Sectional Test 1

CHAPTERS 1–5

You should make this test as realistic as possible. **Tear out this test so that you do not have access to the information in the** *Student's Guide*. Use only data provided in the questions and a periodic table. Do not check your answers until you are finished. If you answer questions incorrectly, review the section in the text indicated after each question.

Choose the best response for each question.

1. Which prefix matches the fraction or multiple of a basic unit?
   (1) centi-: 10^{-2} (2) milli-: 10^{-3} (3) micro-: 10^{-6} (4) kilo-: 10^{3}
   (a) (1), (2) (b) (1), (2), (3) (c) (1), (3), (4) (d) all
   [1–3]

2. Which pair consists of equalities?
   (a) −117°C, −179°F (b) −117°C, 390 K (c) −32°C, 0°F
   (d) 0°F, 243 K
   [1–3]

3. Which pair consists of equalities?
   (a) 6×10^{-2} mm, 6×10^{-5} m (b) 3×10^{-4} µg, 3×10^{-7} g
   (c) 3×10^{-3} mL, 3 L (d) 7×10^{-2} g/mL, 7×10^{-9} kg/L
   [1–3]

4. Which number contains exactly four significant figures?
   (a) 1240 (b) 124.0 (c) 0.0124 (d) 0.124
   [1–4]

5. How many liters will 1760 g of benzene occupy at 20°C if $d_{20°C}$ = 0.88 g/mL?
   (a) 0.25 L (b) 0.50 L (c) 1.0 L (d) 2.0 L
   [1–3, 1–5]

6. How many grams of sugar are contained in 1.00 L of a sugar solution that has a density of 1.15 g/mL and contains 52.0 percent sugar?
   (a) 1150 g (b) 598 g (c) 552 g (d) 115 g
   [1–3, 1–5]

7. What is the mass in grams of a 5.0 grain aspirin tablet, given the following Apothecaries' Weight System: 60 grains = 1 dram and 96 drams = 1 lb? (454 g = 1 lb.)
   (a) 42.6 g (b) 37.8 g (c) 1.39 g (d) 0.39 g
   [1–5]

8. What is the correct sum for the following measurements: 3.65×10^{1} cm, 4.26×10^{2} cm, 1.32×10^{2} cm?
   (a) 9.23×10^{1} cm (b) 9.23×10^{2} cm (c) 5.95×10^{2} cm
   (d) 5.945×10^{2} cm
   [1–4]

9. How many significant figures should the result of the following calculation possess?

   $$(2.65)(3.002)(38.26 - 1.2) =$$

   (a) 1 (b) 2 (c) 3 (d) 4
   [1–4]

10. Which of the following statements is true, given the following information?
    Density of A = 2.0 g/mL; Density of B = 3.5 g/mL; Density of C = 0.10 g/mL; All densities are at 20°C
    (a) 1 mL of A weighs more than 1 mL of B.
    (b) 10 g of C has a smaller volume than 10 g of B.
    (c) A, B, and C all have densities greater than water at 20°C.
    (d) One liter of B has a greater mass than 1 liter of C.
    [1–3]

11. Which of the following names of elements is *incorrectly* matched with its chemical symbol?
    (a) sodium–Na (b) phosphorus–P (c) magnesium–Mn (d) tin–Sn
    [2–6]

12. Which of the following is *incorrectly* named?
    (a) H_3PO_4–phosphoric acid (b) PO_4^{3-}–phosphate ion
    (c) HCl–hydrochloric acid (d) Cl^-–chloride ion
    [2–6]

13. Which of the following is *incorrectly* named?
    (a) CO–carbon monoxide (b) SO_2–sulfur dioxide
    (c) PCl_3–phosphorus trichloride (d) N_2O–nitrogen oxide
    [2–6]

14. Which of the following is *incorrectly* named?
    (a) $CaCl_2$–calcium chloride (b) Na_3PO_4–sodium phosphate
    (c) $KClO_4$–potassium chlorate (d) $Mg(NO_2)_2$–magnesium nitrite
    [2–6]

15. Which of the following is true about Dalton's Atomic Theory?
    (a) Atoms were viewed as indivisible.
    (b) It was the first statement on the atomic characteristics of matter.
    (c) It was immediately and widely accepted.
    (d) All of his postulates are still true based on today's information.
    [2–1]

16. Which of the following is the atomic mass of silver given the following distribution and masses of naturally occurring isotopes of silver: $^{107}_{47}Ag$: 51.88%, 106.906 amu; and $^{109}_{47}Ag$: 48.12%, 108.905 amu.
    (a) 107.868 amu (b) 106.926 amu (c) 108.255 amu
    (d) 108.642 amu
    [3–3]

17. Which of the following is *not* an empirical formula?
    (a) N_2O (b) N_2O_4 (c) NO_2 (d) HNO_3
    [2–5]

18. Which of the following is an ionic compound?
    (a) CO_2 (b) PCl_5 (c) NO_2 (d) $BaCl_2$
    [2–5]

19. Which of the following is true about $^{63}_{29}Cu$? It has
    (a) 63 protons. (b) 29 electrons. (c) 29 neutrons. (d) 63 neutrons.
    [2–3]

20. How many electrons does $^{24}_{12}Mg^{2+}$ possess?
    (a) 10 (b) 12 (c) 14 (d) 24
    [2–3]

21. Which of the following reactions represents a decomposition reaction?
    (a) $P_4O_{10} + 6H_2O \rightarrow 4H_3PO_4$ (b) $2NaN_3 \rightarrow 2Na + 3N_2$
    (c) $2H_2O + O_2 \rightarrow 2H_2O_2$ (d) $HCl + NaOH \rightarrow NaCl + H_2O$
    [3–2]

22. Which of the following chemical equations is not balanced?
    (a) $CaF_2 + H_2SO_4 \rightarrow 2HF + CaSO_4$
    (b) $Ca_3(PO_4)_2 + 4H_3PO_4 \rightarrow 3Ca(H_2PO_4)_2$
    (c) $NaNO_3 + H_2SO_4 \rightarrow Na_2SO_4 + 2HNO_3$
    (d) $P_4O_6 + 6H_2O \rightarrow 4H_3PO_3$
    [3–1]

23. What is the coefficient in front of MnO_2 when the following equation is balanced?

    $$MnO_2 + Al \longrightarrow Mn + Al_2O_3$$

    (a) 1 (b) 2 (c) 3 (d) 4
    [3–1]

24. Which of the following contains 6.00×10^{16} atoms?
    (a) 6.00×10^{16} H_2O molecules
    (b) 3.00×10^{16} Cl_2 molecules
    (c) 2.00×10^{16} P_4 molecules
    (d) 1.50×10^{16} $CaSO_4$ empirical units
    [3–5]

25. How many atoms are there in 36.20 g of P_4 (mass of one mole P = 30.97 g)
    (a) 1.746×10^{23} atoms (b) 1.746×10^{23} atoms
    (c) 7.040×10^{23} atoms (d) 7.040×10^{23} atoms
    [3–5]

