Chapter 4

(1) Lithium - Group I always dissociates completely
Since 2 Li^+ & 1 SO_4^{2-} in every Li_2SO_4
(C) is the answer

(2) HCl strong acid dissociates into H^+ & Cl^- ions ∴ ions can conduct electricity

(3) a) nonelectrolyte - no dissociation
b) weak electrolyte - some dissociate
c) strong electrolyte - all dissociate

(4) acetic acid requires higher conc (molarity) since it is a weak acid and partially dissociates to make same conc of H^+ from the low molarity strong acid HBr

(5) A) NaOH strong base completely dissociates
B) AgBr insoluble salt
C) glucose = nonelectrolyte no dissociation

(7) B, C always soluble so they always cancel in net ionic reactions

(11) not correct, movement of ions

(20) a) insoluble
b) insoluble
c) soluble
d) insoluble
e) soluble

Chapter 4 continued...

(21) a) $Na_2CO_3(aq) + 2AgNO_3(aq) \rightarrow 2NaNO_3(aq) + Ag_2CO_3(s)$

b) no reaction / no precipitate Na^+ & NO_3^- always soluble

c) $FeSO_4(aq) + Pb(NO_3)_2(aq) \rightarrow PbSO_4(s) + Fe(NO_3)_2(aq)$

(22) a) precipitate will form

$Ni(NO_3)_2(aq) + 2NaOH(aq) \rightarrow 2NaNO_3(aq) + Ni(OH)_2(s)$

b) no precipitate (both group I metals always soluble)

c) $Na_2S(aq) + Cu(CH_3COO)_2(aq) \rightarrow 2NaCH_3COO(aq) + CuS(s)$

(23) a) Na^+, SO_4^{2-}

b) NO_3^-, Na^+

c) NH_4^+, Cl^-

(24) a) $Cr^{+3} + \cancel{SO_4^{2-}} + \cancel{NH_4^+} + CO_3^{2-} \rightarrow Cr_2(CO_3)_3 + NH_4^+ + \cancel{SO_4^{2-}}$

$2Cr^{+3}(aq) + 3CO_3^{2-}(aq) \rightarrow Cr_2(CO_3)_3(s)$

spectator ions : SO_4^{2-} and NH_4^+

b) $Ba^{+2}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$

spectator ions : NO_3^- and K^+

c) $Fe(OH)_2(s)$ formed

$Fe^{+2}(aq) + 2OH^-(aq) \rightarrow Fe(OH)_2(s)$

spectator ions : NO_3^- and K^+

(25) Pb^{2+}

Chapter 4 continued...

(26) CO_3^{2-}

(29) B - HI strong acid - makes most H^+ = protons

(30) KOH and $Ba(OH)_2$ both strong bases
KOH makes 0.150 M OH^- ions
$Ba(OH)_2$ makes $0.1 \times 2\ OH^- = 0.2\ M$
(c) makes highest conc when dissociated

(31) a) monoprotic - one H^+ dissociates (eg HCl)
diprotic - two H^+ dissociate (eg. H_2SO_4)
b) weak acid - slightly dissociates
strong acid - completely dissociates
c) acid - forms H^+ ions in water
base - forms OH^- ions in water

(35) a) HF = weak acid (partially dissociates)
mixture of molecules & ions
HF, H^+ and F^-

b) none - covalent cmpd (not acid or base)
only molecules (nonelectrolyte)

c) salt; entirely ions completely dissociates into Na^+ & ClO_4^-

Chapter 4 continued...

d) $Ba(OH)_2$ = strong base Completely dissociates entirely into ions Ba^{+2} and OH^- ions

(36) Since acid: must contain removable H located in front of formula
weak conductor means weak acid
= H_3PO_3

(37) a) weak electrolyte = weak acid
b) nonelectrolyte = covalent cmpd
c) weak base = weak electrolyte
d) strong electrolyte - always soluble
e) strong electrolyte - always soluble

(38) a) strong electrolyte - strong acid
b) strong electrolyte - strong acid
c) strong electrolyte - always soluble
d) nonelectrolyte - covalent cmpd
e) strong electrolyte
f) nonelectrolyte - covalent cmpd

(39) a) $HBr(aq) + Ca(OH)_2(aq) \rightarrow H_2O(l) + CaBr_2(aq)$
$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

Chapter 4 continued...

