

CHEMISTRY TEST

60 min

Part A

No calculator

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

Questions 1-4

- (A) Thermometer
 - (B) Separatory funnel
 - (C) Flame spectrophotometer
 - (D) Burette
 - (E) Volumetric flask
1. Used to study the characteristic emission lines produced by excited atoms of elements
 2. Used for the preparation of solutions of specific concentrations when a solid is used as the solute
 3. Commonly used for removing the water layer from a system containing oil and water
 4. Used for volume measurements during titration

Questions 5-9

- (A) Linear
- (B) Bent (V-shaped)
- (C) Trigonal, planar
- (D) Pyramidal
- (E) Regular tetrahedral

From the list above, select the shape that describes each of the following.

5. H_2O
6. BI_3
7. NH_3
8. Br_2
9. NH_4^+

Questions 10-12

- (A) NaHCO_3
 - (B) H_2SO_4
 - (C) CH_4
 - (D) Ca(OH)_2
 - (E) C_8H_{18}
10. A significant constituent of baking powders
 11. A constituent of gasoline
 12. A major constituent of natural gas

Questions 13-15

- (A) $3 \text{O}_2(g) \rightleftharpoons 2 \text{O}_3(g)$
 - (B) $\text{OH}^- + \text{H}_3\text{O}^+ \rightleftharpoons 2 \text{H}_2\text{O}$
 - (C) $\text{BaCl}_2 \cdot 2 \text{H}_2\text{O}(s) \xrightarrow{\Delta} \text{BaCl}_2(s) + 2 \text{H}_2\text{O}(g)$
 - (D) $\text{Ca}^{2+} + \text{CO}_3^{2-} \rightarrow \text{CaCO}_3(s)$
 - (E) $\text{Fe} + \text{Cu}^{2+} \rightleftharpoons \text{Fe}^{2+} + \text{Cu}$
13. Represents an oxidation-reduction reaction
 14. Involves the formation of an ionic precipitate from a solution
 15. Represents a Brønsted acid-base reaction

GO ON TO THE NEXT PAGE

CHEMISTRY TEST—Continued

Questions 16-19

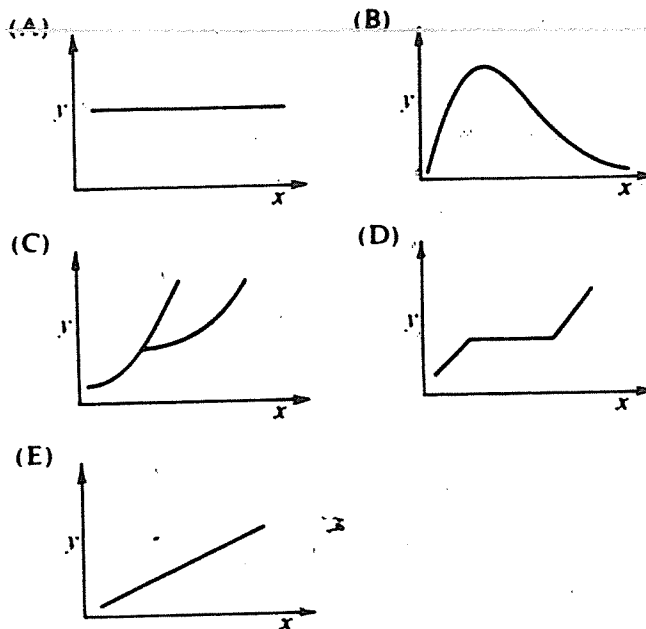
- (A) 3d Transition metals
- (B) Alkali metals
- (C) Halogens
- (D) Noble gases
- (E) Actinides

16. Are the most readily oxidized elements within a given period
17. Have the highest first ionization energies (potentials) of the elements in their respective rows of the periodic table
18. Are all radioactive elements
19. Are the most electronegative of the elements above

Questions 20-22 refer to the following dilute solutions.

- (A) 0.010-molar HCl
 - (B) 0.010-molar NaOH
 - (C) 0.010-molar $\text{Ba}(\text{OH})_2$
 - (D) 0.010-molar H_2SO_4
 - (E) 0.010-molar $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ (cane sugar)
20. Which of the above has the lowest pH?
 21. Which of the above has the highest concentration of OH^- ions?
 22. Which of the above has a freezing point closest to 0°C ?

