Answers to Selected Questions from Lessons

Lesson 1: 2. a. 2.50×10^{-1} L b. 1.49×10^{4} ìg c. 2.23×10^{-8} km d. 8.0×10^{1} Mwatts e. 1.135×10^{6}ps f. 5.9×10^{4} ìL
3. a. 13.6 kg/L b. 1.34×10^{3} g 4. 39.4 °C, 312.4 K, 5. 81 F degrees 6. 8.32 min 7. 36 cm^3, 35.9 cm^3
8. 1.90 x 10^{4} millions of years 9. 23.577, -11.423 10. 9.0×10^{10}

Lesson 2:Atomic Theory 7. 12 g 10. a. 53 b. 78 c. 53 d. 0 f. 53 g. 131 11. Co-58 12. 60 13. 1.2×10^{22}
14. 3.45×10^{-22} g 15. 4.5×10^{22} 16. 10 g 18. 69.8 19. 87.6 g/mole 20. 100, 342, 149

Lesson 3: Formulas 1. 53 2. 14.1 4. $C_2H_6O_2$ 5. $CaCO_3$ 6. P_2S_3 7. 54.9, Mn

Lesson 4: Equations and Stoichiometry 1. no. It does not tell rate or any intermediates.2. convention
3. experimentally 5. a. 3.6, b. 18.9 6. a. 0.015 b. 4.67 c. 0.05 7. 96.6 8. a. 0.67 b. 9.3 c. 0.15
d.1.0 9. a. HCl b. 11.9

Lesson 5: Groups and Periodicity: 3. Rb 4. S^{2-} 5. Al^{3+} 6. F 7. Na 8. Ne 9. Mg 10. N 11. $LaCl_3$
12. After the first electron is gone there is one more proton in the nucleus than electrons in the ion and so it is smaller than the atom, the electrons are held tighter.
13. There are more electron than protons and the electrons are not held as tightly nor as closely.
14. The number of protons in the nuclei increase but the added electrons are being added into the same energy level. 16. H, N, O, F, Cl, He, Ne, Ar, Kr, Xe, Rn upper right, non metals

Lesson 6: Bonding 5. water-2, ammonia-1, methyl alcohol-2, carbon dioxide-4

Lesson 45: Nuclear Chemistry I
3. a. Fe b. Fe c. U 4. He 5. a. electron b. beta particle(electron) c. positron
7. a. electron b. iron 56 8. a. 0 b. 1 c. positron d. decomposition of proton 9. beta 10. U-238
13. 320 g 14. 6.5×10^{19} 16. 6×10^{9} kg/s, 6.6×10^{6} tons/s

Lesson 11: Molarity 1. 5.0 g 2. 0.256 g 3. no, volume would be greater than 1 L 4. 113 mL
5. 364 mL 6. 62.5 mL 7. a. 0.067, 0.133 b. 0.133, 0 c. 0.20, 0.20 8. 0.040 M 9. 37.5 mL
10. 300 mL 11. 0.571 M 12. 0.254 M

Lesson 8: Molecular Geometry

1.

substance	electron pair orientation	geometry	bond angles
H_2S	tetrahedral	bent	109
NH_3	tetrahedral	trigonal pyramid	109
NH_4^+	tetrahedral	tetrahedral	109
BF_3	trigonal planar	trigonal planar	120
SF_6	octahedron	octahedron	90,180
CO_2	linear	linear	180
SO_2	trigonal planar	bent	120
CH_4	tetrahedral	tetrahedral	109

2. a. tetrahedral b. tetrahedral c. 109 d. 109 3. a. HF b. H-O c. C-Cl d. C-F
4. H_2O, CO_2 5. SO_2 is a bent molecule and center of positive charge does not coincide with the center of negative charge. CO_2 is linear and symmetrical. 6. a. H_2O b. HCl c. H_2O d. CH_3Cl

Lesson 9: Dissolution, Precipitation & Acid-base Rxns 2. the following form precipitates: b,c,e,f,h,i,k,l,m,n
4. H^+, HF, OH^-, HNO_2, H^+, $HC_2H_3O_2$, H_2S, OH^-, H^+, H^+, $HC_3H_5O_3$, HCLO, NH_3

Lesson 10: Redox Rxns 2. reduced 3. a. nitrogen, b. nitrogen 4. a. O,R b. O,R c. R,O d R,O e. O,R
f. O,R g. R,O h. R,O 5. a. Mg b. H^+ c. H^+