(40) a) weak acid $HC_2H_3O_2(aq)$ + strong base $KOH(aq) \rightarrow H_2O(l) + KC_2H_3O_2(aq)$

$HC_2H_3O_2(aq) + OH^-(aq) \rightarrow H_2O(l) + C_2H_3O_2^-$

b) weak base $Cr(OH)_3(aq) + 3HNO_3(aq) \rightarrow 3H_2O(l) + Cr(NO_3)_3$

$Cr(OH)_3(aq) + H^+(aq) \rightarrow H_2O(l) + Cr^{3+}(aq)$

c) weak acid $HClO(aq)$ + strong base $Ca(OH)_2(aq) \rightarrow H_2O(l) + CaClO(aq)$

$HClO(aq) + OH^-(aq) \rightarrow ClO^-(aq) + H_2O(l)$

(45) a) oxidation is loss of electrons
reduction is gain of electrons

b) oxidation is increase in charge
reduction is decrease in charge

(47) most oxidized - A
least oxidized - D

(49) a) +4 c) +7 e) 0
b) +4 d) +1 f) -1

(50) a) +4 c) +3 e) +3
b) +2 d) +2 f) +6

(51) a) oxidized : H reduced : N
b) Oxid : Al red : Fe

Ch. 4 continued...

51. (c) oxidized: I reduced: Cl

d) oxidized: S reduced: O

52) a) Acid-base

b) redox

oxidized: C reduced: Fe

c) precipitation

d) redox

oxidized: Zn reduced: N

53) a) $2Mn(s) + H_2SO_4(aq) \rightarrow H_2(g) + MnSO_4(aq)$

$Mn(s) + 2H^+(aq) \rightarrow H_2(g) + Mn^{2+}$

use table on pg 141 to know what ions the transition metals make

b) $2Cr(s) + 6HBr(aq) \rightarrow 2CrBr_3(aq) + 3H_2(g)$

$2Cr(s) + 6H^+(aq) \rightarrow 2Cr^{3+}(aq) + 3H_2(g)$

c) $Sn(s) + 2HCl(aq) \rightarrow SnCl_2(aq) + H_2(g)$

$Sn(s) + 2H^+(aq) \rightarrow Sn^{2+}(aq) + H_2(g)$

60) a) remains same

b) ↑ conc ↓ L solution

c) 22.5 g

61) a) $M = \frac{0.0250 \text{ mol}}{.5} = 0.05\ M$

Chapter 4 continued...

b) $2.50\ M = \frac{mol}{0.05}$ $mol = .125\ mol$

c) $1.50\ M = \frac{0.275\ mol}{L}$ $0.183\ L = 183\ mL$

(69) a) $KCl = 0.20\ M\ K^+$

$K_2CrO_4 = 0.15 \times 2K^+ = 0.30\ M\ K^+$

$K_3PO_4 = .08 \times 3K^+ = 0.24\ M$

b) K_2CrO_4 $0.15 = \frac{mol}{.03} = 0.0045\ mol\ K_2CrO_4$

$= 0.009\ mol\ K^+$

K_3PO_4 $0.08 = \frac{mol}{.025}$ $mol = 0.002$

$.006\ mol\ K^+$

(73) a) $0.250\ M = \frac{mol}{1L}$ $mol = 0.250\ mol$

$14.8 = \frac{.250\ mol}{L}$ $0.0169\ L$ or $16.9\ mL$

b) $14.8\ M = \frac{mol}{.01\ L}$ $.148\ mol$

$M = \frac{.148\ mol}{.5\ L}$ $0.296\ M$

Chapter 4 continued...