Questions 23-25



23. Shows how a plot of the pressure-volume product y varies with absolute temperature x for 1 mole of an ideal gas
24. Shows a plot of temperature y versus time x for the complete conversion, by uniform heating, of a pure liquid from below its boiling point to its vapor form above its boiling point
25. Shows a plot of the fraction of molecules in a gas sample y versus kinetic energy x at a given temperature

GO ON TO THE NEXT PAGE

CHEMISTRY-TEST—Continued

Part B

Directions: For each of the questions below, ONE or MORE of the responses given are correct. Decide which of the responses is (are) correct and on the answer sheet blacken space

- A if 1, 2, and 3 are correct;
B if only 1 and 2 are correct;
C if only 2 and 3 are correct;
D if only 1 is correct;
E if only 3 is correct.

MARK ONE SPACE ONLY ON YOUR ANSWER SHEET FOR EACH QUESTION

Directions Summarized				
(A)	(B)	(C)	(D)	(E)
1, 2, 3	1, 2 only	2, 3 only	1 only	3 only

26. $\text{CaCO}_3(s) \xrightarrow{\text{heat}}$
- Products resulting from the thermal decomposition of CaCO_3 indicated above include
- (1) CaO
 - (2) CO_2
 - (3) C
27. A neutral atom, atomic number 33 and atomic mass 75, contains
- (1) 75 neutrons
 - (2) 42 electrons
 - (3) 33 protons
28. When the temperature is increased, the speed of a chemical reaction usually increases because the
- (1) pressure has decreased
 - (2) molecules collide less frequently
 - (3) fraction of the molecules possessing the activation energy for the reaction increases
29. When H_2S burns completely in oxygen, the products include
- (1) S
 - (2) SO_2
 - (3) H_2O
30. A piece of zinc may be distinguished from a piece of magnesium by
- (1) determining which conducts electricity
 - (2) determining which releases H_2 gas from a 1-molar hydrochloric acid solution
 - (3) measuring the density of each
31. Two 1-liter flasks contain hydrogen and oxygen, respectively, at the same temperature and pressure. It is true that the hydrogen and oxygen molecules have the same average
- (1) kinetic energy
 - (2) mass
 - (3) speed
32. Molecules that involve both *s* and *p* orbital electrons in their bonding include which of the following? (Atomic numbers: $\text{H} = 1$, $\text{C} = 6$, $\text{N} = 7$, $\text{Cl} = 17$)
- (1) NH_3
 - (2) CCl_4
 - (3) HCl

GO ON TO THE NEXT PAGE

CHEMISTRY TEST—Continued

DIRECTIONS SUMMARIZED ON THE OPPOSITE PAGE.

33. Species that, in water, can function as both a Brønsted acid and a Brønsted base include which of the following?

(1) HClO_4
(2) HCO_3^-
(3) HPO_4^{2-}

34. $2 \text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2 \text{SO}_3(\text{g}) + \text{heat}$

For the system above at equilibrium, increasing the temperature increases the number of moles of which of the following when equilibrium is reestablished?

(1) $\text{SO}_3(\text{g})$
(2) $\text{O}_2(\text{g})$
(3) $\text{SO}_2(\text{g})$

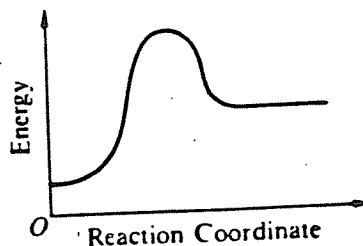
35. $\dots \text{CaO}(\text{s}) + \dots \text{H}_3\text{O}^+ + \dots \text{Cl}^- \rightarrow$

Addition of solid calcium oxide to a solution of hydrochloric acid results in the formation of

(1) Ca^{2+}
(2) H_2O
(3) H_2

36. The SiCl_4 molecule is nonpolar and chlorine is more electronegative than silicon. From this information alone it can be deduced that the

(1) silicon-chlorine bond is nonpolar
(2) SiCl_4 molecule is planar
(3) SiCl_4 molecule is symmetrical



37. The diagram above shows how the potential energy changes as reactants are converted to products for a given reaction. From the diagram, it can be concluded that the

