Appendix D ANSWERS TO END-OF-CHAPTER PROBLEMS

Chapter 34

1. F T T F T
2. T F F T T
3. b and e
4. a. 38.00 kJ b. 33.9 kJ
5. a. 0.33 kJ b. 1.52 kJ c. 1.6 kJ d. 4.72 kJ e. 8.2 kJ
6. 24.5 kJ

Chapter 35

1. T T T T T F
2. T T F F F T
3. 61%, 24%
4. a. 1.61 g b. 0.470 g c. 1.14 g
5. 0.70 g

Chapter 36

1. F T F T F
2. 0.0278 g
3. 1.79 Torr
4. 7.9%
5. a. E b. D c. H d. vaporization

Chapter 37

1. F T F F F F
2. F F F F T F
3. a. dispersion b. dispersion c. dispersion, dipole-dipole d. dispersion, dipole-dipole
4. a. dispersion (strongest), dipole-dipole b. dispersion c. dispersion, dipole-dipole, hydrogen bonding (strongest) d. dispersion
5. a. HF, H_3CNH_2 b. all c. HF d. PBr_3
6. a. HBr, dispersion, dipole-dipole; Br_2, dispersion; HCl, dispersion, dipole-dipole

   b. dispersion: Br_2 > HBr > HCl; dipole-dipole: HCl > HBr > Br_2 (nonpolar)

   c. Br_2 > HBr > HCl
7. a. H_2CBr_2 b. C_2H_4 c. C_2H_4
8. a. $AsCl_3$ b. Cl_2CO c. H_3CGeH_3
9. $SiCl_4$
10. HCl, PH_3, CH_4

Chapter 38

1. F T T F F T
2. bcc: 2 fcc: 4

3. 4
4. four anions, eight cations
5. two cations, four anions
6. a. covalent network b. molecular c. Group 18 d. ionic network e. metallic network f. ionic network

Chapter 39

1. T T T T T
2. F F T F F
3. a. ion-dipole b. dispersion, hydrogen bonding, dipole-dipole c. dispersion, dipole-induced dipole d. dispersion, hydrogen bonding, dipole-dipole
4. a. dispersion, dipole-dipole b. dispersion, dipole-induced dipole c. dispersion, dipole-induced dipole d. dispersion, dipole-dipole
5. MgO
6. a. ΔH°_{vap} b. ΔH°_{soln} c. ΔH°_{hyd} d. ΔH°_{vap}, ΔH°_{sub}, ΔH°_{lat}
7. a. 33.9 kJ b. −39.8 kJ
8. ΔH°_{vap} = 44.72 kJ ΔH°_{hyd} = −61.04 kJ ΔH°_{soln} = −16.32 kJ
9. $ZnCl_2(s) \rightleftharpoons Zn^{2+}(aq) + 2\ Cl^-(aq)$ ΔH°_{soln} = −73.16 kJ exothermic

Chapter 40

1. T F F T T
2. a. disfavored b. disfavored c. can be favored or disfavored
3. a. $CH_3OH(l)$ b. $CH_3CH_2CH_2CH_3(g)$
4. a. H_2O_2, $H_2NCH_2CH_2NH_2$ b. CH_2Cl_2 c. C_8H_{18}
5. CH_3CO_2H (miscible)
6. a. hydrophobic b. amphiphilic c. hydrophilic

Chapter 41

1. T F F F F
2. 0.019 atm
3. 0.91 g

Chapter 42

1. 0.0018 mol
2. a. 31.9% b. 27.0%
3. 47.2% C_6H_6, 33.7% C_5H_{12}, 19.1% C_2Cl_6
4. 3.08 g
5. 0.893 m
6. a. 4.5 M b. 5.1 m c. 8.4 mol%
7. a. 0.547% b. 3.50% 0.302 M

Chapter 43

1. F F T T
2. a. 0.52 °C b. −0.52 °C

3. 4.9 g
4. 0.00108 atm

Chapter 44

1. F F F T T T F
2. a. $Br_2(g)$ b. $CH_3OH(g)$
3. a. $PF_5(g)$ b. $AsH_3(g)$
4. 287.51 J/K
5. −723.5 J/K
6. 80.70 J/K
7. a. 4 b. 5