Lesson 11: Nomenclature

sodium oxide	iron(II) sulfide (ferrous sulfide)	bismuth(III) hydroxide
dinitrogen pentoxide	phosphoric acid (hydrogen phosphate)	potassium hypochlorite
tin(IV)nitrate (stannic nitrate)	aluminum sulfide	zinc sulfite
mercury(I) chloride (mercurous chloride)	silver acetate	ammonium carbonate
bromic acid (hydrogen bromate)	silicon tetrachloride	hydrogen sulfide (hydrosulfuric acid)
aluminum carbide	iron(II) hydroxide (ferrous hydroxide)	cesium bicarbonate (hydrogen carbonate)
cobalt(III) dichromate (cobaltic dichromate)	magnesium nitride	barium hydrogen phosphate
diphosphorus trioxide	chromium(VI) oxide	dichloro heptoxide
mercury(II) permanganate (mercuric permanganate)	sulfuric acid (hydrogen sulfate)	calcium hydride
cadmium cyanide	manganese(IV) oxide	copper(II) iodide (cupric iodide)
hydrogen sulfite	methane (hydrogen carbide)	tin(IV) hypochlorite (stannic hypochlorite)
nickel chromate	cobalt(II) carbonate	hydroiodic acid (hydrogen iodide)

$LiNO_3$	NCl_3	AuF_3
SiO_2	$Al_2(CO_3)_3$	$NH_4C_2H_3O_2$
$Co_2(SO_4)_3$	$Ca(ClO_3)_2$	$Sb(HSO_4)_5$
HIO_4	$Cd(OH)_2$	$FeCl_3$
NH_4HSO_3	IBr	$Mg(OH)_2$
$AgBrO_2$	$ZnCr_2O_7$	SnO
SF_6	$Ni(NO_2)_2$	$Pb(MnO_4)_4$
HNO_2	Cu_2S	KOH
NaH_2PO_4	NH_4HCO_3	CS_2

Lesson 12: Gas Laws

1. Cl, Kr, H, He, N 2. increase 3. increase 4. smaller than
5. n/V is smaller since lower P and higher T give higher V 6. b,c,d,f,i,l,n,o 7. 80 g/mL
8. 2.46 L 9. a. 5.0 L b. 0.0972 g 10. -23 ^oC 11. 42.7 psi

Lesson 13: Kinetic Theory

1. a. 1.20 atm b. 0.25 c. 0.90 2. 0.041 3. a. 2.65 b. 21.2 min c. a decrease
4. as V decreases, molecules hit walls more often, so P goes up.
5. He atoms being smaller move much faster so find out faster. 6. more often, with more force
7. less often, with the same force 8. c,d

Lesson 14: Condensed phases, Phase changes and Water

1. b,c,d,e,g,h,i,j,k,l 2. decreases, decreases
3. He;dispersion, ice;dipole-dipole, $Na^+(aq)$;ion-dipole, $O_2(aq)$; dipole-induced dipole
4. a. HF, HBr, HI b. H_2O, NH_3, H_2S c. alc, ether 6. a,c,e; a,c,e,g
7. more molecules have sufficient kinetic energy to overcome the intermolecular forces and the kinetic energy (velocity) of the gas molecules is increased. 8. 35

Lesson 15: Phase diagrams, Raoult=s and Henry=s laws

4. 1.21×10^{-9} 5. 1.36×10^{-2} ppm 6. a. 0.139 mole, 0.304 M b. 3.38 g, 0.272 L
c. 78.1 g, 0.868 mole 7. a. 2.26 b. 0.926 c. 4.38 d. M 9. 0.200

Lesson 16: Colligative Prop 1. a,c,d,e,f,j,l 3. solubility 5. the same 6. higher than 7, lower than
8. They are not temperatue dependent.