26. What is the percentage of Ca in one mole of $Ca_3(PO_4)_2$? (Mass of one mole: Ca, 40.1 g; P, 31.0 g; O, 16.0 g)
    (a) 9.9% (b) 20.0% (c) 12.9% (d) 38.8%
    [3–5]

27. What is the empirical formula of caffeine if it contains 5.19% H, 28.85% N, 16.48% O, and 49.48% C by weight?
    (a) $C_4H_5NO_2$ (b) $C_2H_9NO_2$ (c) C_3H_5NO (d) $C_4H_5N_2O$
    [3–6]

28. How many milliliters of 1.00 M NaOH are required to completely neutralize 100.0 mL of 0.500 M H_3PO_4?
    (a) 50.0 mL (b) 100.0 mL (c) 150.0 mL (d) 200.0 mL
    [3–7, 4–7]

29. What is the molarity of a $NaNO_3$ solution if 25.0 mL of a 0.200 M $NaNO_3$ solution is diluted to 100.0 mL?
    (a) 0.0500 M (b) 0.100 M (c) 0.150 M (d) 0.200 M
    [4–1]

30. What is the mass of Cu produced if 10.0 g of Cu_2S reacts with 16.0 g of O_2 as follows: (Mass of one mole: Cu, 63.5 g; O, 16.0 g; S, 32.1 g.)

    $$Cu_2S + O_2 \longrightarrow 2Cu + SO_2$$

    (a) 31.8 g (b) 63.5 g (c) 3.99 g (d) 7.98 g
    [3–7, 3–8]

31. What is the percent yield if 25.0 g of I_2 is formed when 130.0 g of HNO_3 reacts with 285.0 g of HI as follows: (Mass of one mole: H, 1.01 g; N, 14.0 g; O, 16.0 g; I, 126.9 g.)

    $$2HNO_3 + 6HI \longrightarrow 2NO + 3I_2 + 4H_2O$$

    (a) 92 g (b) 142 g (c) 283 g (d) 566 g
    [3–7, 3–8]

32. How many moles of $KClO_3$ are required to produce 2.51 g of O_2? (Mass of one mole: K, 39.1 g; Cl, 35.5 g; O, 16.0 g.)

    $$2KClO_3 \longrightarrow 2KCl + 3O_2$$

    (a) 1.18×10^{-1} mol (b) 5.23×10^{-2} mol (c) 2.35×10^{-1} mol
    (d) 1.57×10^{-2} mol
    [3–7, 3–8]

33. What is the molarity of a solution that contains 32.0 g of HCl (molar mass = 36.46 g) in 2.50 L of solution?
    (a) 0.00351 M (b) 0.0128 M (c) 0.351 M (d) 12.8 M
    [4–1]

34. How many moles of H_2SO_4 are present in 250 mL of a 3.00 M H_2SO_4 solution?
    (a) 0.150 moles (b) 0.750 moles (c) 1.50 moles (d) 750 moles
    [4–1]

For questions 35 through 42, identify each substance as a (a) strong electrolyte, (b) weak electrolyte, or (c) nonelectrolyte in water.

35. HCl   36. HF   37. HCN   38. NH_3
39. Sugar   40. I_2 41. $HClO_4$ 42 $MgCl_2$

43. Which of the following is not a strong base?
    (a) NaOH (b) $Ca(OH)_2$ (c) LiOH (d) NH_3
    [4–3]

44. When HBr is neutralized with KOH, what salt is produced?
    (a) H_2O (b) KH (c) KBr (d) K_2O
    [4–3]

45. When the following is completed and balanced,

    $$Al(OH)_3(s) + H_2SO_4(aq)$$

    the products of the reaction are
    (a) $AlSO_4(aq) + 6H_2O(l)$ (b) $Al_2(SO_4)_3(aq) + 6H_2O(l)$
    (c) $AlSO_4(s) + H_2O(l)$ (d) $Al_2(SO_4)_3(aq) + H_2O(l)$
    [4–3]

46. What are the spectator ions in the reaction

$$BaCl_2(aq) + Na_2SO_4(aq) \longrightarrow 2NaCl(aq) + BaSO_4(s)$$

(a) Ba^{2+}, Cl^- (b) Na^+, Cl^- (c) Ba^{2+}, SO_4^{2-} (d) Na^+, SO_4^{2-}
[4–4]

47. Which of the following is the net ionic equation for the reaction

$$Fe(NO_3)_3(aq) + K_3PO_4(aq) \longrightarrow FePO_4(s) + 3KNO_3(aq)$$

(a) $K^+(aq) + NO_3^-(aq) \rightarrow KNO_3(aq)$
(b) $Fe^{3+}(aq) + PO_4^{3-}(aq) \rightarrow FePO_4(aq)$
(c) $3K^+(aq) + PO_4^{3-}(aq) \rightarrow K_3PO_4(aq)$
(d) $Fe^{3+}(aq) + PO_4^{3-}(aq) \rightarrow FePO_4(s)$
[4–4, 4–5]

For questions 48 through 53, identify each species as (a) soluble or (b) insoluble in water. [4–4]

48. Na_3PO_4 **49.** $AgBr$ **50.** NH_4NO_3 **51.** $Ni(OH)_2$

52. $CaCO_3$ **53.** $BaCl_2$

54. What is the net ionic equation for the reaction between $Cu(NO_3)_2(aq)$ and $NaOH(aq)$?

(a) no reaction (b) $Na^+(aq) + NO_3^-(aq) \rightarrow NaNO_3(s)$
(c) $Cu^{2+}(aq) + 2OH^-(aq) \rightarrow Cu(OH)_2(s)$
(d) $Cu^{2+}(aq) + 2NO_3^-(aq) \rightarrow Cu(NO_3)_2(s)$
[13–1]

55. What is the net ionic equation for the reaction between $Pb(NO_3)_2(aq)$ and $CaCl_2(aq)$?

(a) no reaction (b) $Pb^{2+}(aq) + 2Cl^-(aq) \rightarrow PbCl_2(s)$
(c) $Pb^{2+}(aq) + 2NO_3^-(aq) \rightarrow Pb(NO_3)_2(s)$
(d) $Ca^{2+}(aq) + 2NO_3^-(aq) \rightarrow Ca(NO_3)_2(s)$
[4–5]

56. Which of the following is most easily oxidized?

(a) Na (b) Cl_2 (c) Au (d) S
[4–6]

57. When a strong acid reacts with a metal, which of the following is formed?

(a) $H_2(g)$ (b) $H_2O(l)$ (c) an element of the acid
(d) another acid
[4–6]

58. Magnesium is more active than cobalt and hydrogen lies below both of them in the activity series. This means that

(a) cobalt is the most easily oxidized.
(b) magnesium is the most easily oxidized.
(c) neither metal reacts with acids.
(d) water is produced when the metals react with hydrogen ion.
[4–6]