(1) overall reaction is endothermic
(2) activation energy of the forward reaction is greater than that for the reverse reaction
(3) forward reaction is a more rapid reaction than the reverse reaction

38. The number of moles of CO_2 that can be dissolved in a liter of water increases when the

(1) pressure of the CO_2 is increased
(2) temperature of the water is increased
(3) liquid is stirred

GO ON TO THE NEXT PAGE

CHEMISTRY TEST—Continued

Part C

Directions: Each question below consists of an assertion (statement) in the left-hand column and a reason in the right-hand column. On the appropriate line of the answer sheet blacken space

- A if both assertion and reason are true statements and the reason is a correct explanation of the assertion;
 B if both assertion and reason are true statements, but the reason is NOT a correct explanation of the assertion;
 C if the assertion is true, but the reason is a false statement;
 D if the assertion is false, but the reason is a true statement;
 E if both assertion and reason are false statements.

Directions Summarized

A - True	True	Reason is a correct explanation
B - True	True	Reason is <u>NOT</u> a correct explanation
C - True	False	
D - False	True	
E - False	False	

<u>Assertion</u>		<u>Reason</u>
39. Element number 12 and element number 20 undergo similar chemical reactions	BECAUSE	element number 12 and element number 20 have similar valence electron configurations.
40. The element carbon forms the basic structural framework of more compounds than any other element	BECAUSE	the carbon-carbon bond is ionic.
41. The molecule CO ₂ has a net dipole moment of zero	BECAUSE	the arrangement of atoms in the CO ₂ molecule is linear and symmetrical, and the bond polarities within the molecule are canceled out.
42. A catalyst that increases the rate of a forward reaction also increases the rate of the reverse reaction	BECAUSE	the activation energy for a forward reaction is necessarily equal to that of the reverse reaction.
43. The boiling temperature of water is lower at high elevations than at sea level	BECAUSE	the atmospheric pressure is lower at high elevations than at sea level.
44. An element X with the electronic configuration 1s ² 2s ² 2p ⁶ 3s ² 3p ⁴ can be expected to form a compound of the type H ₂ X	BECAUSE	two additional electrons fill the valence shell of an element with outer electronic configuration 3s ² 3p ⁴ .
45. The heat of vaporization of water and the heat of fusion of water are numerically different	BECAUSE	when water freezes or vaporizes, its chemical composition remains unchanged.

GO ON TO THE NEXT PAGE

CHEMISTRY TEST—Continued

DIRECTIONS SUMMARIZED ON THE OPPOSITE PAGE.

46. When a piece of Zn is dropped into 1.0-molar CuSO_4 solution, metallic Cu appears

BECAUSE

Zn is more readily oxidized than Cu is.

47. HCO_3^- can act as a Brønsted acid or a Brønsted base

BECAUSE

HCO_3^- can donate a proton to form CO_3^{2-} or accept a proton to form H_2CO_3 .

48. At 25°C and 1 atmosphere pressure, H_2O is a liquid but H_2S is a gas

BECAUSE

the molecular weight of H_2O is less than that of H_2S .

49. The equation
 $\text{Fe}^{2+} + \text{NO}_3^- + 4 \text{H}^+ \rightleftharpoons \text{Fe}^{3+} + \text{NO} + 2 \text{H}_2\text{O}$
 is balanced

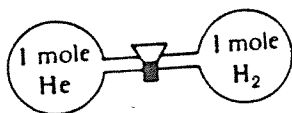
BECAUSE

all the atoms and charges in the equation shown for this reaction are conserved.

50. ^{50}Ti and ^{50}Cr are isotopes of each other

BECAUSE

atoms of ^{50}Ti and ^{50}Cr have the same mass number.



51. When the valve in the system shown above is opened and the system is allowed to reach equilibrium, most of the helium remains in the bulb on the left

BECAUSE

when two bulbs containing gases are connected, the randomness of the system decreases.

52. The first ionization energy of Li is less than that of Na

BECAUSE

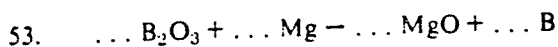
Li is a smaller atom than Na.

GO ON TO THE NEXT PAGE

CHEMISTRY TEST—Continued

Part D

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 blacken the corresponding space on the answer sheet.

