Chapter 9

(1) Look up

(2) $2Ag + Cl_2 \rightarrow 2AgCl$

$\quad\quad\; x \quad\quad\quad\; 84g$

$$84.0g\ AgCl \times \frac{1\,mol\ AgCl}{143.3L} \times \frac{1\,mol\ Cl_2}{2\,mol\ AgCl} \times \frac{70.90}{1\,mol\ Cl_2} = 20.5g\ Cl_2$$

(3) $\overset{4}{\cancel{2}}NH_3 + \overset{7}{\cancel{2}}O_2 \rightarrow \overset{6}{\cancel{3}}H_2O + \overset{4}{\cancel{2}}NO_2$

2.1×10^{24} molecule

$$2.1 \times 10^{24}\ molecules \times \frac{1\,mol\ molecules}{6.02 \times 10^{23}\ molecules} \times \frac{4\,mol\ NH_3}{7\,mol\ O_2} \times \frac{17.04g\ NH_3}{1\,mol\ NH_3} = \boxed{3.40g\ NH_3}$$

(4) $2HCl \rightarrow H_2 + Cl_2$

25.8g $\quad$ Actual 13.6g

$$25.8g \times \frac{1\,mol\ HCl}{36.45g} \times \frac{1\,mol\ Cl_2}{2\,mol\ HCl} \times \frac{70.90g\ Cl_2}{1\,mol\ Cl_2} = \boxed{25.1g\ Cl_2}$$

$$\%\ yield = \frac{A}{T} \times 100 = \frac{13.6}{25.1} \times 100 = \boxed{54.2\%}$$

(5) $2H_2 + O_2 \rightarrow 2H_2O$

16.2g $\quad$ 16.4g

$$16.2g\ H_2 \times \frac{1\,mol\ H_2}{2.02g\ H_2} \times \frac{2\,mol\ H_2O}{2\,mol\ H_2} \times \frac{18.02g\ H_2O}{1\,mol\ H_2O} = 144.51g\ H_2O$$

$$\boxed{16.4g\ O_2} \times \frac{1\,mol\ O_2}{32.0g\ O_2} \times \frac{2\,mol\ H_2O}{1\,mol\ O_2} \times \frac{18.02g\ H_2O}{1\,mol\ H_2} = \boxed{18.47g\ H_2O}$$

Limiting

Maximum amount of H_2O

Chapter 10

① p 329 for gases

② Temperature Increase causes gas particles to move. KINETIC ENERGY IS THE product speed and mass of particles. As TEMP INCREASES so does kinetic energy and speed

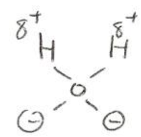
③ The stronger the attractive forces the lower the equilibrium vapor pressure. (less gas particles present)

④ AT THE BOILING A LIQUID IS heated to where VAPOR PRESSURE of that SUBSTANCE IS EQUAL ATMOSPHERIC PRESSURE.

⑤ These values are large, this means water has strong IMF's (Intermolecular forces). They require larger Amounts of energy to break bonds.

⑥ The values are positive therefore endothermic. Ice and ~~gas~~ liquid gain energy to form ~~wate~~ liquid and gas.

⑦ ~~Wh~~ Water's structure is



The Hydrogen has partial positive charge and the lone pairs are negative. The molecule has a positive and negative side therefore it is polar.

Water is bent because of VSEPR. The lone pairs of electrons repel the bonds bending the shape of the molecule.

⑧. ~~I~~ WATER HAS very strong IMF's, thus water has a low vapor pressure.

Ⓐ Water stays mostly in the liquid form at room temp.

Ⓑ Water requires large amounts of energy to boil

Ⓒ Solid H_2O seperates ~~to~~ and is less dense than liquid.

Ⓓ Even though water is a small molecule ~~IT~~, therefore weak london dispersion forces ITS Hydrogen bonding allows large ~~amount~~ boiling point.

Chapter 11 Gases

① As more gas enters the balloon, there are more collisions which increases pressure.

② Because IMF are ignored therefore the molecules cannot attract each other.

③ $PV = nRT$

$V = 855mL \times \frac{1}{1000mL} = 0.855L$

$n = \frac{PV}{RT}$

$T = 35°C + \cancel{273} = 308\ K$

$P = 1860mmHg \times \frac{1\ atm}{760mmHg} = 2.45\ atm$

$= \frac{(2.45)(0.855L)}{(0.0821 \frac{L \cdot atm}{K \cdot mol})(308K)}$

$R = 0.0821 \frac{L \cdot atm}{K \cdot mole}$

$\boxed{n = 0.0828\ moles}\ CO_2 \times \frac{44.01g\ CO_2}{1mol} = \boxed{3.64g\ CO_2}$

