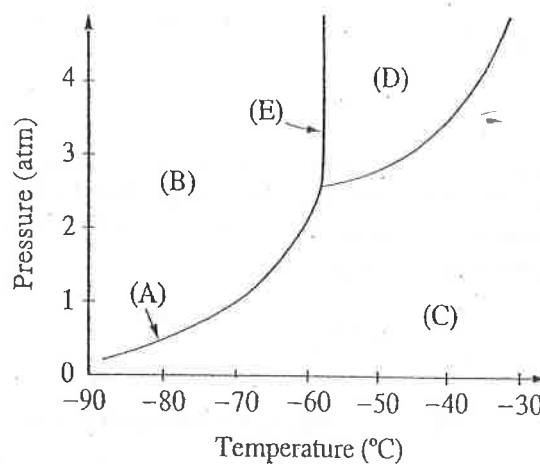
CHEMISTRY TEST—Continued

Questions 19-20

- (A)  $\text{NH}_4\text{Cl}$
- (B)  $\text{NaClO}$
- (C)  $\text{HBr}$
- (D)  $\text{KOH}$
- (E)  $\text{KHCO}_3$

- 19. Is a strong acid in aqueous solution
- 20. Is a strong base in aqueous solution

Questions 21-23 refer to the following phase diagram for a pure substance.



- 21. Where are the vapor pressure of the solid and the pressure of the gas equal?
- 22. Where does the solid exist in equilibrium with the liquid?
- 23. Where does the substance exist only as a gas?



CHEMISTRY TEST—Continued

PLEASE GO TO THE SPECIAL SECTION AT THE LOWER LEFT-HAND CORNER OF THE PAGE OF THE ANSWER SHEET YOU ARE WORKING ON AND ANSWER QUESTIONS 101-115 ACCORDING TO THE FOLLOWING DIRECTIONS.

Part B

**Directions:** Each question below consists of two statements, I in the left-hand column and II in the right-hand column. For each question, determine whether statement I is true or false and whether statement II is true or false and fill in the corresponding T or F circles on your answer sheet. Fill in circle CE only if statement II is a correct explanation of the true statement I.

**EXAMPLES:**

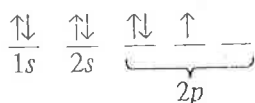
	<u>I</u>		<u>II</u>
EX 1.	H <sub>2</sub> SO <sub>4</sub> is a strong acid	BECAUSE	H <sub>2</sub> SO <sub>4</sub> contains sulfur.
EX 2.	An atom of oxygen is electrically neutral	BECAUSE	an oxygen atom contains an equal number of protons and electrons.

SAMPLE ANSWERS

	I	II	CE*
EX 1	● (F)	● (F)	○ (T)
EX 2	● (F)	● (F)	● (T)

101. The orbital diagram for a nitrogen atom in its ground state is



BECAUSE the most stable configuration for three p electrons is three unpaired electrons.

102. At a fixed temperature, all of the molecules in a given volume of an ideal gas have the same speed

BECAUSE at constant pressure, the volume occupied by a fixed quantity of an ideal gas is proportional to the absolute temperature.

103. The CO<sub>2</sub> molecule is nonpolar

BECAUSE the bond dipoles in the CO<sub>2</sub> molecule cancel one another.

104. All endothermic reactions are nonspontaneous

BECAUSE in endothermic reactions, the total energy of the products is higher than the total energy of the reactants.

CHEMISTRY TEST—Continued

I

II

5. The bonds in solid sodium chloride have more ionic character than the bonds in solid aluminum chloride have
6. A catalyst increases the rate of a chemical reaction
7. All pure hydrocarbons have the same percentage composition
8. The oxidation number of chlorine in HCl is -1
9. The entropy of a substance increases as it changes from a gas to a liquid

BECAUSE sodium is a metal and aluminum is a nonmetal.

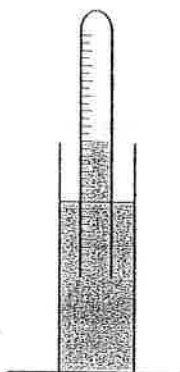
BECAUSE a catalyst increases the activation energy of a reaction.