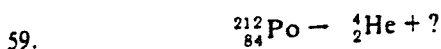


According to the equation above, how many moles of magnesium would be required to react completely with 1 mole of B_2O_3 ? (Equation is not balanced.)

- (A) 0.2 mole
 - (B) 0.3 mole
 - (C) 1 mole
 - (D) 2 moles
 - (E) 3 moles
54. In the ionic solid NH_4NO_3 , the ions present are
- (A) NH_4^+ and NO_3^-
 - (B) N^{5-} , H^+ , and O^{2-}
 - (C) NH_4^+ , N^{5-} , and O^{2-}
 - (D) NH_3 , H^+ , and NO_3^-
 - (E) N^{5-} , N^{3-} , H^+ , and O^{2-}
55. All of the following are good laboratory practices EXCEPT:
- (A) Wait for a hot object to cool before weighing it.
 - (B) Rinse a burette with the solution that will be used to fill the burette.
 - (C) Wear goggles at all times.
 - (D) Return unused chemicals to the reagent bottles.
 - (E) To dilute H_2SO_4 , pour it into water slowly.
56. Which of the following ions does NOT have a noble gas electron configuration? (Atomic numbers: O = 8, Na = 11, Ca = 20, Mn = 25, I = 53)
- (A) O^{2-}
 - (B) Na^+
 - (C) Ca^{2+}
 - (D) Mn^{2+}
 - (E) I^-
57. What volume of 0.20-molar HCl is required to exactly neutralize 40 milliliters of 0.10-molar NaOH?
- (A) 50 ml
 - (B) 40 ml
 - (C) 20 ml
 - (D) 10 ml
 - (E) 8 ml
58. All of the following are true of aluminum EXCEPT:
- (A) It is a good conductor of electricity.
 - (B) It is a metal of high density.
 - (C) It forms a protective coating in air that resists further corrosion.
 - (D) It is an excellent reducing agent.
 - (E) It forms a hydroxide that is soluble in both strong base and acid.

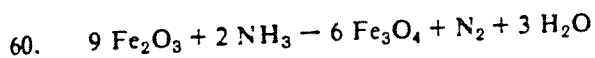
GO ON TO THE NEXT PAGE 

CHEMISTRY TEST—Continued



The missing product in the equation above is

- (A) ${}^{216}_{86}\text{Pb}$
- (B) ${}^{212}_{86}\text{Pb}$
- (C) ${}^{212}_{82}\text{Pb}$
- (D) ${}^{208}_{84}\text{Pb}$
- (E) ${}^{208}_{82}\text{Pb}$



According to the balanced equation above, when 1 mole of NH_3 reacts completely, which of the following is true?

- (A) 1 mole of N_2 must be formed
- (B) 1 mole of H_2O must be formed
- (C) 3 moles of Fe_3O_4 must be formed
- (D) 2 moles of Fe_2O_3 must react
- (E) 4 moles of Fe_2O_3 must react

61. What is the percent composition of CaBr_2 ?
(Atomic weights: $\text{Ca} = 40$, $\text{Br} = 80$)

- (A) 10% Ca and 90% Br
- (B) 20% Ca and 80% Br
- (C) 25% Ca and 75% Br
- (D) 33% Ca and 67% Br
- (E) 50% Ca and 50% Br

62. Two samples were weighed using different balances and the following data were obtained.

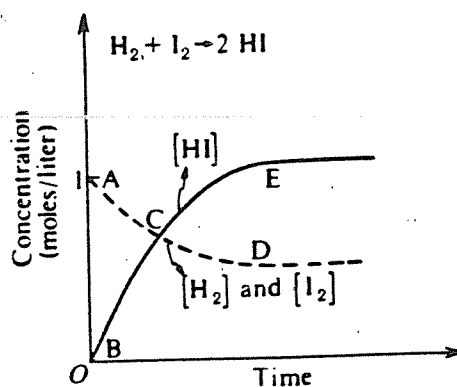
Sample #1 = 3.719 grams
Sample #2 = 0.42 gram

The total mass of the samples should be reported as

- (A) 4 grams
- (B) 4.1 grams
- (C) 4.139 grams
- (D) 4.14 grams
- (E) 4.140 grams

63. A solution of a base that has a pH of 9.0 has a hydrogen ion concentration of

- (A) 1×10^{-9} molar
- (B) 1×10^{-5} molar
- (C) 1×10^{-5} molar
- (D) 1×10^{-7} molar
- (E) 1×10^{-9} molar



64. The graph above shows the variation in concentration of reactants and products as H_2 and I_2 react to form HI at a given temperature. Equilibrium is reached when the concentration of HI is

- (A) A
- (B) B
- (C) C
- (D) D
- (E) E

65.