59. Copper does not react with hydrochloric acid whereas manganese does. This means that

(a) copper is more active than hydrogen

(b) manganese is less active than hydrogen
(c) chloride ion will react with copper.
(d) manganese is higher on the activity series than copper
[4–6]

60. Which of the following metals *cannot* displace hydrogen from water (steam or liquid)?

(a) Mg (b) Ba (c) Li (d) Ag
[4–6]

61. Use the activity series in your text to predict which of the following reactions will occur.

(a) $Cu(s) + 2AgNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + 2Ag(s)$
(b) $3Fe(s) + Al_2(SO_4)_3(aq) \rightarrow 2Al + 3FeSO_4(aq)$
(c) $H_2(g) + LiOH(aq) \rightarrow 2Li(s) + 2H_2O(l)$
(d) $Cu(s) + ZnSO_4(aq) \rightarrow Zn(s) + CuSO_4(aq)$
[4–6]

62. Which of the following will *always* decrease the internal energy of a gaseous system?

(a) an endothermic process and a corresponding decrease in volume
(b) an endothermic process and a corresponding increase in volume
(c) an exothermic process and a corresponding increase in volume
(d) an exothermic process and a corresponding decrease in volume
[5–2]

63. What is ΔH_f° for one mole of $C_2H_5OH(l)$ given the following data at 25°C:

$$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$$

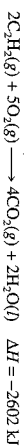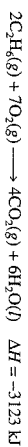$$\Delta H_{rxn}^\circ = -1366.0 \text{ kJ}; \quad \Delta H_f^\circ(H_2O(l)) = -285.8 \text{ kJ/mol};$$
$$\Delta H_f^\circ(CO_2(g)) = -393.5 \text{ kJ/mol};$$

(a) +362.6 kJ (b) +277.8 kJ (c) -362.6 kJ (d) -278.4 kJ
[5–6]

64. What is the heat of hydrogenation of acetylene, at 25°C and 1 atm,

$$C_2H_2(g) + 2H_2(g) \longrightarrow C_2H_6(g)$$

given the following thermochemical equations:

$$2C_2H_6(g) + 7O_2(g) \longrightarrow 4CO_2(g) + 6H_2O(l) \quad \Delta H = -3123 \text{ kJ}$$
$$2C_2H_2(g) + 5O_2(g) \longrightarrow 4CO_2(g) + 2H_2O(l) \quad \Delta H = -2602 \text{ kJ}$$
$$H_2(g) + 1/2O_2(g) \longrightarrow H_2O(l) \quad \Delta H = -286 \text{ kJ}$$

(a) –312 kJ (b) +312 kJ (c) +1613 kJ (d) –1613 kJ
[5–5]

65. What is the heat of combustion for one mole of benzene at 25°C and 1 atm,

$$2C_6H_6(l) + 15O_2(g) \longrightarrow 12CO_2(g) + 6H_2O(l)$$

given the following data: ΔH_f° $(CO_2(g)) = -394$ kJ/mol; $\Delta H_f^\circ(H_2O(l)) = -286$ kJ/mol; $\Delta H_f^\circ(C_6H_6(l)) = 49$ kJ/mol.

(a) +3271 kJ (b) –3271 kJ (c) +1636 kJ (d) –1636 kJ
[5–6]

66. What is ΔE for a system when it does 230 kJ of work on its surroundings and 130 kJ of heat is removed from the system?

(a) +100 kJ (b) −100 kJ (c) +360 kJ (d) −360 kJ

[5–3]

67. When is ΔH approximately equal to ΔE?

(a) at constant pressure (b) $P\Delta V$ is large (c) $P\Delta V$ is small

(d) pressure is large

[5–3]

68. What is the final temperature of 30 g of Al if 2000 J of heat is added to a sample at 25.0°C? (specific heat of Al = 0.902 J/K·g)

(a) 32.6°C (b) 98.9°C (c) 120.2°C (d) 2192°C

[5–7]

69. What is the specific heat of copper if 90.0 g of Cu at 39.1°C is placed in water at 30.0°C, the calorimeter gains 263 J, and the final temperature of the mixture is 31.5°C?

(a) 0.126 J/K·g (b) 0.385 J/K·g (c) 10.2 J/K·g (d) 34.65 J/K·g

[5–7]

70. What is the final temperature in degrees centigrade of 100.0 g of water at 30.0°C if it is mixed with 50.0 g of water at 0.0°C?

(a) 40.0 (b) 20.0 (c) 15.0 (d) 10.0

[5–7]

ANSWERS

1. (d).	2. (a).	3. (a).	4. (b).	5. (d).	6. (b).	7. (d).	8. (c).	9. (c).
10. (d).	11. (c).	12. (b).	13. (d).	14. (c).	15. (a).	16. (a).	17. (b).	18. (d).
19. (b).	20. (a).	21. (a).	22. (c).	23. (c).	24. (b).	25. (b).	26. (d).	27. (d).
28. (c).	29. (a).	30. (a).	31. (c).	32. (c).	33. (c).	34. (b).	35. (a).	36. (b).
37. (b).	38. (b).	39. (c).	40. (c).	41. (a).	42. (a).	43. (d).	44. (c).	45. (b).
46. (b).	47. (d).	48. (a).	49. (b).	50. (a).	51. (b).	52. (b).	53. (a).	54. (c).
55. (b).	56. (a).	57. (a).	58. (b).	59. (d).	60. (d).	61. (a).	62. (c).	63. (d).
64. (a).	65. (b).	66. (d).	67. (c).	68. (b).	69. (b).	70. (b).		

Electronic Structures of Atoms

6

OVERVIEW OF THE CHAPTER

Objectives: You should be able to:

6.1 ELECTROMAGNETIC RADIATION

1. Describe the wave properties, and characteristic speed of propagation of radiant energy (electromagnetic radiation).
2. Use the relationship $\lambda \nu = c$, which relates the wavelength (λ) and the frequency (ν) of radiant energy to its speed (c).

Objectives: You should be able to:

6.2 QUANTIZATION OF ENERGY

1. Explain the essential feature of Planck's quantum theory, namely, that the smallest increment, or quantum, of radiant energy of frequency, ν, that can be emitted or absorbed is $h\nu$, where h is Planck's constant.
2. Explain how Einstein accounted for the photoelectric effect by considering the radiant energy to be a stream of particle-like photons striking a metal surface. In other words, you should be able to explain all the observations about the photoelectric effect using Einstein's model.

Objectives: You should be able to:

6.3 LINE SPECTRA AND THE BOHR MODEL

1. Explain the origin of the expression *line spectra.*
2. List the assumptions made by Bohr in his model of the hydrogen atom.
3. Explain the concept of an allowed energy state and how this concept is related to the quantum theory.
4. Calculate the energy differences between any two allowed energy states of the electron in hydrogen.
5. Explain the concept of ionization energy.