Chapter 45

1. T T T F T
2. F T T F T
3. $Ne(g)$, $H^+(aq)$, $Al(s)$
4. a. −1,104.14 kJ b. −143.21 J/K c. −1,061.44 kJ
5. a. −507.45 kJ b. 29.55 J/K c. −516.26 kJ
6. a. −620.6 kJ b. −203.4 J/K c. −560.0 kJ
7. a
8. 530.94 kJ
9. −92.34 kJ
10. −606.60 kJ

Chapter 46

1. T F F T T
2. −113 kJ
3. a. $\Delta H^\circ_{vap} = 38.00$ kJ $\Delta S^\circ_{vap} = 113.0$ J/K b. 336.3 K
4. a. $\Delta H^\circ_{soln} = -20.28$ kJ $\Delta S^\circ_{soln} = -96.2$ J/K b. 13.7 kJ
5. a. $Q = \dfrac{[H^+]^2\,[NO_3^-]^2}{P(N_2O_5)}$ b. $Q = \dfrac{[Mg^{2+}]\,P(CO_2)}{[H^+]^2}$ c. $Q = \dfrac{P(H_2S)}{[HF]^2}$
6. 0.00764
7. 544
8. a. 4.20 kJ b. reverse
9. a. 5.05 kJ b. reverse

Chapter 47

1. T F T F
2. b
3. 9.23
4. 2.61×10^{-10}
5. a. 4.122×10^{-4} atm b. 8.098×10^{-3} atm
6. 0.0148 M

Chapter 48

1. F T T T T F F

2. a. speed $= -\frac{1}{2}\frac{\Delta[NO]}{\Delta t} = -\frac{\Delta[O_2]}{\Delta t} = \frac{1}{2}\frac{\Delta[NO_2]}{\Delta t}$

   b. speed $= -\frac{\Delta[HS^-]}{\Delta t} = -\frac{1}{3}\frac{\Delta[ClO^-]}{\Delta t} = \frac{\Delta[HSO_3^-]}{\Delta t} = \frac{1}{3}\frac{\Delta[Cl^-]}{\Delta t}$

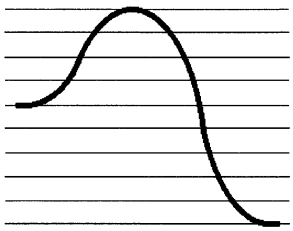
   c. speed $= -\frac{\Delta[CH_2Cl_2]}{\Delta t} = -\frac{1}{2}\frac{\Delta[H_2O]}{\Delta t} = \frac{\Delta[CO_2]}{\Delta t} = \frac{1}{2}\frac{\Delta[HCl]}{\Delta t} = \frac{1}{2}\frac{\Delta[H_2]}{\Delta t}$

Chapter 49

1. F T F T F F T T
2. T F F F T
3. T T F T
4. a. rate = $k\,[ClO]^2$

   b. The concentration of ClO is decreasing at a rate of 2.0×10^{-5} (mol/L)/s. The concentrations of Cl_2 and O_2 are each increasing at a rate of 1.0×10^{-5} (mol/L)/s.
5. a. rate = $k\,[C_2H_5Cl]$ b. 0.42 (mol/L)/s c. 0.15 s
6. a. rate = $k\,[H_2O]\,[N_2O_4]$ b. 801 (L/mol)/s
7. a. 21 s b. 0.0263 mol/L c. 0.0041 mol/L d. 24%
8. a. 5,350 s b. 1.27×10^{-4} mol/L c. 4.3×10^{-5} mol/L d. 25%
9. a. 0.016 mol/L b. 0.020 mol/L c. 38%
10. 683 s^{-1}

Chapter 50

1. F F F F T
2. F T T T T
3. a. rate = $k\,[ClNO]\,[NO_2]$ b. NO, NO_2 c. both
4. 
5. a. D b. B – C c. D – C d. endothermic e. endothermic
6. 220. kJ
7. There is a very high E_a in the first step.