BECAUSE hydrocarbons contain only the elements carbon and hydrogen.

BECAUSE chlorine forms the stable molecule  $\text{Cl}_2$ .

BECAUSE molecules in a liquid have more freedom of movement than molecules in a gas have.

The apparatus represented below is used to measure the volume of a gas produced in an experiment.



10. The volume of the gas in the inverted tube represented above should be measured when the water level inside the tube is the same as the water level outside the tube

BECAUSE when the water levels inside and outside the inverted tube represented above are the same, the total pressure inside the tube is equal to the atmospheric pressure.



CHEMISTRY TEST—Continued



I

II

111. At 1 atm, methane,  $\text{CH}_4$ , has a lower boiling point than water,  $\text{H}_2\text{O}$ , BECAUSE there is more intermolecular hydrogen bonding in  $\text{CH}_4$  than in  $\text{H}_2\text{O}$ .
112. At a given temperature, the average speed of atoms of He is greater than the average speed of atoms of Xe BECAUSE at a given temperature, atoms of He and Xe have the same average kinetic energy, and He has a lower atomic mass than Xe.
113. Most of the alpha particles directed at a thin sheet of gold foil pass through it, while only a few particles are widely deflected BECAUSE the nucleus occupies a very small portion of the volume of the gold atom.
114. The freezing point of a 0.1-molal solution of sugar in water is lower than the freezing point of a 0.1-molal solution of sodium chloride in water BECAUSE the freezing point of water is lowered in proportion to the concentration of independent solute particles.
115. A 0.1 M solution of HCl has a greater concentration of  $\text{H}_3\text{O}^+$  than a 0.1 M solution of acetic acid,  $\text{HC}_2\text{H}_3\text{O}_2$ , has BECAUSE the chlorine atom is less electronegative than the carbon atom is.

RETURN TO THE SECTION OF YOUR ANSWER SHEET YOU STARTED FOR CHEMISTRY AND ANSWER QUESTIONS 24-70.



CHEMISTRY TEST—Continued

Part C

Directions: Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case and then fill in the corresponding circle on the answer sheet.

Positive ions are formed when neutral atoms

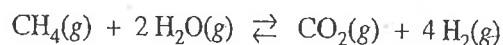
- (A) gain neutrons
- (B) gain nuclear charge
- (C) release energy
- (D) lose protons
- (E) lose electrons

5. The oxidation number of hydrogen is negative in which of the following compounds?

- (A) NaH
- (B) NH<sub>3</sub>
- (C) H<sub>2</sub>O
- (D) HCl
- (E) KOH

6. Electrons in atoms absorb and emit energy only

- (A) in amounts large enough for ionization
- (B) in discrete amounts called quanta
- (C) in the visible region of the spectrum
- (D) when the atoms are in molecules
- (E) when the atoms are in colored molecules



27. Which of the following is the correct expression for the equilibrium constant,  $K_c$ , for the reaction represented by the equation above?

(A)  $K_c = \frac{[\text{CH}_4][\text{H}_2\text{O}]}{[\text{CO}_2][\text{H}_2]}$

(B)  $K_c = \frac{[\text{CH}_4][\text{H}_2\text{O}]^2}{[\text{CO}_2][\text{H}_2]^4}$

(C)  $K_c = \frac{[\text{CO}_2] + 4[\text{H}_2]}{[\text{CH}_4] + 2[\text{H}_2\text{O}]}$

(D)  $K_c = \frac{[\text{CO}_2][\text{H}_2]}{[\text{CH}_4][\text{H}_2\text{O}]}$

(E)  $K_c = \frac{[\text{CO}_2][\text{H}_2]^4}{[\text{CH}_4][\text{H}_2\text{O}]^2}$



## CHEMISTRY TEST—Continued



28. Which of the following is a characteristic of nonmetals?

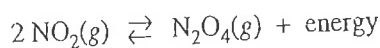
- (A) Being malleable
- (B) Being an electrical conductor
- (C) Having an oxide that forms acidic solutions
- (D) Having high density
- (E) Appearing on the left side of the periodic table

29. The following data were collected to determine the density of a liquid.

Mass of bottle filled with liquid	21.245 g
Mass of empty bottle	10.234 g
Volume of liquid in bottle	11.0 mL

The density of the liquid is best recorded as

- (A) 0.1 g/mL
- (B) 1 g/mL
- (C) 1.0 g/mL
- (D) 1.00 g/mL
- (E) 1.001 g/mL



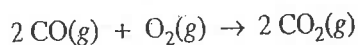
30.  $\text{NO}_2(g)$  is sealed in a glass tube and allowed to reach equilibrium at room temperature according to the equation above. Placing the tube in ice water will result in which of the following?