CHAPTERS 6-9

You should make this test as realistic as possible. **Tear out this test so that you do not have access to the information in the** *Student's Guide.* **Use only the data provided in the questions and a periodic table. Do not check your answers until you are finished. If you answer questions incorrectly, review the section in the text indicated after each question.**

Choose the best response for each question.

1. The energy required to break a nitrogen triple bond is 1,113 kJ/mol. Calculate the wavelength in meters of photons having sufficient energy to break this bond ($h = 6.63 \times 10^{-34}$ J-s, $c = 3.00 \times 10^8$ m/s.)

(a) $\dfrac{(6.63\times10^{-34} \text{ J-s})(3.00\times10^8 \text{ m/s})}{1,113 \text{ kJ}} = 1.79\times10^{-28}$ m

(b) $\dfrac{(6.63\times10^{-34} \text{ J-s})(3.00\times10^8 \text{ m/s})}{1,113\times10^6 \text{ J}} = 1.79\times10^{-31}$ m

(c) $\dfrac{(6.63\times10^{-34} \text{ J-s/molecule})(3.00\times10^8 \text{ m/s})}{(1,113 \text{ kJ/mol})(6.023\times10^{23} \text{ molecules/mole})} = 5.92\times10^{-52}$ m

(d) $\dfrac{\left(\dfrac{6.63\times10^{-34} \text{ J-s}}{\text{molecule}}\right)(3.00\times10^8 \text{ m/s})\left(6.023\times10^{23}\, \dfrac{\text{molecules}}{\text{mole}}\right)}{(1.113\times10^6 \text{ J/mol})}$

$= 1.07\times10^{-7}$ m

[6-1, 6-2]

2. What is the frequency of ultraviolet radiation with a wavelength of 15.3 nm?

(a) 1.96×10^{16}/s (b) 1.96×10^7/s (c) 4.59/s

(d) 4.59×10^{-9}/s

[6-1]

3. Which of the following statements is *not* correct?
(a) Photons of lower-frequency radiation have lower energies.
(b) Planck's study of black-body radiation led to the hypothesis that radiation is emitted in quantas of energy.
(c) Bohr's model of the hydrogen atom showed emission of energy by atoms occurs when an electron moves to a higher orbit.
(d) The lowest energy state of an electron in an atom is known as the ground state.
[6-1, 6-2, 6-3]

4. The energy of an electron in a Bohr orbit depends on the principal quantum number as follows:
(a) $E = R_H/n$ (b) $E = R_H/n^2$ (c) $E = -R_H/n$ (d) $E = -R_H/n^2$
[6-3]

5. As the principal quantum number of a Bohr orbit increases, the energy levels of a hydrogen atom
(a) become the same. (b) are closer together. (c) are further apart.
(d) approach an infinitely negative energy.
[6-3]

6. In the Bohr model of the hydrogen atom, which of the following statements is correct?
(a) When $n = \infty$, the electron is in its ground state.
(b) When $n = 1$, the electron is in an excited state.
(c) The transition $n = 2 \to n = 4$ represents emission of energy.
(d) The transition $n = 1 \to n = 3$ represents absorption of energy.
[6-3]

7. What is the ionization energy of the hydrogen atom in kJ/mol? ($R_H = 2.18 \times 10^{-18}$ J)
(a) $-R_H/1^2 = -2.18 \times 10^{-21}$ kJ/mol
(b) $R_H/1^2 = 2.18 \times 10^{-21}$ kJ/mol
(c) $(-R_H/1^2)(6.023 \times 10^{23} \text{ atoms/mol}) = -1.31 \times 10^3$ kJ/mol
(d) $(R_H/1^2)(6.023 \times 10^{23} \text{ atoms/mol}) = 1.31 \times 10^3$ kJ/mol
[6-3]

8. What is the initial principal quantum number for the transition to the $n = 1$ state if the frequency of the hydrogen line is 2.93×10^{15}/s? ($R_H = 2.18 \times 10^{-18}$ J, $h = 6.63 \times 10^{-34}$ J-s)
(a) 4 (b) 3 (c) 2 (d) 1
[6-3]

9. What are the possible values of m_l for $l = 3$?
(a) 3, -3 (b) 3, 0, 3 (c) 3, 2, 1, -1, -2, -3
(d) 3, 2, 1, 0, -1, -2, -3
[6-5]

10. Which set of quantum numbers for an electron in an atom is *not* allowed?

	n	l	m_l	m_s
(a)	2	1	0	-1/2
(b)	3	2	1	+1/2
(c)	3	3	2	+1/2
(d)	1	0	0	+1/2

[6-5]

11. Which electron has the label $3d$?

	n	l	m_l	m_s
(a)	3	2	1	
(b)	3	1	0	
(c)	3	0	0	
(d)	3	3	2	

[6-5]

12. Which hydrogen electron is *not* in an excited state?
(a) $1s^1$ (b) $2s^1$ (c) $3p^1$ (d) $4s^1$
[6–3, 6–9]

13. What is the total number of *orbitals* possible for $n = 3$?
(a) $n = 3$ (b) $2n = 6$ (c) $n^2 = 9$ (d) $2n^2 = 18$
[6–5, 6–7]

14. What is the maximum number of *electrons* that occupy the $n = 4$ energy level?
(a) $n = 4$ (b) $2n = 8$ (c) $n^2 = 16$ (d) $2n^2 = 32$
[6–5]

15. What is the value of l for a $5d$ electron?
(a) $l = 0$ (b) $l = 1$ (c) $l = 2$ (d) $l = 3$
[6–5, 6–7]

16. What are the possible m_l values for a $4p$ electron?
(a) 4, 3, 2, 1, 0, –1, –2, –3, –4
(b) 3, 2, 1, 0, –1, –2, –3
(c) 2, 1, 0, –1, –2
(d) 1, 0, –1
[6–5, 6–7]

17. Which of these is *not* allowed?
(a) $2s$ (b) $2f$ (c) $3p$ (d) $4d$
[6–6]
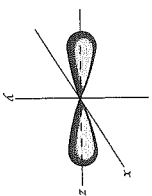
18. What is the correct label for the orbital
(a) $d_{z^2-y^2}$ (b) d_{xy} (c) d_{xz} (d) d_{yz}
[6–6]

19. What is the correct label for the orbital
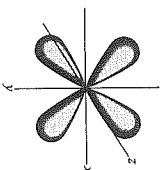
(a) s_z (b) p_z (c) p_y (d) d_{yz}
[6–6]

20. Which order of energies of orbitals is correct in a many-electron atom?
(a) $2s = 2p$ (b) $3s < 3p$ (c) $3d < 2s$ (d) $4s > 5s$
[6–7]

21. Which statement is *not* true for many-electron atoms?
(a) Outer electrons penetrate the electron clouds of inner electrons.
(b) Outer electrons experience the full nuclear charge.
(c) The $2s$ and $2p$ orbitals are of differing energies, whereas in a hydrogen atom they are the same.