(79) $KCl + AgNO_3 \rightarrow KNO_3 + AgCl$

$$\frac{0.200 \text{ mol } AgNO_3}{L} \times \frac{0.015\,L}{} \times \frac{1 \text{ mol } KCl}{1 \text{ mol } AgNO_3} \times \frac{74.553\text{ g } KCl}{1 \text{ mol } KCl}$$

$= 0.224 \text{ g } KCl$

(81) a) $HClO_4 + NaOH \rightarrow NaClO_4 + H_2O$

$$\frac{0.0875 \text{ mol } NaOH}{L} \times \frac{0.05\,L}{} \times \frac{1 \text{ mol } HClO_4}{1 \text{ mol } NaOH} \times \frac{1\,L}{0.115 \text{ mol}} =$$

$0.0380\,L$ or 38.0 mL

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

$$2.87\text{ g } Mg(OH)_2 \times \frac{1 \text{ mol } Mg(OH)_2}{58.3158\text{ g } Mg(OH)_2} \times \frac{2 \text{ mol } HCl}{1 \text{ mol } Mg(OH)_2}$$

c) $$\frac{0.108 \text{ mol } HCl}{L} \times \frac{0.0453\,L\ HCl}{} \times \frac{1 \text{ mol } KOH}{1 \text{ mol } HCl} \times \frac{56.107\text{ g } KOH}{1 \text{ mol } KOH}$$

$= 0.273 \text{ g } KOH$

$HCl + KOH \rightarrow H_2O + KCl$

Chapter 4 continued...

(87)

a) $2KOH(aq) + NiSO_4(aq) \rightarrow K_2SO_4(aq) + Ni(OH)_2(s)$

b) $Ni(OH)_2$

c) $\frac{0.2 \text{ mol KOH}}{L} \times .1\text{ L} \times \frac{1 \text{ mol } Ni(OH)_2}{2 \text{ mol KOH}} \times \frac{92.7058 \text{ g } Ni(OH)_2}{1 \text{ mol } Ni(OH)_2}$

$= 0.927 \text{ g}$

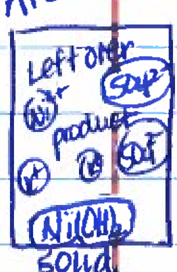
$\frac{0.150 \text{ mol } NiSO_4}{L} \times 0.2\text{ L} \times \frac{1 \text{ mol } Ni(OH)_2}{1 \text{ mol } NiSO_4} \times \frac{92.7058 \text{ g } Ni(OH)_2}{1 \text{ mol } Ni(OH)_2} =$

$= 2.78 \text{ g}$

Limiting reactant = KOH (made least product)

d) 0.927 g $Ni(OH)_2$ formed from limiting reactant

After rxn



e) $0.927 \text{ g } Ni(OH)_2 \times \frac{1 \text{ mol } Ni(OH)_2}{92.7058 \text{ g } Ni(OH)_2} \times \frac{1 \text{ mol } NiSO_4}{1 \text{ mol } Ni(OH)_2} = 0.01 \text{ mol used}$ =

$\frac{.150 \text{ mol}}{L} \times .2\text{ L} = 0.03 \text{ mol orig} - 0.01 = \frac{0.02 \text{ mol left over}}{.3\text{ L}} = 0.0667 \text{ M } NiSO_4$

$.927 \text{ g } Ni(OH)_2 \times \frac{1 \text{ mol } Ni(OH)_2}{92.7058 \text{ g } Ni(OH)_2} \times \frac{1 \text{ mol } K_2SO_4}{1 \text{ mol } Ni(OH)_2} \times \frac{1}{.3\text{ L}} =$

$0.0333 \text{ M } K_2SO_4$

Since the product K_2SO_4 + reactant $NiSO_4$ both dissociate

$Ni^{2+} = 0.0667\text{M}$, $SO_4^{2-} = 0.0667 + 0.0333 = 0.100\text{M}$

$K^+ = 2 \times .0333 = 0.0667 \text{ M}$