④ $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$P_2 = \frac{P_1V_1T_2}{T_1V_2} = \frac{(95.2kPa)(2.75L)(313K)}{(297K)(1.82L)} = \boxed{151\ kPa}$

$P_1 = 95.2kPa$

$P_2 = ?$

$V_1 = 2.75L$

$V_2 = 1.82L$

$T_1 = 24.0 + 273 = 297K$

$T_2 = 40 + 273 = 313$

⑤ $P_{TOT} = P_A + P_B + P_C$

6.11atm = 168(1atm/101.325)+3.89atm+Pc

Pc = .55atm

⑥ Ammonia NH_3

Ethanol C_2H_5OH

Smell Ammonia first because it is smaller (lower mass) therefore moves ~~&~~ with more speed.

⑦ $8.00g \times \frac{1mole\ O_2}{32.00g} \times \frac{22.4L}{1mol\ O_2} = 5.6L$

Only true at STP

⑧ Charles = constant pressure $V_1/T_1 = V_2/T_2$

Boyle = Constant Temperature. $P_1V_1 = P_2V_2$

Gay-Lussac = constant Volume $P_1/T_1 = P_2/T_2$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

Chapter 16

(1) $q = m \cdot C_p \cdot \Delta T$

$= 32.0g \times 4.18 \frac{J}{g \cdot C°} \times (80 - 25)$

$q = 7357\,J \approx \boxed{7400\,J}$

(2) $C_p = \frac{q}{m \cdot \Delta T} = \frac{849\,J}{95.4g \cdot (48.0 - 25.0)} = \boxed{0.387 \frac{J}{g \cdot C°}}$

(3) The SAME!

(4) Energy absorbed by water = -(Energy released by dissolving of $CaCl_2$)
(endothermic) (exothermic)

$m \cdot C_p \cdot \Delta T = q = -\Delta H$ 125mL H_2O = 125g H_2O

$125g \cdot 4.18 \frac{J}{g \cdot \Delta T°} \cdot (42.0 - 25.0) = q = -\Delta H$ density = 1.09/mL

$8880\,J = q = -\boxed{\Delta H = -8880\,J}$ (A) $\rightarrow$ $\boxed{-8.88\,kJ}$

(B) $\frac{kJ}{mol} = \Delta H_{soln}$ $CaCl_2 = 28.2g \times \frac{1 mol\ CaCl_2}{110.78g} = 0.254\,mol$

$\frac{-8.88\,kJ}{0.254\,mol} = -34.9\,kJ/mol$

(5) $W_{(s)} + C_{(s)} \rightarrow WC_{(s)}$

$2W + 3O_2 \rightarrow 2WO_3$ DH = -842.9 kJ (1/2)
$2C + O_2 \rightarrow CO_2$ DH = -393.5 kJ
$2WO_3 + 2CO_2 \rightarrow 2WC + 5O_2$ DH = -2391.8 (-1/2)

DH = 380.5 kJ

Chapter 12

① Look up definitions

② (A) Solid

a Solid will increase solubility for endothermic reactions

b Shaking will inceasc solubility

c Increase pressure has no effect

d ~~de~~ pressure = no effect on solid/liquid
decrease temp slows solubility

(B) Gases

a Increase in temp decreases solubility
gases move faster, escape solution

b decrease solubility

c Increase solubility

d increase solubility

③ (a) 1. a dilute unsaturated solution adds water and is diluted
2. a dilute saturated solution would cause more solid to dissolve.

(b) 1. concentrated saturated soln can have no greater molarity unless temp is increased.
2. concentrad unsaturated can have more solid added to increase molarity.

(c) (a) A supersaturated solution is unstable and holds more dilute solute than is possible.

(b) A saturated solution holds maximum solute possible.

④ (a) $\text{Molarity} = \frac{\text{moles}}{L} = \frac{42.6\text{g NaOH} \times \frac{1\text{mol}}{40.00\text{g}}}{3.00\text{L}} = \boxed{0.355\text{ M}}$

(b) $M = \frac{\text{moles}}{L}$ $\quad M \cdot L = \text{moles}$ $\quad 0.25M \times 0.680L = \text{moles}$
$\boxed{0.17 \text{ moles } Na_2SO_4}$

(c) $\text{Moles} = M \cdot L = 0.100M \cdot 0.500L = .05\text{ moles KBr} \times \frac{119.0\text{ g}}{1\text{ mole}} = \boxed{5.95\text{g KBr}}$