- I. An increase in gas volume
- II. An increase in gas pressure
- III. A decrease in concentration of  $\text{NO}_2(g)$

- (A) I only
- (B) II only
- (C) III only
- (D) I and II only
- (E) I, II, and III

31. How many electrons does the chlorine-37 ion,  ${}^{37}_{17}\text{Cl}^-$ , have?

- (A) 16
- (B) 17
- (C) 18
- (D) 36
- (E) 38



32. At standard temperature and pressure, when 1 mol of CO and 1 mol of  $\text{O}_2$  are mixed and heated, the reaction represented above takes place. When the reaction has progressed as completely as possible and the reaction chamber has returned to original conditions of temperature and pressure, the final system contains

- (A) 1 mol of  $\text{CO}_2$  only
- (B) 0.5 mol of  $\text{CO}_2$  only
- (C) 0.5 mol of  $\text{CO}_2$  and 0.5 mol of  $\text{O}_2$
- (D) 1 mol of  $\text{CO}_2$  and 0.5 mol of CO
- (E) 1 mol of  $\text{CO}_2$  and 0.5 mol of  $\text{O}_2$

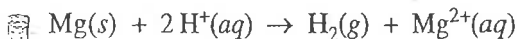
33. A cylinder is filled with butane gas to a pressure of 3.20 atm at  $47^\circ\text{C}$ . What is the pressure in the cylinder when the temperature is  $27^\circ\text{C}$ ?

- (A) 0.320 atm
- (B) 1.00 atm
- (C) 2.24 atm
- (D) 3.00 atm
- (E) 4.48 atm

CHEMISTRY TEST—Continued

1. The molar concentration of hydrogen ions in a solution of pH 6 is

- (A)  $10^{-8} M$
- (B)  $10^{-6} M$
- (C)  $6 M$
- (D)  $8 M$
- (E)  $10^6 M$

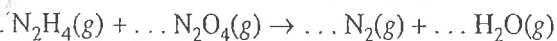


2. What volume of  $4.0 M \text{HCl}(aq)$  is required for complete reaction with  $12 \text{ g}$  of  $\text{Mg}(s)$  according to the reaction represented above?

- (A)  $0.12 \text{ L}$
- (B)  $0.25 \text{ L}$
- (C)  $0.50 \text{ L}$
- (D)  $0.75 \text{ L}$
- (E)  $1.0 \text{ L}$

3. Characteristics of a  $0.1 M$  aqueous solution of  $\text{HNO}_3$  include all of the following EXCEPT:

- (A) It conducts electricity.
- (B) It turns blue litmus paper red.
- (C) It reacts with magnesium to produce hydrogen gas.
- (D) It has a hydroxide ion concentration of  $10^{-7} M$ .
- (E) It reacts with  $0.1 M \text{KOH}$ .



When the equation above is balanced and all coefficients are reduced to lowest whole-number terms, the coefficient for  $\text{N}_2(g)$  is

- (A) 1
- (B) 2
- (C) 3
- (D) 4
- (E) 6

38. A freshly opened can of carbonated beverage fizzes because

- (A) an acid is reacting with dissolved solids
- (B) the solution is boiling
- (C) oxygen from the air reacts with dissolved carbon
- (D) air is a catalyst for an otherwise slow reaction
- (E) dissolved gas escapes when the pressure is reduced



39. The reaction represented above could be correctly described as

- (A) a proton transfer reaction
- (B) a neutron transfer reaction
- (C) an electron transfer reaction
- (D) a hydronium ion transfer reaction
- (E) a nuclear reaction

40. Which of the following contains the greatest percent chlorine by mass?

- (A)  $\text{KCl}$
- (B)  $\text{KClO}$
- (C)  $\text{KClO}_2$
- (D)  $\text{KClO}_3$
- (E)  $\text{KClO}_4$