Element	Electronegativity
P	2.1
H	2.2
Br	2.8
O	3.5

On the basis of the electronegativity values given above, in which of the following are the bonds most polar?

- (A) PH_3
- (B) H_2O
- (C) HBr
- (D) P_4
- (E) PBr_3

66. Potassium hydroxide is a good conductor of an electric current in the

- (A) gaseous state only
- (B) molten (fused) state only
- (C) solid state only
- (D) solid and molten (fused) states
- (E) molten (fused) state and in aqueous solution

GO ON TO THE NEXT PAGE

CHEMISTRY TEST—Continued

67. Liquid	Vapor Pressure (mm Hg), 25° C
A	20
B	35
C	56
D	112
E	224

In which of the liquids listed in the table above are the intermolecular forces of attraction the strongest?

- (A) A
- (B) B
- (C) C
- (D) D
- (E) E

68. The range of oxidation states exhibited by most elements in group V of the periodic table (N, P, As, Sb, Bi) is

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

69. Mass of Empty Flask	38.913 grams
Mass of Flask + KMnO_4	39.898 grams
Mass of Flask + Residue (after ignition)	39.773 grams

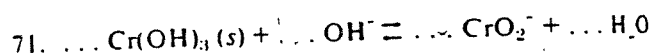
The data above were taken for the decomposition of KMnO_4 by ignition, which liberates oxygen and leaves a solid residue. The experimental mass ratio is

- (A) $\frac{0.125}{0.985}$ gram residue / gram KMnO_4
- (B) $\frac{0.125}{0.860}$ gram residue / gram KMnO_4
- (C) $\frac{0.860}{0.985}$ gram residue / gram KMnO_4
- (D) $\frac{0.985}{0.860}$ grams residue / gram KMnO_4
- (E) $\frac{0.860}{0.125}$ grams residue / gram KMnO_4

70. To find the concentration of a solution of a base by titration with a solution of an acid, which of the following represents the minimum data needed, assuming that the titration has been carried to the proper end point and that the equation for the reaction is known?

- I. Volume of acid
- II. Volume of base
- III. Concentration of acid

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



When the equation above is balanced, how many grams of water will be produced when 1.00 mole of CrO_2^- is formed?

- (A) 9.0 grams
- (B) 18.0 grams
- (C) 27.0 grams
- (D) 36.0 grams
- (E) 45.0 grams

GO ON TO THE NEXT PAGE

CHEMISTRY TEST—Continued

72. Which of the following statements concerning fluorine and chlorine is FALSE?

(A) Fluorine is more electronegative than chlorine.
 (B) The atomic radius of the fluorine atom is less than that of the chlorine atom.
 (C) Fluorine is a stronger oxidizing agent than chlorine.
 (D) Both fluorine and chlorine commonly exist in positive and negative oxidation states.
 (E) Both fluorine and chlorine are diatomic gases at room conditions.

73. How many moles of sodium oxalate, $\text{Na}_2\text{C}_2\text{O}_4$, are present in 6.7 grams of this compound? (Atomic weights: C = 12, O = 16, Na = 23)

(A) 2.0 moles
 (B) 1.0 mole
 (C) 0.50 mole
 (D) 0.10 mole
 (E) 0.050 mole

74. A sample of 90.0 grams of glucose is dissolved in enough water to yield 200. milliliters of solution. What is the molar concentration of glucose (molecular weight 180.)?