(d) The $2p_x$ and $2p_y$ orbitals have the same energy in the absence of an applied magnetic field.
[6–5, 6–7]

22. Which of the following is the electron configuration of N (at. no. = 7) in its ground state?
(a) $1s^2 2s^2 2p^2$ (b) $1s^2 2s^2 2p^3$ (c) $1s^2 2s^2 2p^4$ (d) $1s^2 2p^5$
[6–8, 6–9]

23. Which of the following is the electronic configuration of Ni (at. no. = 28) in its ground state?
(a) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$ (b) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9 4s^1$
(c) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^6 5s^2$ (d) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^2$
[6–8, 6–9]

24. Which element has the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^2$?
(a) C (b) Si (c) N (d) P
[6–8, 6–9]

25. The number of valence shell electrons for oxygen is
(a) 2 (b) 4 (c) 6 (d) 8
[6–8]

26. Which of the following are valence electrons for Sr?
(a) $5s^1$ (b) $5s^2$ (c) $5s^1 5p^1$ (d) $6s^2$
[6–8]

27. Which of the following valence-electron orbital diagrams is correct for the ground state of As?

(a) 4s: [↑↓]   4p: [↑][↑][↑]

(b) 4s: [↑↓]   4p: [↑][↑][↑]

(c) 4s: [↑↓]   4p: [↑↓][↑][↑]

(d) 4s: [↑↓]   4p: [↑][↑][↑]

[6–9, 6–10]

28. Which of the following atoms is the largest?
(a) C (b) Si (c) Ge (d) Sn
[7–3]

29. Which of the following atoms is the largest?
(a) Na (b) Mg (c) O (d) F
[7–3]

30. Which of the following arrangements of increasing ionization energy is correct?
(a) Na < Rb (b) C < N (c) Cl < S (d) S < Te
[7–4]

31. Which element is expected to have the smallest first ionization energy?
(a) Be (b) Rb (c) F (d) O
[7–4]

32. Which order of electron affinities is *not* correct?
(a) Cl > Br > I (b) O > B > Li (c) Cs > Ba > P
(c) S > Se > Te
[7–5]

33. Which of the following is the peroxide ion?
(a) O^{1-} (b) O^{2-} (c) O_2^{2-} (d) O_2^-
[7–8]

34. Which statement is true?
(a) The coinage metals (Cu, Ag, Au) are less reactive than the alkali metals.
(b) Beryllium shows properties very similar to those of magnesium.
(c) Group 2A elements are more reactive than group 1A elements.
(d) Group 1A elements form +2 ions.
[7–7]

35. KO_2 is
(a) potassium oxide (b) potassium peroxide
(c) potassium superoxide (d) potassium hydroxide
[7–7, 7–8]

36. An acceptable Lewis dot structure of the *ground* state of C is
(a) $\cdot\ddot{C}\colon$ (b) $\cdot\ddot{C}\cdot$ (c) $\cdot\dot{C}\colon$ (d) $\cdot\dot{C}\cdot$
[8–1]

37. Which of the following statements is *false* for the reaction between $Rb(s)$ and $Cl_2(g)$?
(a) Rb is oxidized. (b) The product is RbCl.
(c) Cl^- ions are formed. (d) The product is covalent.
[8–2, 8–4]

38. Which of the following is *not* a typical property of an ionic solid?
(a) High melting point (b) Soft, moldable (c) Conductor of electricity when melted (d) Often soluble in water
[8–2]

39. Which of the following represents the correct order of lattice energies?
(a) $NaCl < MgCl_2$ (b) $MgO < Na_2O$ (c) $MgO = Al_2O_3$
(d) $NaF < CsBr$
[8–2]

40. Which of the following is *not* a correct chemical formula for a metallic oxide?
(a) Al_2O_3 (b) Na_2O (c) MgO (d) NO_2
[8–2]

41. Which of the following represents an isoelectronic series of ions, in order of *decreasing* ionic size?
(a) Na^+, K^+, Rb^+, Cs^+ (b) $O^{2-}, S^{2-}, Se^{2-}, Te^{2-}$
(c) $O^{2-}, F^-, Na^+, Mg^{2+}$ (d) $Ca^{2+}, K^+, Cl^-, S^{2+}$
[8–3]

42. Which order of ionic size is correct?
(a) $Na^+ > Mg^{2+}$ (b) $F^- > O^{2-}$ (c) $Rb^+ > K^+$ (d) $Ca^{2+} > Sr^{2+}$
[8–3]

43. Which of the following compounds is a covalent molecule?
(a) SO_2 (b) $CaCl_2$ (c) Al_2O_3 (d) Na_2S
[8–2, 8–4]

44. Which of the following is the correct Lewis dot structure for PCl_3?

(a) [structure]

(b) [structure]

(c) [structure]

(d) [structure]

[8–6]

45. Which of the following exhibits resonance?
(a) H_2O (b) ClO_3^- (c) SO_2 (d) HCl
[8–7]

46. How many lone pair *electrons* are on the Br atom in BrF_3?
(a) 2 (b) 3 (c) 4 (d) 6
[8–8]

47. Which of the following is the correct Lewis dot structure for KCN?
(a) $K-C\equiv N\colon$ (b) $K-C\equiv N\colon$ (c) $K^+\colon C\equiv N\colon^-$
(d) $K^+\colon C\equiv N\colon^-$
[8–6]

48. Which of the following statements concerning the bonding in the nitrite ion (NO_2) is *not* true?
(a) It possesses 18 valence electrons.
(b) The arrangement of bonds is O—O—N.
(c) Two resonance structures can be written.
(d) Its structure is trigonal planar.
[8–6, 9–1]

49. Which of the following possesses a polar covalent bond?
(a) $NaCl(s)$ (b) $O_2(g)$ (c) $Al(s)$ (d) $SO_2(g)$
[8–9]

50. Which is the most electronegative atom?
(a) Cl (b) Se (c) Al (d) Ca
[8–5]

51. Which species contains the strongest C—C bond?
(a) CH_4 (b) C_2H_6 (c) C_2H_4 (d) C_2H_2
[8–9]

Use the following responses for questions 52 through 56:
(a) +7 (b) +6 (c) +5 (d) +4 (e) +2 (f) +1 (g) 0
(h) –1 (i) –2 (j) –3 (k) –4 (l) –5
[8–10]

52. What is the oxidation number of nitrogen in NO_3^-?
53. What is the oxidation number of chlorine in $NaClO_4$?
54. What is the oxidation number of iodine in I_2?
55. What is the oxidation number of nitrogen in N_2H_4?
56. What is the oxidation number of chromium in $K_2Cr_2O_7$?
57. Which name is *incorrect*?
(a) CO_2, carbon dioxide (b) NH_4Cl, ammonium chloride
(c) NO, nitrogen(I) oxide (d) HCl, hydrogen chloride
[8–10]