Lesson 17: Gaseous Equilibrium

1. a. $\dfrac{P_{POCl}^{10}}{P_{PCl_5}^{6} \; P_{P_4}^{} \; P_{H_{10}}^{}}$ b. $\dfrac{P_{SO}^{2}}{P_{O_2}^{3}}$ c. P_{O_2}

2. b. 1/11 c. Q = 8, to the right 3. a. 1/1.30 b. $(1.3)^2$ 4. 1.38×10^4
5. a. to the left b. H_2 and I_2=0.242 atm, HI = 1.92 atm 6. a. mostly Cl_2 b. some of both
7. H_2 and CO_2 = 0.266 atm, Co and H_2O = 0.234 atm
8. CO_2 = 0.0883 atm, Br_2 = 0.0683atm, $COBr_2$ = 0.0317 atm

Lesson 18: LeChatelier=s Principle

1. a. increase b. increase c. increase d. decrease e. increase f. increase g. nothing h. nothing i. nothing 3. large

Lesson 22: Acids and Bases I

1. H_2S, H_2CO_3, H_3O^+, HCN 2. PO_4^{3-}, S^{2-}, O^{2-}, NH_3 3. a. 5×10^{-11} b. 3.70
4. 0.0176 1.6×10^{-13} 5. a. 1.70×10^{-3} b. 11.23 c. OH^- 6. $SO_2(OH)_2$ {H_2SO_4}
7. CN^-, CO_3^{2-} 8. a. HC b. C^- c. C^- 9. a. Na_2S b. NH_4Cl c. NaCl 10. directly, undefined
11. 9.4 12. 1/100 13. close to1, small, large 14. a. HCl b. CO_3^{2-} c. HCO_3^- d. Cl^-
e. $F^- + H_2O \Longrightarrow HF + OH^-$ f. 1.4×10^{-11}

Lesson 22: Acids and Bases II

1. a. 2.79 b. 0.80% 2. a. 5×10^{-6} b. 5.30 3.a. 3.22 b. 1.2×10^{-6} 4. a. 1.35×10^{-9} b. 0.056
5. basic (CN^- is a stronger base than NH_4^+ is as an acid) 6. a. 0.01 b. 0.67(2 to 3) c. 2.0 d. 0.5
7. a. 8×10^{-13} b. 1×10^{-7} c. 1.8×10^{-5} d. 2×10^{-9} e. 4×10^{-13} 8. a. 1), 2), 3), 4)
b. 1), 2), 3), 4) c. 2), 3), 5) 9. 4.22 - 6.22 10. either NaOH or NH_3 (NH_4OH) 11. all three

Lesson 23: Titrations

1. same 2. a.<7 b. >7 c.>7 d. <7 e.>7 f.7 g.<7 h.<7 i.<7 j.>7 k.>7 l.<7 m.<7
n.>7 o.>7 3. i, l, m 4. all 5. a. orange b. yellow c. 6 d. yes 6. HPO_4^{2-}

Lesson 24: Solubility Equilibrium

1. unpredictable
2. $K_{sp} = [Ag^+][Cl^-]$, $[Pb^{2+}][Br^-]^2$, $[Bi^{3+}]^2[S^{2-}]^3$, $[Fe^{3+}][OH^-]^3$
3. a. 2.05×10^{-4} M b. 4.10×10^{-4} M c. 3.4×10^{-11}
4. 0.016M 5. $CaCO_3$ $Fe(OH)_3$ $AlPO_4$ ZnS 6. a. 1.1×10^{-11} b. 10.5 7. 6.3×10^{-5}
8. $[OH^-] = 4.0 \times 10^{-4}$ M $[Ca^{2+}] = 0.10$ M $Q = (0.10)(4.0 \times 10^{-4})^2 = 1.6 \times 10^{-8} < K_{sp}$
   Therefore, no precipitate. 9. 1.8×10^{-18} 11. a) 12. $Cu(OH)_2$

Lesson 26: Thermochemistry I

1. water 2. 0.639 J/g°C 3. mass, composition 4. 19.8 kJ/mole 5. -118 kJ 6. zero 7. 3.43×10^4 kJ
8. a,b,c 9. less 10. $1/2N_2(g) + O_2(g) \Longrightarrow NO_2(g)$ 11. $Br_2(g)$ 12. -286 kJ/mole
13. -2602 kJ 14. +86 kJ 15. -1676 kJ/mole

Lesson 27: Thermochemistry II

2. a. +92 kJ/mole b. -1.8×10^3 kJ/mole 3. a. by, - b. no work, about 0 c. on, + 5. -198 J
6. +37.5 kJ, -3.2 kJ, +40.7 kJ

Lesson 28: Thermodynamics I

2. a. Li(l) b. CH_3OCH_3(l) c. Xe d. CO_2 3. a.8 b.9 c.8 d.8 e.8 f.8 g.9 h.8 i. about 0
5. J/°C 6. increase 7. +ÄS 8. ÄG = -TÄS, ΔH_{sys} is inversely related to ΔS_{surr}
9. no net change 10. ΔH_{sys}, negative; ΔS_{surr}, positive