(A) 0.500 M
 (B) 1.00 M
 (C) 2.00 M
 (D) 2.50 M
 (E) 10.0 M

75. $\text{CO}_2(\text{g}) + \text{C}(\text{s}) \rightarrow 2 \text{CO}(\text{g})$

A sample of 100 liters of carbon dioxide at 25°C and 1 atmosphere pressure is reduced by being passed over hot coke according to the equation above. When measured at 25°C and 1 atmosphere pressure, the volume of carbon monoxide formed is

(A) 22.4 liters
 (B) 44.8 liters
 (C) 50 liters
 (D) 100 liters
 (E) 200 liters

76. Which of the following acids, listed with their ionization constants at 25°C , is the strongest?

(A) Nitrous acid (HNO_2) $K_i = 4.5 \times 10^{-4}$
 (B) Formic acid (HCHO_2) $K_i = 1.8 \times 10^{-4}$
 (C) Benzoic acid ($\text{HC}_7\text{H}_5\text{O}_2$) $K_i = 6.3 \times 10^{-5}$
 (D) Acetic acid ($\text{HC}_2\text{H}_3\text{O}_2$) $K_i = 1.8 \times 10^{-5}$
 (E) Hydrocyanic acid (HCN) $K_i = 4.0 \times 10^{-10}$

77. $\dots \text{S}_2\text{O}_8^{2-} + \dots \text{I}^- \rightarrow \dots \text{SO}_4^{2-} + \dots \text{I}_2$

What is the maximum yield of iodine that can be obtained when 1 mole of $\text{Na}_2\text{S}_2\text{O}_8$ reacts completely with excess iodide ion according to the equation above? (Equation above is not balanced.)

(A) 1 mole
 (B) 2 moles
 (C) 4 moles
 (D) 6 moles
 (E) 8 moles

78. The heat of formation for CO_2 is given as $\Delta H = -94.2 \text{ kcal/mole}$. The negative value of ΔH indicates that

(A) CO_2 is formed from its elements by an endothermic reaction
 (B) the reaction of carbon with oxygen occurs rapidly at 25°C
 (C) the enthalpy of the product CO_2 is less than that of the reactants, O_2 and C
 (D) no heat is liberated when carbon is oxidized
 (E) 94.2 kcal must be added to oxidize one mole of carbon

79. The oxidation number of the nitrogen atom in the ammonium ion is

(A) +3
 (B) +2
 (C) +1
 (D) -2
 (E) -3

GO ON TO THE NEXT PAGE 

CHEMISTRY TEST—Continued

80. Which of the following is a saturated hydrocarbon?

(A) C_2H_2
 (B) C_2H_4
 (C) C_2H_6
 (D) C_6H_6
 (E) C_6H_{10}

81. The volume occupied by 0.50 mole of propane gas, C_3H_8 , at a temperature of $27^\circ C$ and a pressure of 2.0 atmospheres is best expressed by which of the following? ($R = 0.082$ liter-atm mole $^{-1}$ K)

(A) $\frac{0.50 \times 0.082 \times 27}{2}$ liters
 (B) $\frac{0.50 \times 0.082 \times 300}{2}$ liters
 (C) $\frac{0.50 \times 0.082 \times 273}{300}$ liters
 (D) $\frac{0.50 \times 0.082 \times 300}{2 \times 760}$ liters
 (E) $\frac{0.50 \times 0.082 \times 27}{2 \times 760}$ liters

82. $N_2(g) + 3 H_2(g) \rightleftharpoons 2 NH_3(g)$

The correct equilibrium expression, K_c , for the formation of ammonia according to the equation above is

(A) $K_c = \frac{[N_2][H_2]}{[NH_3]}$
 (B) $K_c = \frac{[NH_3]}{[N_2][H_2]}$
 (C) $K_c = \frac{[N]^2[H]^6}{[NH_3]^2}$
 (D) $K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$
 (E) $K_c = \frac{[N_2][H_2]^3}{[NH_3]^2}$

83. In qualitative analysis the separation of Ag^+ ions from Cu^{2+} ions by the addition of HCl depends on the fact that

(A) Cu^{2+} forms an insoluble chloride and Ag^+ does not
 (B) Ag^+ forms an insoluble chloride and Cu^{2+} does not
 (C) Cu^{2+} forms a complex with HCl and Ag^+ does not
 (D) Cu reacts with HCl and Ag does not
 (E) Ag^+ is oxidized by HCl whereas Cu^{2+} is in its highest oxidation state

84. A battery jar contained a solution of copper sulfate. Two electrodes, one made of copper, the other a metal object to be copper plated, were placed in the jar and connected to a source of direct current. Which of the following statements concerning this system is correct?