58. Which name is correct?
  (a) SF$_6$, sulfur pentafluoride (b) CaCl$_2$, calcium chloride
  (c) BaO, barium peroxide (d) NCl$_3$, nitrogen chloride
  [8–10]

59. Which geometry is *not* correct for the paired molecule?
  (a) XeF$_2$, linear (b) SF$_6$, octahedral (c) BrF$_5$, square pyramid
  (d) XeF$_4$, tetrahedral
  [9–1]

60. Which of the following molecules has a dipole moment?
  (a) CO$_2$ (b) PF$_3$ (c) NH$_4^+$ (d) SiH$_4$
  [9–2]

61. Which of the following is *incorrect*?
  (a) SiCl$_4$, regular tetrahedron, nonpolar (b) HCN, bent, polar
  (c) N$_2$, linear, nonpolar (d) NH$_3$, trigonal pyramid, polar
  [9–1, 9–2]

62. What is the expected Cl—C—Cl bond angle in C$_2$Cl$_4$?
  (a) 60° (b) 109.5° (c) 120° (d) 180°
  [9–1, 9–4]

63. Which hybrid orbital does *not* agree with the expected geometry of the paired molecule?
  (a) BF$_3$, sp^3 (b) HgCl$_2$, sp (c) PF$_5$, dsp^3 (d) SF$_6$, d^{2}sp^3
  [9–5]

64. What is the type of hybridization used by carbon in C$_2$H$_2$ (acetylene)?
  (a) sp (b) sp^2 (c) sp^3 (d) sp^{2}d
  [9–5]

65. Which type of hybridization is associated with a square planar array of hybrid orbitals?
  (a) sp (b) sp^3 (c) sp^{2}d (d) sp^{3}d^2
  [9–5]

66. Which of the following describes the molecular orbital description for electrons in the n = 2 level of O$_2^+$?
  (a) $\sigma^2_{2s}\sigma^{*2}_{2s}\pi^4_{2p}\sigma^2_{2p}\pi^{*1}_{2p}$ (b) $\sigma^2_{2s}\sigma^{*2}_{2s}\pi^4_{2p}\sigma^2_{2p}\pi^{*2}_{2p}$
  (c) $\sigma^2_{2s}\sigma^{*2}_{2s}\pi^4_{2p}\pi^{*1}_{2p}$ (d) $\sigma^2_{2s}\sigma^{*2}_{2s}\sigma^2_{2p}\pi^4_{2p}\sigma^{*1}_{2p}$
  [9–7]

67. What is the bond order for He$_2$?
  (a) 0 (b) 1/2 (c) 1 (d) 1 1/2
  [9–6]

68. According to molecular orbital theory, which one of the following is paramagnetic?
  (a) F$_2$ (b) H$_2$ (c) NO$^+$ (d) NO
  [9–6, 9–7]

69. Which type of molecular orbital is

  (a) π (b) π* (c) σ$^*_{2s}$ (d) σ$_{2s}$
  [9–5]

70. Which of the following is paramagnetic based on its molecular orbital configuration?
  (a) F$_2$ (b) N$_2$ (c) O$_2^-$ (d) N$_2^{2-}$
  [9–7]

ANSWERS

1. (d). 2. (a). 3. (c). 4. (d). 5. (b). 6. (d). 7. (d). 8. (b). 9. (d).
10. (b). 11. (a). 12. (a). 13. (c). 14. (d). 15. (d). 16. (d). 17. (b). 18. (b).
19. (b). 20. (b). 21. (b). 22. (b). 23. (a). 24. (b). 25. (c). 26. (b). 27. (a).
28. (d). 29. (a). 30. (b). 31. (b). 32. (c). 33. (c). 34. (a). 35. (c). 36. (b).
37. (d). 38. (b). 39. (a). 40. (d). 41. (c). 42. (c). 43. (a). 44. (a). 45. (c).
46. (c). 47. (c). 48. (b). 49. (d). 50. (a). 51. (d). 52. (c). 53. (a). 54. (g).
55. (i). 56. (b). 57. (c). 58. (b). 59. (d). 60. (b). 61. (b). 62. (c). 63. (a).
64. (a). 65. (c). 66. (b). 67. (a). 68. (d). 69. (b). 70. (c).

Sectional Test 3

CHAPTERS 10-13

You should make this test as realistic as possible. **Tear out this test so that you do not have access to the information in the** *Student's Guide*. Use only data provided in the questions and a periodic table. Do not check your answers until you are finished. If you answer questions incorrectly, review the section in the text indicated after each question.

Choose the best response for each question.

1. Which of the following is not a property of a gas under normal conditions?

   (a) Flows easily (b) Compressible (c) Completely fills its container (d) High density

   [10-1]

2. The pressure of a gas is measured using a U-shaped manometer. The height of the mercury in the manometer is 13 cm on the side connected to the sample and 26 cm on the side connected to the atmosphere. Atmospheric pressure is 752 torr. What is the gas pressure of the sample?

   (a) 882 torr (b) 765 torr (c) 752 torr (d) 622 torr

   [10-2]

3. Which of the following is a statement of Boyle's Law

   (a) $V = kn$ (P, T constant) (b) $P = kT$ (V, n constant)
   (c) $PV = k$ (n, T constant) (d) $V = kT$ (n, P constant)

   [10-3]

4. A gas at 30°C and 1 atm pressure has a volume of 3.50 L. What volume does the gas occupy at 40°C and 1 atm pressure?

   (a) $\left(\dfrac{30°C}{40°C}\right)(3.50\,L) = 2.63\,L$ (b) $\left(\dfrac{40°C}{30°C}\right)(3.50\,L) = 4.67\,L$

   (c) $\left(\dfrac{303\,K}{313\,K}\right)(3.50\,L) = 3.39\,L$ (d) $\left(\dfrac{313\,K}{303\,K}\right)(3.50\,L) = 3.62\,L$

   [10-3]

5. How many moles of hydrogen gas are in a sample of H_2 gas with a volume of 9.00 L at a temperature of 100°C and at a pressure of 2.00 atm. (R = 0.08206 L-atm/K-mol)

   (a) 2.19 moles (b) 0.588 moles (c) 0.429 moles (d) 0.0289 moles

   [10-4]

6. A sample of gas at 750 torr and at a temperature of −50°C and a volume of 3.00 L is allowed to change so that the temperature is 200°C and gas pressure is 845 torr. What is the new volume?