Lesson 29: Thermodynamics II

1. When all reactants and products are 1.0 M or 1.0 atm; no, ΔG^o is not; no; no, ΔG^o is not.
2. calculating ΔG^os for reactions. 3. a. >0 b. >0 c. 1) 0 2) <0 3) >0 d. 1) >0 2) <0
   e. >0 f. 1) >0 2) >0

Lesson 30: Metallurgy and Redox

1. very poor reducing agents 2. a. Fe, Al b. Pb, Zn c. Au, Pt, Ag, Cu
4. a. CO b. C c. lower d. Cr e. combine with silicates to form slag for removal 5. Cu & SO_2
6. can be pulled into a wire, can be shaped by pounding, etc 7. Cu, alloys of Hg

Lesson 31: Electrochemistry I

2. 75 C, 0.031 3. 348 min 4. 108 g/mole 5. a. 0.588 g b. 0.132 A 6. 42.4 min

Lesson 32: Electrochemistry II

1. a. Mg b. Mg c. $Mg + 2Ag^+ \Longrightarrow Mg^{2+} + 2Ag$ d. 3.16 v
2. a. $NO_3^-(H^+)$ b. $NO_3^-(H^+)$ c. $Al + NO_3^- + 4H^+ \Longrightarrow Al^{3+} + NO + 2H_2O$ d. 2.64 v e. lower than 3. -4.37 v, no 4. a. Ag^+ b. I_2 c. many including I_2, Cu^{2+}, H^+, Ni^{2+} 5. a. Hg, Cu b. Cl_2, Au^{3+} c. H_2
6. $\Delta G^o = -nFE^o$ $\Delta G^o = -RT\ln K_{eq}$ $E^o = (RT/nF)\ln K_{eq}$ If $\Delta G^o < 0$ then E^o is > 0 and K_{eq} is > 1
7. no, very high zinc ion concentration and very low cupric ion concentration

Lesson 33: Electrochemistry III

1.

anode	cathode
a. $2Br^- \text{===> } Br_2 + 2e^-$	$K^+ + e^- \text{===> } K$
b. $2I^- \text{===> } I_2 + 2e^-$	$2H_2O + 2e^- \text{===> } H_2(g) + 2OH^-(aq)$
c. $2I^- \text{===> } I_2 + 2e^-$	$2H^+ + 2e^- \text{===> } H_2(g)$
d. $2H_2O \text{===> } O_2(g) + 4H^+ + 4e^-$	$Cu^{2+} + 2e^- \text{===> } Cu$
e. $2H_2O \text{===> } O_2(g) + 4H^+ + 4e^-$	$2H_2O + 2e^- \text{===> } H_2(g) + 2OH^-(aq)$

4. a. $2H_2(g) + O_2(g) \text{===> } 2H_2O(l)$ b. 1.23 v

Lesson 34: Solids I (answers in text)

Lesson 35: Solids II 1.all false 2. $CaCO_3$-ionic, SiO_2-network covalent, KNO_3-ionic, H_2O(ice)-polar molecular, Ca-metallic, CO_2-nonpolar molecular, I_2-nonpolar molecular, glass-amorphous, diamond-network covalent 3. a. ionic b. molecular c. network covalent

Lesson 36: Kinetics (rate laws)

1. a. zero, first, first 2. a. 0.96 b. 0.80 s^{-1}
3. second order with respect to A and first order with respect to B
4. a.. first, first b. -6×10^{-6} c. 2×10^{-3} L $mole^{-1}$ s^{-1}
5.a. 1.44×10^{-4} s^{-1} b. 1.15×10^{5} s 6. a. 35 s b. 2.76×10^{-2} M

Lesson 37: Catalysis

2. b,c,e,f 3. kinetic energy increases so there are more collisions and more collisions which are hard enough to reach the transition state. 4. rate vs temperature data, all variables other than T
6. a. Y b. Y c. N d. N e. Y f .N g.Y

Lesson 38: Mechanisms

2. a. C & D, b. (fast) rate = $k_1[NO_2]^2$, (slow) rate = $k_2[N_2O_4]^1[CO]^2$
3. rate = $k[NO_2]^2$ 4. a. rate = $k[NO_3][NO]$ b. NO_3