41. All of the following are good laboratory practices EXCEPT

- (A) fire-polishing all sharp edges of glass tubes and rods
- (B) heating substances in test tubes only when the test tubes are pointed away from everyone
- (C) slowly adding water to acid when diluting concentrated acids
- (D) conducting reactions that produce gaseous products in a fume hood
- (E) removing any nearby flammable reagents before lighting a burner

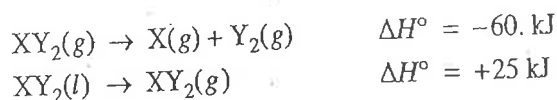


## CHEMISTRY TEST—Continued

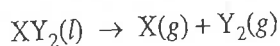


42. A sample originally contained 8.0 g of Ra-225. If the half-life of Ra-225 is 15 days, in how many days will the sample contain only 1.0 g of Ra-225?

(A) 8 days  
(B) 15 days  
(C) 30 days  
(D) 45 days  
(E) 60 days



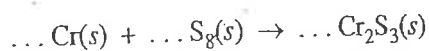
43. According to the reactions represented above, what is the standard enthalpy of reaction,  $\Delta H^\circ$ , for the following reaction?



(A) -110 kJ  
(B) -85 kJ  
(C) -60. kJ  
(D) -35 kJ  
(E) +25 kJ

44. A pH meter is used to measure the pH of a solution of  $\text{NH}_4\text{Cl}$ . When a dilute solution of  $\text{NH}_3$  is added to this solution, a change in pH is observed. The pH of the  $\text{NH}_4\text{Cl}$  solution would change in the same direction if which of the following were added to it?

(A) HCl solution  
(B) KOH solution  
(C) Solid  $\text{NH}_4\text{Cl}$   
(D) Solid NaCl  
(E) Solid sugar



45. When the equation above is balanced and all coefficients are reduced to lowest whole-number terms, the coefficient for  $\text{Cr}(s)$  is

(A) 2  
(B) 3  
(C) 4  
(D) 8  
(E) 16

46. Of the following, which is the strongest Brønsted-Lowry base?

(A)  $\text{NH}_3$   
(B)  $\text{CO}_3^{2-}$   
(C)  $\text{H}_2\text{O}$   
(D)  $\text{Cl}^-$   
(E)  $\text{OH}^-$

47. To calculate the molar mass of a pure gas from experimental data, one must know all of the following for a sample of the gas EXCEPT its

(A) mass  
(B) boiling point  
(C) pressure  
(D) temperature  
(E) volume

48. If an aqueous solution containing 4 mol of NaOH is mixed with one containing 3 mol of HCl, the final solution contains

(A) 1 mol of NaOH and 3 mol of NaCl  
(B) 1 mol of HCl and 3 mol of NaCl  
(C) 3 mol of NaOH and 1 mol of NaCl  
(D) 3 mol of NaOH and 1 mol of HCl  
(E) 4 mol of NaOH and 3 mol of HCl

CHEMISTRY TEST—Continued

9. When 1 mol of  $\text{Cr}^{3+}$  is oxidized to form 1 mol of  $\text{CrO}_4^{2-}$ , how many moles of electrons are transferred?

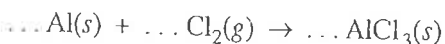
- (A) 3 mol
- (B) 4 mol
- (C) 5 mol
- (D) 6 mol
- (E) 7 mol

10. Which of the following would most likely be associated with a reaction that occurs at a high rate?

- (A) A large activation energy
- (B) A small activation energy
- (C) A low temperature
- (D) A low concentration of reactants
- (E) A decrease in entropy

The best piece of equipment for delivering exactly 17.50 mL of 0.3175 M hydrochloric acid into a clean, dry flask is a

- (A) graduated cylinder
- (B) volumetric flask
- (C) beaker
- (D) test tube
- (E) buret



When the equation above is balanced and all coefficients are reduced to lowest whole-number terms, what is the coefficient for  $\text{Al}(s)$ ?