Chapter 51

1. T T F T F F T
2. a. 2.92×10^{-6} b. 1.71×10^{-3}
3. 3.19
4. 4.12
5. 6.5×10^{-8}

6. 314
7. $P(H_2) = 0.214$ atm; total $P = 0.541$ atm

Chapter 52

1. $P(C_2H_5Cl) = 0.481$ atm; $P(C_2H_4) = P(HCl) = 8.50 \times 10^{-4}$ atm
2. $P(Cl_2) = 0.83$ atm; $P(BrCl) = 1.34$ atm
3. $[Mg^{2+}] = 0.00484$ M; $[Ba^{2+}] = 0.00116$ M
4. $[CO_2] = 0.028$ M; $[F^-] = 0.017$ M; $[CO_3^{2-}] = 4.4 \times 10^{-6}$ M; $[HF] = 8.8 \times 10^{-6}$ M
5. $P(N_2O) = 0.194$ atm; $P(Cl_2) = 0.294$ atm; $P(Cl_2O) = 0.91$ atm; $P(N_2) = 1.11$ atm

Chapter 53

1. T F F F
2. a. left b. left c. right d. no effect
3. a. no effect b. left c. no effect d. right
4. a. left b. left c. no effect d. no effect
5. a and c

Chapter 54

1. T T F F T
2. F T F T F
3. F F T F T
4. T T F T T
5. $\Delta G° = 80.8$ kJ; $K_w = 2.43 \times 10^{-14}$; pH 6.81
6. a. F^- b. HBr c. $H_2PO_4^-$
7. a. ClO_2^- b. HCN c. NH_3
8. water, hydrogen oxalate ion, dihydrogen arsenate ion
9. a. 0.00334 M b. 2.48 c. 11.52
10. a. 8.50×10^{-4} M b. 3.07 c. 10.93
11. 2.03
12. 11.26
13. 0.21 g
14. 0.038 L

Chapter 55

1. T F T T F
2. a. $HBrO(aq) \rightleftharpoons H^+(aq) + BrO^-(aq)$ $\quad K_a = \dfrac{[H^+]\,[BrO^-]}{[HBrO]}$

   b. $HN_3(aq) \rightleftharpoons H^+(aq) + N_3^-(aq)$ $\quad K_a = \dfrac{[H^+]\,[N_3^-]}{[HN_3]}$
3. $H_3AsO_4(aq) \rightleftharpoons H^+(aq) + H_2AsO_4^-(aq)$
   $H_2AsO_4^-(aq) \rightleftharpoons H^+(aq) + HAsO_4^{2-}(aq)$
   $HAsO_4^{2-}(aq) \rightleftharpoons H^+(aq) + AsO_4^{3-}(aq)$
4. nitric acid, chlorous acid

5. $HP_2O_7^{3-}(aq) \rightleftharpoons H^+(aq) + P_2O_7^{4-}(aq)$ $\qquad K_{a4} = \dfrac{[H^+]\,[P_2O_7^{4-}]}{[HP_2O_7^{3-}]}$

6. $[C_3H_7CO_2H] = 0.131$ M; $[H^+] = [C_3H_7CO_2^-] = 0.0014$ M; pH 2.85; 1.1% diss

7. $[ClCH_2CO_2H] = 0.0273$ M; $[H^+] = [ClCH_2CO_2^-] = 0.0062$ M; pH 2.21; 19% diss

8. 2.41

9. $K_{a1} = 6.8 \times 10^{-5}$ $\qquad \Delta G° = 24$ kJ

10. $[H_2C_2O_4] = 0.065$ M; $[H^+] = [HC_2O_4^-] = 0.059$ M; 48% diss; $[C_2O_4^{2-}] = 5.4 \times 10^{-5}$ M

11. 1.33

12. Strongest, $HClO_3$; weakest, HIO

13. $\Delta H° = 43.5$ kJ $\qquad \Delta S° = -30.6$ J/K $\qquad$ endothermic: Expect K_a greater at 70. °C.
$\Delta G°$ (70. °C) = 54.0 kJ $\qquad K_a$ (70. °C) $= 5.97 \times 10^{-9}$ $\qquad K_a$ is greater at 70. °C compared to the value at 25 °C (6.2×10^{-10}), as expected.