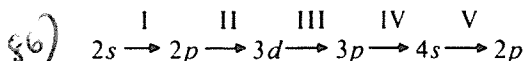
(A) The object to be plated is the anode.
 (B) Oxidation occurs at the anode.
 (C) The sulfate ions migrate toward the cathode.
 (D) The concentration of the copper sulfate solution increases as electrolysis proceeds.
 (E) The copper electrode increases in mass.

85. Which of the following contains the greatest total number of atoms?

(A) One mole of CO_2 (molecular weight = 44)
 (B) One mole of H_2O_2 (molecular weight = 34)
 (C) One molecule of glucose, $C_6H_{12}O_6$ (molecular weight = 180)
 (D) One gram of helium (atomic weight = 4)
 (E) One gram of H_2O (molecular weight = 18)

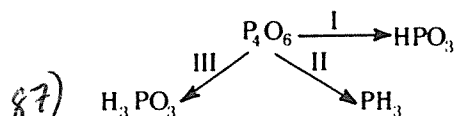
GO ON TO THE NEXT PAGE 

CHEMISTRY TEST—Continued



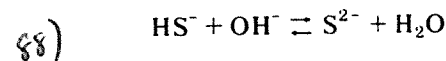
The electronic transitions shown above are observed when lithium atoms are sprayed into a hot flame. The various transitions are numbered for identification. Which of these transitions would result in emission of electromagnetic radiation (light)?

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



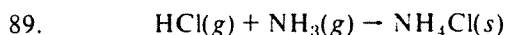
The compound P_4O_6 may be chemically converted into a variety of other species by processes I-III, indicated above. In which of the conversions above is phosphorus reduced?

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



In the system indicated by the equation above, which of the substances are Brönsted acids?

- (A) HS^- and H_2O
- (B) HS^- and S^{2-}
- (C) HS^- and OH^-
- (D) S^{2-} and H_2O
- (E) OH^- and H_2O



If 3.0 moles of HCl gas and 5.0 moles of NH_3 gas, each measured at 20°C and 1.0 atmosphere pressure, are allowed to react completely according to the equation above, the final mixture will contain

- (A) 3 moles of solid NH_4Cl only
- (B) 5 moles of solid NH_4Cl only
- (C) 3 moles of solid NH_4Cl + 2 moles of NH_3 gas
- (D) 3 moles of solid NH_4Cl + 2 moles of HCl gas
- (E) 2 moles of HCl gas, 4 moles of NH_3 gas, and 1 mole of solid NH_4Cl

90. In an electrolysis cell, the passage of 6.02×10^{23} electrons can produce

- (A) 22.4 liters of H_2 gas (measured at standard conditions) from dilute H_2SO_4 solution
- (B) 22.4 liters of O_2 gas (measured at standard conditions) from dilute H_2SO_4 solution
- (C) 1 mole of Cl_2 gas from HCl solution
- (D) 1 mole of metallic silver from AgNO_3 solution
- (E) 1 mole of metallic copper from CuSO_4 solution

S T O P

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

1982

How to Score the Chemistry Achievement Test

When you take the Chemistry Achievement Test, your answer sheet will be "read" by a scanning machine that will record your responses to each question. Then a computer will compare your answers with the correct answers and produce your raw score. You get one point for each correct answer. For each

wrong answer, you lose one-fourth of a point. Questions you omit (and any for which you mark more than one answer) are not counted. This raw score is converted to a College Board scaled score that is reported to you and to the colleges you specify. After you have taken this test, you can get an idea of what your score might be by following the instructions in the next two sections.

Determining Your Raw Score

Step 1: Table A on the next page lists the correct answers for all the questions on the test.* Compare your answer with the correct answer and • Put a check in the column marked "Right" if your answer is correct. • Put a check in the column marked "Wrong" if your answer is incorrect. • Leave both columns blank if you omitted the question.
Step 2: Count the number of right answers and enter the number here
Step 3: Count the number of wrong answers and enter the number here 4) _____ Enter the result of dividing by 4 here
Step 4: Subtract the number you obtained in Step 3 from the number in Step 2; round the result to the nearest whole number (.5 is rounded up) and enter here.. ..
The number you obtained in Step 4 is your raw score. (The correction for guessing — subtraction of a quarter of a point for each incorrect answer — adjusts for the fact that random guessing on a large number of questions will result in some questions being answered correctly by chance.) Instructions for converting your raw score to a scaled score follow.