   (a) $\dfrac{T_1}{T_2} \times \dfrac{P_1}{P_2} \times V_1 = 5.65\,L$ (b) $\dfrac{T_2}{T_1} \times \dfrac{P_1}{P_2} \times V_2 = 1.26\,L$

   (c) $\dfrac{T_1}{T_2} \times \dfrac{P_2}{P_1} \times V_1 = 7.17\,L$ (d) $\dfrac{T_2}{P_2} \times \dfrac{T_1}{P_1} \times V_1 = 0.499\,L$

   [10-4]

7. A scuba diving tank is filled with 42 L of O_2 at 1.00 atm and 10 L of He at 1.00 atm and 27°C. The tank has a total volume of 6.0 L. What is the total pressure in the scuba tank at 25°C?

   (a) 5.3 atm (b) 8.6 atm (c) 10.3 atm (d) 12.6 atm

   [10-4]

8. What is the gas density of C_2H_2 at STP in units of g/L.?

   (a) 2.12 g/L (b) 1.83 g/L (c) 1.16 g/L (d) 0.850 g/L

   [10-5]

9. A sample of $KClO_3$ is heated and decomposed as follows:

$$2KClO_3(s) \longrightarrow 2KCl(s) + 3O_2(g)$$

If 3.00 g of $KClO_3$ (molar mass = 122.55 g) is totally decomposed and the evolved O_2 collected in a 1.00 L vessel at 22°C, what pressure will the O_2 exert?

   (a) 0.245 atm (b) 0.389 atm (c) 0.811 atm (d) 0.889 atm

   [10-7]

10. Which of the following statements is true according to the kinetic molecular theory?

   (a) Gravitational forces act upon gas particles.
   (b) Average kinetic energy of gas particles is proportional to kelvin temperature.
   (c) Gas particles exert forces upon each other.
   (d) Gas particles have measurable volumes.

   [10-8]

11. How many times faster (or slower) will H_2 gas pass through a pinhole than HF(g)?

   (a) 0.101 (b) 0.318 (c) 3.15 (d) 9.91

   [10-9]

12. A real gas typically exhibits behavior that is closest to an ideal gas at

   (a) low pressure and high temperature
   (b) high pressure and high temperature
   (c) low pressure and low temperature
   (d) high pressure and low temperature

   [10-10]

13. 43.2 g of a gas occupies 22.4 L at 200°C and 2.00 atm. What is its molar mass?

(a) 49.9 g/mol (b) 37.6 g/mol (c) 21.6 g/mol (d) 13.2 g/mol
[10–5]

14. In what state of matter is molecular motion slowest?
(a) Solid (b) Liquid (c) Aqueous (d) Gas
[11–1]

15. What is the direct conversion of solid to gas termed?
(a) Condensation (b) Sublimation (c) Evaporation (d) Freezing
[11–6]

16. What is the enthalpy change for the conversion of 3.0 mol of ice at 0°C to water vapor at 130°C? Data: $\Delta H_f = 6.02$ kJ/mol; C_p ($H_2O(l)$) = 75.3 J/°C-mol; $\Delta H_v = 40.67$ kJ/mol; C_p ($H_2O(g)$) = 33.1 J/°C-mol. (Note that C_p is in units of J, not kJ.)
(a) 49.8 kJ (b) 55.2 kJ (c) 166 kJ (d) 237 kJ
[11–4]

17. Which of these statements is true?
(a) The vapor pressure of a liquid increases with decreasing temperature.
(b) The boiling point of a liquid is independent of atmospheric pressure.
(c) Vapor pressure varies directly with volume.
(d) The higher a boiling point of a liquid at 1 atm atmospheric pressure, the greater the internal cohesive forces of the liquid.
[11–4, 11–5]

18. The viscosity of a liquid
(a) increases with increasing temperature
(b) decreases with increasing temperature
(c) increases with increasing quantity
(d) decreases with decreasing quantity
[11–3]

19. Which of these substances has the lowest boiling point?
(a) NaCl (b) HF (c) H_2O (d) H_2
[11–2]

20. Which of these substances has the highest melting point?
(a) Cl_2 (b) H_2O (c) KCl (d) $CaCl_2$
[11–2]

21. Which of these substances has the highest boiling point?
(a) H_2O (b) H_2Se (c)H_2S (d) H_2Te
[11.2]

22. How many KF formula units are there in a unit cell of KF? KF has a NaCl structure.
(a) 1 (b) 2 (c) 4 (d) 6
[11–8]

23. What is the density of KF(s) if it has a NaCl structure and a unit cell length of 5.35×10^{-10} m?
(a) 1.38 g/cm^3 (b) 2.47 g/cm^3 (c) 3.92 g/cm^3 (d) 4.65 g/cm^3
[11–8]

24. Which solvent should dissolve CCl_4 best?
(a) $H_2O(l)$ (b) $CH_3OH(l)$ (c) HCl(aq) (d) benzene(l)
[11–2]

25. Consider the phase diagram for water
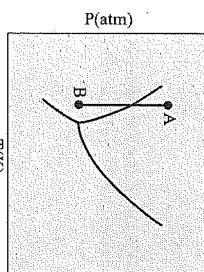
If the external pressure at point B is raised to the value of A at constant temperature, which of the following happens?
(a) Water sublimes (b) Ice changes to liquid water
(c) Ice changes to water vapor (d) A triple point forms
[11–6]

26. Which of the following should exhibit hydrogen bonding?
(a) CH_3OH (b) CH_4 (c) PH_3 (d) LiH
[11–2]

27. Which of the following is characteristic of a liquid crystal?
(a) Molecules are arranged in an ordered way.
(b) Molecules are arranged in a partial ordering.
(c) Low viscosity. (d) Low density.
[12–1]

28. Which of the following structural characteristics is likely to be present in a liquid crystal?
(a) cholesteric (b) smectic (c) nematic (d) polymeric
[12–1]

29. In which liquid crystalline phase are diskshaped molecules stacked in layers?
(a) Thermoplastic (b) Thermosetting plastic (c) Elastomer (d) Fibers
[12–2]

30. Which of the following bonding sites in a monomer would likely be the reactive site in forming a polymer during polymerization?
(a) C═O (b) C═C (c) C—H (d) C—Cl
[12–2]

31. Which of the following types of polymers can not be reshaped?
(a) Thermoplastic (b) Thermosetting plastic (c) Elastomer (d) Fibers
[12–2]

32. Which statement about polymers is true?
(a) Mechanical strength of a polymer increases with increased crystallinity.
(b) Low density polymers often exhibit extensive chain branching.
(c) The greater the density of crosslinks in a polymer, the softer the material.
(d) Plasticizers increase the rigidity of polymers.
[12–2]

33. Glass is a
(a) crystalline ceramic. (b) noncrystalline ceramic. (c) an ionic compound. (d) polymer.
[12–3]

34. Which of the following is *not* used to form a ceramic?
(a) Alumina (b) Zirconia (c) Silicon carbide (d) Kevlar
[12–3]

35. A primary goal of the sol-gel process is
(a) to form a polymer.
(b) to activate a structural site in a monomer.
(c) to form extremely fine particles of uniform size.
(d) to process a polymer.
[12–3]