14. $[H^+] = 2.4 \times 10^{-4}$ $\qquad$ pH = 3.62

Chapter 56

1. T T T F F T

2. a. $CH_3NH_2(aq) + H_2O(l) \rightleftharpoons OH^-(aq) + CH_3NH_3^+(aq)$ $\qquad K_b = \dfrac{[OH^-]\,[CH_3NH_3^+]}{[CH_3NH_2]}$

   b. $C_6H_5NH_2(aq) + H_2O(l) \rightleftharpoons OH^-(aq) + C_6H_5NH_3^+(aq)$ $\qquad K_b = \dfrac{[OH^-]\,[C_6H_5NH_3^+]}{[C_6H_5NH_2]}$

3. $[C_5H_5N] = 0.0143$ M; $[OH^-] = 4.9 \times 10^{-6}$ M; $[C_5H_5NH^+] = 4.9 \times 10^{-6}$ M; pOH = 5.31; pH = 8.69 or 8.70

4. $[(C_2H_5)_3N] = 0.0267$ M; $[OH^-] = 0.0037$ M; $[(C_2H_5)_3NH^+] = 0.0037$ M; pH = 11.57; 12% diss

5. 6.7 g

6. a. $HONH_3^+(aq) \rightleftharpoons H^+(aq) + HONH_2(aq)$ $\qquad K_a = \dfrac{[H^+]\,[HONH_2]}{[HONH_3^+]}$

   b. $CN^-(aq) + H_2O(l) \rightleftharpoons OH^-(aq) + HCN(aq)$ $\qquad K_b = \dfrac{[OH^-]\,[HCN]}{[CN^-]}$

7. a. 1.4×10^{-11} $\qquad$ b. 1.0×10^{-12} $\qquad$ c. 2.3×10^{-11} $\qquad$ d. 7.7×10^{-12}

8. a. $K_a = 8.9 \times 10^{-8}$; $K_b = 2.0 \times 10^{-12}$

   b. $K_a = 4.8 \times 10^{-9}$; $K_b = 4.2 \times 10^{-12}$

   c. $K_a = 4.5 \times 10^{-13}$; $K_b = 1.6 \times 10^{-7}$

9. $[ClO^-] = 0.00544$ M; $[OH^-] = 4.2 \times 10^{-5}$ M; $[HClO] = 4.2 \times 10^{-5}$ M; pOH = 4.38; pH = 9.62

10. $[C_6H_5NH_3^+] = 0.00683$ M; $[H^+] = 4.1 \times 10^{-4}$ M; $[C_6H_5NH_2] = 4.1 \times 10^{-4}$ M; pH = 3.39

11. 0.0027 atm

12. $Cr(H_2O)_6^{3+}(aq) \rightleftharpoons Cr(H_2O)_5(OH)^{2+}(aq) + H^+(aq)$ $\qquad$ OR
$Cr(H_2O)_6^{3+}(aq) + H_2O(l) \rightleftharpoons Cr(H_2O)_5(OH)^{2+}(aq) + H_3O^+(aq)$

13. a. neutral $\qquad$ b. acidic $\qquad$ c. basic $\qquad$ d. basic $\qquad$ e. acidic

14. a. neutral $\qquad$ b. basic $\qquad$ c. acidic $\qquad$ d. neutral $\qquad$ e. acidic

15. a. acidic $\qquad$ b. basic $\qquad$ c. acidic $\qquad$ d. acidic

Chapter 57

1. T T T F F

2. 2.82
3. 10.76
4. 0.028 mol
5. 9.86
6. $C_6H_5CO_2H$
7. a. 4.89 b. 4.84 c. 4.99
8. a. 6.87 b. 6.50 c. 7.21

Chapter 58

1. T T F T F
2. a. 16.17 mL b. 1.14 c. 1.62 d. 7.00
3. a. 1.50 b. 1.81 c. 11.70
4. a. 41.44 mL b. 2.42 c. 3.69 d. 8.11
5. a. 4.39 b. 8.40 c. 11.84