- (A) 1
- (B) 2
- (C) 3
- (D) 4
- (E) 6

53. The mass of a piece of copper wire and the mass of a crucible are measured. The copper wire is placed in the crucible, covered with sulfur, and heated to redness. The mass of the crucible containing the product is measured after cooling. All of the following are possible experimental observations EXCEPT:

- (A) The product is black.
- (B) The product is solid.
- (C) The product weighs more than the copper.
- (D) Each copper atom has lost two electrons.
- (E) The copper wire has disappeared.

54. Which of the following configurations is that of an element of the group in the periodic table that contains nitrogen?

- (A)  $1s^2 2s^2 2p^4$
- (B)  $1s^2 2s^2 2p^6 3s^2$
- (C)  $1s^2 2s^2 2p^6 3s^2 3p^3$
- (D)  $1s^2 2s^2 2p^6 3s^2 3p^5$
- (E)  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^2$

55. Suppose that 0.5 mol of oxygen gas and 0.5 mol of nitrogen gas are placed in the same container and that no reaction occurs. In the container, the ratio of the pressure exerted by the nitrogen to the pressure exerted by the oxygen is equal to

- (A) 0.5
- (B)  $\frac{28}{32}$
- (C) 1
- (D)  $\frac{32}{28}$
- (E) 2

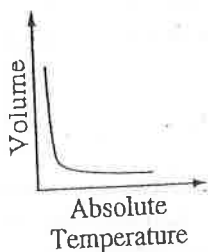


### CHEMISTRY TEST—Continued

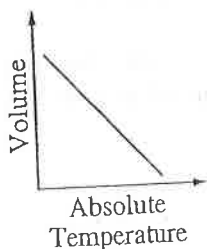


56. Which of the following represents the relation between the volume and the absolute temperature of 1 mol of an ideal gas at constant pressure?

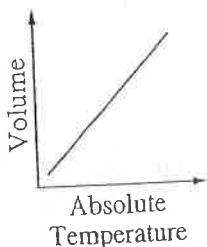
(A)



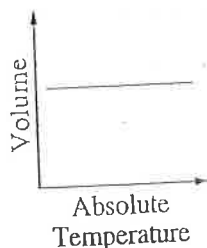
(B)



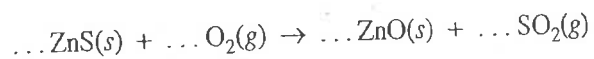
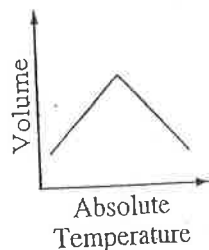
(C)



(D)

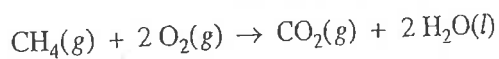


(E)



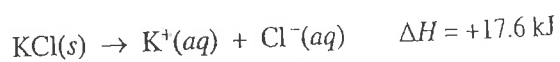
57. When the equation for the reaction represented above is balanced and all the coefficients are reduced to the lowest whole-number terms, the coefficient for  $\text{O}_2(g)$  is

- (A) 1
- (B) 2
- (C) 3
- (D) 4
- (E) 5



58. If a mixture of 0.5 mol of  $\text{CH}_4(g)$  and 2 mol of  $\text{O}_2(g)$  react as represented above, how many moles of each gas are present after the reactants react as completely as possible?

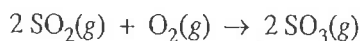
	$\text{CH}_4$	$\text{O}_2$	$\text{CO}_2$
(A)	0.5	1	0.5
(B)	0.5	0.5	1
(C)	0	0.5	0.5
(D)	0	0.5	1
(E)	0	1	0.5



59. Based on the information above, which of the following conclusions is correct?

- (A) At room temperature, KCl is practically insoluble in water.
- (B) At higher temperatures, KCl dissolves at a very slow rate.
- (C) The solubility of KCl in water decreases as temperature increases.
- (D) Heat is released as KCl dissolves in water.
- (E) Heat is released as KCl crystallizes from a water solution.

CHEMISTRY TEST—Continued



60. If all measurements are made under the same conditions, what volume of  $\text{SO}_3(g)$  is produced when 40 mL of  $\text{SO}_2(g)$  and 20 mL of  $\text{O}_2(g)$  react completely according to the equation above?