36. Which is true about ceramic fibers?
(a) They undergo condensation polymerization with ceramics.
(b) They exhibit great strength when loads are applied along the long axis.
(c) Silicon carbide is an example of one.
(d) They weakly resist deformations when imbedded in a ceramic matrix.
[12–3]

37. Which statement is true about superconducting ceramics?
(a) New superconducting ceramics have simple oxide structures.
(b) They exhibit superconductivity only above a superconducting transition temperature.
(c) They include within their volume all magnetic fields.
(d) The copper-oxygen content of new superconductors is of great significance.
[12–3]

38. For a thin film to be useful, it must possess several properties, one of which is
(a) Chemically stable in the environment.
(b) Shows low adhesiveness.
(c) Shows high density of dislocations.
(d) Exhibits diversity of thickness.
[12–4]

39. Which of the following processes requires a high voltage source?
(a) Vacuum deposition (b) Sputtering (c) Chemical vapor deposition (d) All of the above
[12–4]

40. Which statement is *not true*?
(a) A solute takes on the phase of the solvent.
(b) A solute is in lesser quantity than a solvent.
(c) A solute and solvent may be gases.
(d) A polar solvent dissolves a nonpolar solute.
[13–1]

41. What is the molarity of a solution that contains 32.0 g of HCl (molar mass = 36.46 g) in 2.50 L of solution?
(a) 0.00351 *M* (b) 0.0128 *M* (c) 0.351 *M* (d) 12.8 M
[13–2]

42. How many moles of H_2SO_4 are present in 250 mL of a 3.00 *M* H_2SO_4 solution?
(a) 0.150 moles (b) 0.750 moles (c) 1.50 moles (d) 750 moles
[13–2]

43. What is the molality of a solution of 100.0 g of methanol, CH_3OH (molar mass = 32.05 g), in 250 mL of water? The density of water is 1.00 g/mL.
(a) 0.00400 molal (b) 0.0125 molal (c) 8.91 molal (d) 12.5 molal
[13–2]

44. What is the mole fraction of NaCl (molar mass = 58.44 g) in a solution containing 20.2 g of NaCl and 55.0 g of water (molar mass = 18.02 g)?
(a) 0.898 (b) 0.102 (c) 0.113 (d) 0.268
[13–2]

45. When NaCl dissolves in water
(a) energy is released when NaCl bonds are broken.
(b) Na^+ interacts with the positive dipole of water.
(c) Cl^- interacts with the positive dipole of water.
(d) Na^+ ions remain independent of water molecules.
[13–2, 13–3]

46. The solubility of a particular salt in water is 9.8 g/mL at 25°C. If 10.3 g is completely dissolved, the solution is
(a) supersaturated (b) saturated (c) unsaturated (d) dilute
[13–3]

47. An aqueous solution strongly conducts electrical current. The solution contains a(n)
(a) nonelectrolyte (b) weak electrolyte (c) strong electrolyte
(d) nonpolar solute
[13–3]

48. The solubility of $CO_2(g)$ in water
(a) increases with increasing temperature.
(b) increases with decreasing pressure.
(c) increases with increasing pressure.
(d) is not affected by temperature or pressure.
[13–4]

49. Which of the following is not a colligative property?
(a) Vapor pressure lowering (b) Boiling point elevation
(c) Osmotic pressure (d) Density
[13–5]

50. What is the osmotic pressure in atmospheres of a solution containing 36.5 g of NaCl dissolved in water to form 3.50 L of solution at 25°C? (R = 0.08206 L-atm/mol-K.)
(a) 8.73 atm (b) 4.36 atm (c) 1.28 atm (d) 2.57 atm
[13–5]

51. What mass in grams of CH_3OH must be added to 500 g of water to produce a solution boiling at 102.35°C? (K_b = 0.52°C/m for water.)
(a) 3.55 g (b) 4.52 g (c) 36.2 g (d) 72.4 g
[13–5]

52. 1.08 g of a protein is dissolved in 50.0 mL of water and the osmotic pressure of the solution is found to be 5.86 torr at 25°C. What is the molar mass of the protein?

(a) 1.52×10^{-5} g
(b) 90.3 g
(c) 5.76×10^3 g
(d) 6.85×10^4 g
[13–5]

53. What is the typical particle range, in nm, for a colloid?
(a) 1–10
(b) 100–200
(c) 1–200
(d) 50–300
[13–6]

54. Which statement is true about colloidal suspensions?
(a) They settle under the influence of gravity in a reasonable time period.
(b) Colloidal particles have a high ratio of surface area to volume.
(c) They are not stable in light.
(d) Light passes directly through the suspension without interference.
[13–6]

55. Lava is a foam colloid. The dispersed phase and dispersion medium are respectively:
(a) gas, solid
(b) gas, liquid
(c) liquid, gas
(d) solid, gas
[13–6]

ANSWERS

1. (d). 2. (a). 3. (c). 4. (d). 5. (b). 6. (a). 7. (b). 8. (c). 9. (d).
10. (b). 11. (c). 12. (b). 13. (b). 14. (a). 15. (b). 16. (c). 17. (d). 18. (b).
19. (d). 20. (d). 21. (a). 22. (c). 23. (b). 24. (d). 25. (b). 26. (a). 27. (b).
28. (d). 29. (a). 30. (b). 31. (b). 32. (b). 33. (b). 34. (d). 35. (c). 36. (b).
37. (d). 38. (a). 39. (b). 40. (d). 41. (c). 42. (b). 43. (d). 44. (b). 45. (c).
46. (a). 47. (c). 48. (c). 49. (d). 50. (a). 51. (d). 52. (d). 53. (c). 54. (b).
55. (a).

Chemical Kinetics 14

OVERVIEW OF THE CHAPTER

14.1, 14.2 REACTION RATES: GENERAL CONSIDERATIONS

Review: Concentration units (13.2); graphing techniques (see Appendix in the text).

Objectives: You should be able to:

1. Express the rate of a given reaction in terms of the variation in concentration of a reactant or product substance with time.
2. Calculate the average rate over an interval of time, given the concentrations of a reactant or product at the beginning and end of that interval.
3. Calculate instantaneous rates from a graph of reactant or product concentrations as a function of time.
4. Explain the meaning of the term *rate constant* and state the units associated with rate constants.
5. Calculate rate, rate constants, or reactant concentration, given two of these together with the rate law.
6. Determine the rate law from experimental results that show how concentration affects rate.

14.3 REACTION RATES: FIRST AND SECOND ORDER

Review: Calculation of the slope of a straight line (see Appendix in the text); use of logarithms (see Appendix in the text).

Objectives: You should be able to:

1. Use the equations

$$\ln\left(\frac{[A]_0}{[A]_t}\right) = kt$$

$$\ln[A]_t = -kt + \ln[A]_0$$

to determine (a) the concentration of a reactant or product at any time after a reaction has started, (b) the time required for a given fraction of sample to