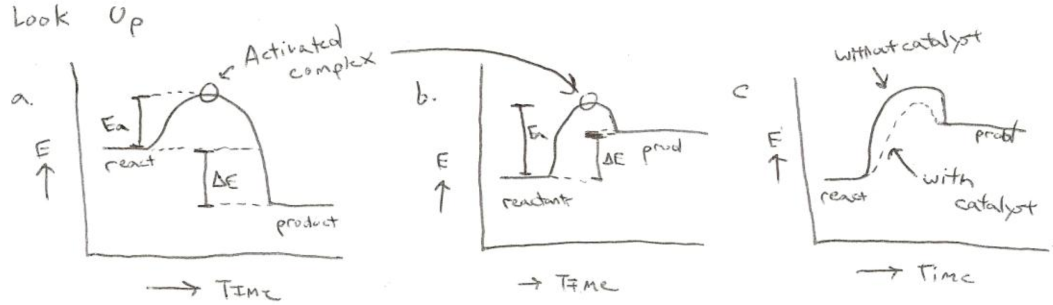
⑤ (A) Dilution
~~~~
$M_1V_1 = M_2V_2$
$(.15M)(.4) = (.75M)(xL)$
0.08M $= xL$

(B) $M_1V_1 = M_2V_2$
$(0.20M)(0.050L) = (4.0M)(V_2)$
.0025L $= V_2$

To perform dilution, Measure out volume of stock solution using a graduated cylinder. Add to a volumetric flask then add water until you reach desired volume.
~~~~

Chapter 17-18

① Look Up

② 

③ ⓐ ↑ rate of reaction, particles move faster ∴ more collisions

ⓑ ↓ rate of reaction, less particles = less collisions and chances for "good" collision.

ⓒ ↑ rate of reaction, more sites available to react

ⓓ ↑ rate of reaction by lowering activation energy.

④ ⓐ shift ~~to~~ left ⓒ shift right ⓔ shift right because of decrease in pressure.

ⓑ shift right ⓓ shift right

⑤ $Rate = k[A]^n[B]^m$

order of A

$$\frac{RATE_2}{RATE_1} = \frac{[A]_2}{[A]_1}$$

$4 = 2^n$

$\boxed{n=2}$ order A

order B

$$\frac{RATE_3}{RATE_1} = \frac{[B]_3}{[B]_1}$$

$4 = 2^m$

$\boxed{2=m}$ order B

overall order = 4

$RATE = k[A]^2[B]^2$

$$\frac{RATE}{[A]^2[B]^2} = k$$

$$\frac{3.0\times10^{-4}\frac{M}{s}}{(2^2 M)(5M)^2} = k \rightarrow \boxed{k = 0.000003\frac{1}{M^3\cdot s}}$$

⑥ Ⓐ $4NH_{3\,g} + 5O_{2\,g} \leftrightarrow 4NO_{(g)} + 6H_2O_{(g)}$

$$k = \frac{[NO]^4[H_2O]^6}{[NH_3]^4[O_2]^5}$$

Ⓑ $N_2O_{4(g)} \leftrightarrow 2NO_{2(g)}$

$$k = \frac{[NO_2]^2}{[N_2O_4]}$$

Ⓒ $COCl_{2(g)} \leftrightarrow CO_{(g)} + Cl_{2(g)}$

$$k = \frac{[CO][Cl_2]}{[COCl_2]}$$

Ⓓ $CaO_{(s)} + CO_{2(g)} \rightarrow CaCO_{3(s)}$

$$K = \frac{1}{[CO_2]}$$

Chapter 17-18 (Cont.)

7. (a) ~~Prod~~ Products are favored
   (b) Reactants are favored

8. (a) $K = \frac{[C]^2}{[A]^2[B]} = \frac{(.4M)^2}{(.6)^2(.1)} = \boxed{4.4}$ (B) $K = \frac{[C]}{[A][B]^3} = \frac{(0.2)}{(1.2)(0.4)^3} = \boxed{2.6}$

   (c) products (c) products

Chapter 13

1. STRONG
   NaCl, HCl } dissociate 100%

   Weak
   Weak Acids & bases $HC_2H_3O_2$ (acetic acid) NH_3 (ammonia) partial amounts of ions formed

   Nonelectrolytes
   Sugar ~~$C_6H_{12}O_6$~~ $C_{12}H_{22}O_{11}$
   Cornstarch
   do not form ions when dissolve

2. (1) WATER IS POLAR
   (a) ✓ soluble (Polar/Ionic)
   (b) X NICKEL (Metals have balanced charge)
   (c) HBR ✓ soluble
   (d) $CaCO_3$ Insoluble (see solubility rules)
   (e) ✓ ethanol (polar) soluble
   (f) X benzene (nonpolar)
   (g) CCl_4 X nonpolar

   Like dissolves Like

   (2) Heptane is nonpolar
   (a) X (b) X (c) X (d) X (e) X (f) ✓ (g) ✓

3. (3) see above (like dissolves like)

4. overall $Ca(OH)_{2(aq)} + Na_2CO_{3(aq)} \rightarrow 2NaOH_{(aq)} + CaCO_{3(s)}$