Chapter 59

1. F T F F
2. a. $Fe(OH)_3(s) \rightleftharpoons Fe^{3+}(aq) + 3\ OH^-(aq)$ $K_{sp} = [Fe^{3+}]\ [OH^-]^3$
   b. $CuCrO_4(s) \rightleftharpoons Cu^{2+}(aq) + CrO_4^{2-}(aq)$ $K_{sp} = [Cu^{2+}]\ [CrO_4^{2-}]$
3. a. $PbBr_2(s) \rightleftharpoons Pb^{2+}(aq) + 2\ Br^-(aq)$ $K_{sp} = [Pb^{2+}]\ [Br^-]^2$
   b. $Ni_3(PO_4)_2(s) \rightleftharpoons 3\ Ni^{2+}(aq) + 2\ PO_4^{3-}(aq)$ $K_{sp} = [Ni^{2+}]^3\ [PO_4^{3-}]^2$
4. 1.0×10^{-5} M for MX, 2.9×10^{-4} M for MX_2, and 0.0014 M for MX_3. Overall, MX < MX_2 < MX_3.
5. $\Delta G° = 64.4$ kJ $K_{sp} = 5.14 \times 10^{-12}$
6. $Ag_2C_2O_4(s) \rightleftharpoons 2\ Ag^+(aq) + C_2O_4^{2-}(aq)$
   $C_2O_4^{2-}(aq) + H_2O(l) \rightleftharpoons HC_2O_4^-(aq) + OH^-(aq)$
   $Ag_2C_2O_4(s) + H_2O(l) \rightleftharpoons 2\ Ag^+(aq) + HC_2O_4^-(aq) + OH^-(aq)$ $K = 1.0 \times 10^{-21}$

Chapter 60

1. F F F F F T
2. a. 5.3×10^{-7} M b. 1.1×10^{-4} M
3. a. 3.5×10^{-8} M b. 2.6×10^{-6} M
4. $[Pb^{2+}] = 5.3 \times 10^{-5}$ M; $[SO_4^{2-}] = 4.70 \times 10^{-4}$ M
5. 2.0×10^{-7} M
6. 0.01 M HNO_3
7. a. $Cd^{2+}(aq) + 4\ OH^-(aq) \rightleftharpoons Cd(OH)_4^{2-}(aq)$ $K_f = \dfrac{[Cd(OH)_4^{2-}]}{[Cd^{2+}]\ [OH^-]^4}$
   b. $Ni^{2+}(aq) + 6\ NH_3(aq) \rightleftharpoons Ni(NH_3)_6^{2+}(aq)$ $K_f = \dfrac{[Ni(NH_3)_6^{2+}]}{[Ni^{2+}]\ [NH_3]^6}$
8. 5.7×10^{-11} M
9. 0.0017 M
10. $CuCl(s) \rightleftharpoons Cu^+(aq) + Cl^-(aq)$
    $Cu^+(aq) + 4\ CN^-(aq) \rightleftharpoons Cu(CN)_4^{3-}(aq)$
    $CuCl(s) + 4\ CN^-(aq) \rightleftharpoons Cu(CN)_4^{3-}(aq) + Cl^-(aq)$ $K = 3.4 \times 10^{23}$

Chapter 61

1. a. $S_2O_3^{2-}/SO_4^{2-}$ and $HBrO/Br^-$

   b. $S_2O_3^{2-} + 5\ H_2O \rightarrow 2\ SO_4^{2-} + 10\ H^+ + 8\ e^-$
   $HBrO + H^+ + 2\ e^- \rightarrow Br^- + H_2O$

   c. $S_2O_3^{2-} + 4\ HBrO + H_2O \rightarrow 2\ SO_4^{2-} + 6\ H^+ + 4\ Br^-$

   d. $S_2O_3^{2-}$ is oxidized. HBrO is reduced.

2. a. $Cd/Cd(OH)_2$ and $NiO(OH)/Ni(OH)_2$

   b. $Cd + 2\ OH^- \rightarrow Cd(OH)_2 + 2\ e^-$
   $NiO(OH) + e^- + H_2O \rightarrow Ni(OH)_2 + OH^-$

   c. $Cd + 2\ NiO(OH) + 2\ H_2O \rightarrow Cd(OH)_2 + 2\ Ni(OH)_2$

   d. Cd is oxidized. NiO(OH) is reduced.