(A) 10 mL  
 (B) 20 mL  
 (C) 40 mL  
 (D) 60 mL  
 (E) 80 mL

61. Which of the following can be observed when 20.0 mL of 1.0 M  $\text{NaOH}(aq)$ , 10.0 mL of 1.0 M  $\text{HCl}(aq)$ , and a few drops of phenolphthalein are combined and react?

(A) A clear, pink solution only  
 (B) A clear, colorless solution only  
 (C) A white solid and a clear, colorless solution  
 (D) A pink solid and a clear, colorless solution  
 (E) A white solid and a clear, pink solution

62. If 100. mL of each of the following aqueous solutions is mixed with 100. mL samples of 1.0 M  $\text{NaOH}(aq)$ , the greatest amount of heat is liberated by

(A) 0.010 M  $\text{H}_2\text{SO}_4$   
 (B) 0.010 M  $\text{HCl}$   
 (C) 0.10 M  $\text{HCl}$   
 (D) 0.10 M  $\text{H}_2\text{SO}_4$   
 (E) 1.0 M  $\text{HCl}$

63. All of the following are good electrical conductors EXCEPT

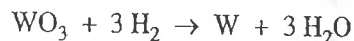
(A) molten  $\text{NaCl}$   
 (B) gasoline  
 (C) a copper wire  
 (D) a silver spoon  
 (E) 1 M  $\text{HCl}$



64. Products of the complete combustion above include which of the following?

I.  $\text{CO}$   
 II.  $\text{CO}_2$   
 III.  $\text{H}_2\text{O}$

(A) I only  
 (B) I and II only  
 (C) I and III only  
 (D) II and III only  
 (E) I, II, and III



65. Which of the following is true for the reaction represented above?

(A)  $\text{WO}_3$  is oxidized.  
 (B)  $\text{W}$  is the oxidizing agent.  
 (C)  $\text{H}_2\text{O}$  is reduced.  
 (D)  $\text{H}_2$  is reduced.  
 (E)  $\text{H}_2$  is the reducing agent.



66. According to the balanced equation above, the maximum amount of compound Z that can be produced from a mixture of 0.10 mol of compound X and 0.12 mol of compound Y is

(A) 0.16 mol  
 (B) 0.20 mol  
 (C) 0.30 mol  
 (D) 0.36 mol  
 (E) 0.48 mol



CHEMISTRY TEST—Continued



67.  $\text{Mg}(s)$  and  $\text{N}_2(g)$  react to form which of the following?
- (A)  $\text{MgN}$
  - (B)  $\text{Mg}_2\text{N}$
  - (C)  $\text{MgN}_2$
  - (D)  $\text{Mg}_3\text{N}_2$
  - (E)  $\text{Mg}_2\text{N}_3$
68. Sulfur has oxidation states of  $-2$ ,  $+2$ ,  $+4$ , and  $+6$  and can be expected to form all of the following stable compounds EXCEPT
- (A)  $\text{SF}_6$
  - (B)  $\text{SO}_2$
  - (C)  $\text{SOCl}_2$
  - (D)  $\text{SO}_3$
  - (E)  $\text{H}_2\text{S}$
69. For which of the following elements in the ground state are there valence electrons in  $p$  orbitals?
- I. Chlorine
  - II. Oxygen
  - III. Magnesium
- (A) I only
  - (B) II only
  - (C) I and II only
  - (D) I and III only
  - (E) I, II, and III
70. A container with a volume of 22.4 L contains 2.0 g of  $\text{H}_2(g)$  and 32 g of  $\text{O}_2(g)$  at  $0^\circ\text{C}$ . In this container
- (A) the total pressure is 760 mm Hg
  - (B) the average kinetic energy of the  $\text{O}_2(g)$  molecules is 8 times the average kinetic energy of  $\text{H}_2(g)$  molecules
  - (C) the partial pressures of the gases are equal
  - (D) all of the molecules in the system have the same average speed
  - (E) all of the molecules have stopped moving because the temperature is  $0^\circ\text{C}$

**STOP**

IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY CHECK YOUR WORK ON THIS TEST ONLY  
DO NOT TURN TO ANY OTHER TEST IN THIS BOOK.