   Total ionic $Ca^{+2}_{(aq)} + 2OH^-_{(aq)} + 2Na^+_{(aq)} + CO_3^{-2}{}_{(aq)} \leftrightarrow 2Na_{(aq)} + 2OH_{(aq)} + CaCO_{3(s)}$

   net ionic $Ca^{+2}_{(aq)} + CO_3^{-2}{}_{(aq)} \leftrightarrow CaCO_{3(s)}$

   Spectators are OH^- & Na^+

Chapter 14-15

① Look up

② Chart page 482

③ $CH_3COOH + H_2O \longleftrightarrow CH_3COO^- + H_3O^+$

acid   base   conjugate base   conjugate acid

④

ⓐ $K_w = [H_3O^+][OH^-]$

$1 \times 10^{-14} = (.0024)(x)$

$\boxed{4.17 \times 10^{-12} M} \; x = [OH^-]$

ⓑ $[OH] = 1.6 \times 10^{-12} M$

$\frac{K_w}{[OH^-]} = H^+$

$\frac{1 \times 10^{-14}}{1.6 \times 10^{-12}} = H^+$

$\boxed{0.0063 M = H^+}$

ⓒ $pH = -\log[H_3O^+]$

$= -\log[0.025]$

$\boxed{pH = 1.602}$

ⓓ $pOH = 14 - pH$

$= 14 - (-\log .025)$

$\boxed{pOH = 12.4}$

ⓔ $pH = 14 - pOH$

$= 14 - (-\log[OH^-])$

$= 14 + \log[4.4]$ ← Remember to multiply by 2 because 2 moles of OH^- in 1 mol $Ca(OH)_2$!

$\boxed{pH = 14.64}$

⑤ $H_2O \rightarrow H^+_{(aq)} + OH^-_{(aq)}$

$K_w = 1 \times 10^{-14} = [H^+][OH^-]$

$1 \times 10^{-14} = [x^2]$

$1 \times 10^{-7} = x = [H^+] = [OH^-]$

$pH = -\log[H^+]$

$= -\log[1 \times 10^{-7}]$

$\boxed{pH = 7}$

⑥ (A) & (B) Strong dissociates 100% weak dissociates partial

~~(B) Weak~~

⑦ ⓐ A high molarity of ~~and~~ acid that does not fully dissociate

ⓑ HCl with lots of water added. Still dissociates 100%

⑧ ⓐ $HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$

ⓑ $2NH_{3(aq)} + H_2SO_{4(aq)} \rightarrow (NH_4^+)_2SO_{4(aq)}$

ⓒ $H_2CO_{3(aq)} + Ca(OH)_2 \rightarrow 2H_2O_{(l)} + CaCO_{3(s)}$

ⓓ $C_2H_3O_2H + KOH \rightleftarrows KC_2H_3O_2 + H_2O$

(9) (a) $NaOH_{(aq)} + HCl_{(aq)} \rightarrow H_2O + NaCl$

1:1 ratio ∴ 3.5 moles HCl = 3.5 mole NaOH

(b) $2HCl + Mg(OH_2)_2 \rightarrow MgCl_2 + 2H_2O$

6.0 moles

1:2 ratio $\frac{6 \text{ moles } Mg(OH)_2}{} \times \frac{2 \text{ mol } HCl}{1 \text{ mole } Mg(OH)_2} = \boxed{12 \text{ mol } HCl}$

(10) $HCl + NaOH \rightarrow NaCl + H_2O$

(a) M? .20M

.020L .040L

Moles NaOH = M × L

= .20M × .040

Moles = .008 moles NaOH

1:1 ration ∴ .008 mole HCl

$M\ HCl = \frac{\text{moles}}{L} = \frac{.0080}{.0020}$

$\boxed{M = 4.0M}$ HCl

(b) $2HCl + Mg(OH)_2 \rightarrow MgCl_2 + 2H_2O$

0.1M moles?

0.075L .050L

Moles HCl = M · V

= 0.1M · 0.075L

Mole HCl = .0075 moles HCl × $\frac{1 \text{ mol } Mg(OH)_2}{2 \text{ mol } HCl}$ = $\boxed{.00375 \text{ moles } Mg(OH)_2}$

(c) $3NaOH + H_3PO_4 \rightarrow Na_3PO_4 + 3H_2O$

M? 1.0M

0.020L .0280L

Moles H_3PO_4 = 1.0 × .0250L

∴ .0280 moles H_3PO_4 × $\frac{3 \text{ mol } NaOH}{1 \text{ mol } H_3PO_4}$ = .084 moles NaOH

$M = \frac{\text{moles}}{L}$

$= \frac{.084}{.020}$

$\boxed{M = 4.2M\ NaOH}$