3. a. $N_2O + 3\ H_2O \rightarrow 2\ HNO_2 + 4\ H^+ + 4\ e^-$
   $Co^{3+} + e^- \rightarrow Co^{2+}$

   b. $N_2O + 3\ H_2O + 4\ Co^{3+} \rightarrow 2\ HNO_2 + 4\ H^+ + 4\ Co^{2+}$

   c. Co^{3+} is the oxidizing agent. N_2O is the reducing agent.

4. a. $3\ PO_4^{3-} + 2\ Cr + 2\ H_2O \rightarrow 2\ CrO_2^- + 3\ HPO_3^{2-} + OH^-$

   b. PO_4^{3-} is the oxidizing agent. Cr is the reducing agent.

Chapter 62

1. T F T T T F

2. a. $Co(s) \rightarrow Co^{2+}(aq) + 2\ e^-$ ---anode
   $AuCl_4^-(aq) + 3\ e^- \rightarrow Au(s) + 4\ Cl^-(aq)$ ---cathode
   Co is oxidized; $AuCl_4^-$ is reduced.

   b. $3\ Co(s) + 2\ AuCl_4^-(aq) \rightarrow 3\ Co^{2+}(aq) + 2\ Au(s) + 8\ Cl^-(aq)$

   c. $Co(s)\,|\,Co^{2+}(aq)\,||\,AuCl_4^-(aq), Cl^-(aq)\,|\,Au(s)$

3. a. Fe/Fe^{3+} and Ag^+/Ag

   b. $Fe(s) \rightarrow Fe^{3+}(aq) + 3\ e^-$ ---anode
   $Ag^+(aq) + e^- \rightarrow Ag(s)$ ---cathode
   Fe is oxidized; Ag^+ is reduced.

   c. $Fe(s) + 3\ Ag^+(aq) \rightarrow Fe^{3+}(aq) + 3\ Ag(s)$

4. a. $Cu(s) \rightarrow Cu^{2+}(aq) + 2\ e^-$ ---anode
   $2\ HClO_2(aq) + 6\ H^+(aq) + 6\ e^- \rightarrow Cl_2(g) + 4\ H_2O(l)$ ---cathode
   Cu is oxidized; $HClO_2$ is reduced.

   b. $3\ Cu(s) + 2\ HClO_2(aq) + 6\ H^+(aq) \rightarrow 3\ Cu^{2+}(aq) + Cl_2(g) + 4\ H_2O(l)$

5. a. $SO_3^{2-}(aq) + 2\ OH^-(aq) \rightarrow SO_4^{2-}(aq) + H_2O(l) + 2\ e^-$ ---anode
   $HSnO_2^-(aq) + H_2O(l) + 2\ e^- \rightarrow Sn(s) + 3\ OH^-(aq)$ ---cathode

   b. $SO_3^{2-}(aq) + HSnO_2^-(aq) \rightarrow SO_4^{2-}(aq) + Sn(s) + OH^-(aq)$

6. a. $2\ CrO_4^{2-}(aq) + 8\ H_2O(l) + 3\ Zn(s) + 2\ OH^-(aq) \rightarrow 2\ Cr(OH)_3(s) + 3\ Zn(OH)_4^{2-}(aq)$

   b. $Zn(s)\,|\,OH^-(aq), Zn(OH)_4^{2-}(aq)\,||\,OH^-(aq), CrO_4^{2-}(aq)\,|\,Cr(OH)_3(s)\,|\,Pt(s)$

7. a. $Hg(l) \rightarrow Hg^{2+}(aq) + 2\ e^-$ ---anode
   $ClO_2(g) + 3\ H^+(aq) + 3\ e^- \rightarrow HClO(aq) + H_2O(l)$ ---cathode

   b. $Hg(l)\,|\,Hg^{2+}(aq)\,||\,H^+(aq), HClO(aq)\,|\,ClO_2(g)\,|\,Pt(s)$

8. T F F F

9. $\Delta G^\circ_{1/2} = -207.92$ kJ; $E^\circ_{1/2} = 1.0775$ V

Chapter 63

1. a. 0.43 V b. 0.45 V c. 0.81 V
2. a. 0.24 V b. 2.73 V c. 0.27 V
3. b or d
4. a. 2 mol b. 12 mol c. 6 mol
5. $E°$ = 0.38 V and $\Delta G°$ = −73 kJ
6. 1.50 V
7. −0.59 V