*The last column in Table A gives the percentage of students who took the test in December 1982 that answered the question correctly. (See page 71 for further explanation.)

1982

Finding Your College Board Scaled Score

When you take Achievement Tests, the scores sent to the colleges you specify will be reported on the College Board scale, ranging from 200 to 800. The raw score that you obtained above (Step 4) can be converted to a scaled score by using Table B.

To find your scaled score on this test, locate your raw score in the left column of Table B; the corresponding score in the right column will be your College Board scaled score. For example, a raw score of 41 on this particular edition of the Chemistry Achievement Test corresponds to a College Board

scaled score of 580. Raw scores are converted to scaled scores to ensure that a score earned on any one edition of the Chemistry Achievement Test is comparable to the same scaled score earned on any other edition of the test.

Because some editions of the Chemistry Achievement Test may be slightly easier or more difficult than others, statistical adjustments are made in the scores so that each College Board scaled score indicates the same level of performance, regardless of the edition of the test you take and the ability of the group you take it with. A given raw score will correspond to

TABLE B SCORE CONVERSION TABLE					
Chemistry Achievement Test, Form 3EAC					
Raw Score	College Board Scaled Score	Raw Score	College Board Scaled Score	Raw Score	College Board Scaled Score
90	800	50	640	10	390
89	800	49	630	9	380
88	800	48	620	8	370
87	800	47	620	7	370
86	800	46	610	6	360
85	800	45	610	5	360
84	800	44	600	4	350
83	800	43	590	3	340
82	800	42	590	2	340
81	800	41	580	1	330
80	800	40	570	0	320
79	800	39	570	-1	320
78	800	38	560	-2	310
77	800	37	560	-3	310
76	800	36	550	-4	300
75	790	35	540	-5	290
74	790	34	540	-6	290
73	780	33	530	-7	280
72	770	32	520	-8	270
71	770	31	520	-9	270
70	760	30	510	-10	260
69	750	29	510	-11	260
68	750	28	500	-12	250
67	740	27	490	-13	240
66	740	26	490	-14	240
65	730	25	480	-15	230
64	720	24	470	-16	230
63	720	23	470	-17	220
62	710	22	460	-18	210
61	700	21	460	-19	210
60	700	20	450	-20 through -22	200
59	690	19	440		
58	690	18	440		
57	680	17	430		
56	670	16	420		
55	670	15	420		
54	660	14	410		
53	660	13	410		
52	650	12	400		
51	640	11	390		

1982

Answer Key

1982

TABLE A

Answers to Chemistry Achievement Test, Form 3EAC, and Percentage of Students Answering Each Question Correctly

Question Number	Correct Answer	Right	Wrong	Percentage of Students Answering the Question Correctly	Question Number	Correct Answer	Right	Wrong	Percentage of Students Answering the Question Correctly
1	C			87%	46	A			38%
2	E			57	47	A			57
3	B			87	48	B			41
4	D			59	49	E			42
5	B			80	50	D			32
6	C			49	51	E			41
7	D			46	52	D			24
8	A			83	53	E			83
9	E			69	54	A			79
10	A			62	55	D			60
11	E			60	56	D			46
12	C			64	57	C			71
13	E			51	58	B			57
14	D			38	59	E			73
15	B			72	60	C			78
16	B			50	61	B			63
17	D			40	62	D			56
18	E			51	63	E			55
19	C			46	64	E			37
20	D			24	65	B			47
21	C			65	66	E			48
22	E			27	67	A			47
23	E			55	68	C			32
24	D			79	69	C			48
25	B			30	70	E			48
26	B			85	71	D			46
27	E			76	72	D			43
28	E			85	73	E			51
29	C			67	74	D			37
30	E			30	75	E			29
31	D			51	76	A			35
32	A			36	77	A			42
33	C			31	78	C			26
34	C			45	79	E			34
35	B			41	80	C			37
36	E			34	81	B			29
37	B			47	82	D			39
38	D			20	83	B			19
39	A			62	84	B			19
40	C			62	85	B			22
41	A			41	86	E			15
42	C			22	87	B			14
43	A			65	88	A			20
44	A			57	89	C			31
45	B			49	90	D			11

Notes: The percentages are based on the analysis of the answer sheets for a random sample of students who took this test in December 1982 and whose mean score was 550.