Chapter 64

1. F T F T T
2. a. 1.07 V b. 2 mol c. 1.27 V
3. a. 0.92 V b. 3 mol c. 0.90 V
4. a. 0.43 V b. 0.30 V c. 1.2×10^{29}
5. a. 0.28 V b. 0.47 V c. 2.5×10^{28}
6. 0.014 M
7. a. decrease b. increase c. increase d. same
8. a. same b. increase c. decrease d. increase e. decrease
9. a. increase b. increase c. increase d. decrease
10. $\Delta G°$ = −373.34 kJ and $E°$ = 1.9347 V

Chapter 65

1. F F T F T
2. a. exergonic b. exergonic c. endergonic d. endergonic e. exergonic
3. a. −0.45 V b. −0.35 V c. 2.4×10^{-46}
4. a. -0.04 V, endergonic b. 0.06 V, exergonic
5. a. 0.0010 mol b. 0.11 g
6. 0.126 g
7. 12.2 min

Chapter 66

1. T T T F F
2. F F T T F
3. a. $^{26}_{14}\text{Si} \rightarrow {}^{26}_{13}\text{Al} + {}^{0}_{1}\beta$
   b. $^{256}_{109}\text{Mt} \rightarrow {}^{252}_{107}\text{Bh} + {}^{4}_{2}\alpha$
   c. $^{67}_{31}\text{Ga} + {}^{0}_{-1}\text{e} \rightarrow {}^{67}_{30}\text{Zn}$
   d. $^{35}_{16}\text{S} \rightarrow {}^{35}_{17}\text{Cl} + {}^{0}_{-1}\beta$
   e. $^{93m}_{44}\text{Ru} \rightarrow {}^{93}_{44}\text{Ru} + \gamma$
   f. $^{238}_{92}\text{U} \rightarrow {}^{134}_{52}\text{Te} + {}^{102}_{40}\text{Zr} + 2\,{}^{1}_{0}\text{n}$
4. a. ^{217}Rn b. ^{119}Sn c. ^{209}Pb d. ^{62}Cu
5. a. β^- b. α c. β^+ or EC
6. a. ^{228}Ra, ^{224}Ra b. ^{208}Pb

Chapter 67

1. a. 2.35×10^{12} Bq b. 63.5 Ci
2. 3.09×10^{12} dis/min
3. 4.95×10^{-5} g
4. a. 115 Ci b. 1.32 Ci
5. 1.42 μg
6. 4.86 MBq
7. 4.17×10^{9} y

Chapter 68

1. T F T F
2. a. $^{222}_{86}Rn \rightarrow {}^{218}_{84}Po + {}^{4}_{2}\alpha$ b. 540. GJ c. 5.592 MeV
3. a. $^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}\beta$ b. 15.1 GJ c. 0.156 MeV
4. a. $^{178}_{74}W + {}^{0}_{-1}e \rightarrow {}^{178}_{73}Ta$ b. 18.5 GJ c. 0.192 MeV
5. a. $^{79m}_{35}Br \rightarrow {}^{79}_{35}Br + \gamma$ b. 20.1 GJ c. 0.208 MeV
6. EC, 1.504 MeV; β^-, 1.311 MeV

Chapter 69

1. T F F F T T T
2. a. 0.081810 u 76.21 MeV 6.928 MeV/nucleon
   b. 0.611075 u 569.2 MeV 8.757 MeV/nucleon
3. a. ^{238}U: $^{238}_{92}U + {}^{4}_{2}\alpha \rightarrow {}^{242}_{94}Pu + \gamma$
   b. ^{39}K: $^{48}_{20}Ca + \gamma \rightarrow {}^{1}_{1}p + {}^{39}_{19}K$
4. a. ^{10}B: $^{10}B(\alpha, p)^{13}C$ b. ^{196}Au: $^{197}Au(\gamma, n)^{196}Au$
5. a. ^{44}Sc b. ^{32}P c. ^{177}Lu
6. 180.6 MeV, 17.4 TJ
7. ^{110}Cd