Chapter 3 Review

I. Name the following compounds:

1. $Ca(OH)2$ Calcium hydroxide
2. $AgNO_3$ Silver nitrate
3. $(NH_4)_2SO_4$ Ammonium sulfate
4. $NaCl$ Sodium chloride
5. $CuCrO_4$ Copper (II) chromate
6. $AlCl_3$ aluminum Chloride
7. $Fe_2S_3$ Iron (III) Sulfide
8. $CaCl_2$ Calcium chloride
9. $SnBr_2$ Tin (II) bromide
10. $NaMnO_4$ Sodium permanganate

II. Write the formula for the following compounds:

1. iron (III) oxide $Fe_2O_3$
2. sodium carbonate $Na_2CO_3$
3. lead (IV) chloride $PbCl_4$
4. aluminum acetate $Al(C_2H_3O_2)_3$
5. ammonium oxalate $(NH_4)_2(C_2O_4)$
6. lead (II) nitrate $Pb(NO_3)_2$
7. copper (II) sulfate $CuSO_4$
8. beryllium hydroxide $Be(OH)_2$
9. lithium nitride $Li_3N$
10. silver fluoride $AgF$

III. Math

1. What is the molar mass of $Ca_3(PO_4)_2$

Ca = 3 (40) 120
P = 2 (31) 62
O = 8 (16) 128
310 g/mol

2. How many grams of $Na_2S_2O_3$ contain 45g of Sulfur?

$Na = 2(23) = 46$
$S = 2(32) = 64$
$O = 3(16) = 48$
$158g$

$\frac{64g\ S}{158g\ Na_2S_2O_3} = \frac{45g\ S}{x\ g\ Na_2S_2O_3}$

$x = 111g\ Na_2S_2O_3$

3. Bicarbonate of soda (sodium hydrogen carbonate) is used in many commercial preparations. Its formula is $NaHCO_3$. Find the mass percentages (mass %) of Na, H, C, and O in sodium hydrogen carbonate.

$Na = 1(23) = 23$
$H = 1(1) = 1$
$C = 1(12) = 12$
$O = 3(16) = 48$
$84g$

$Na = \frac{23}{84} \times 100\% = 27.4\%$
$H = \frac{1}{84} \times 100\% = 1.2\%$
$C = \frac{12}{84} \times 100\% = 14.3\%$
$O = \frac{48}{84} \times 100\% = 57.1\%$

4. A 15.67 g sample of a hydrate of magnesium carbonate was heated, without decomposing the carbonate, to drive off the water. The mass was reduced to 7.58 g. What is the formula of the hydrate?

$MgCO_3 \cdot xH_2O = 15.67$
$MgCO_3 = -7.58$
$H_2O = 8.09g$

$\#\ moles\ H_2O = 8.09g \times \frac{1\ mole}{18g} = .449\ mol$

$\#\ mole\ MgCO_3 = 7.58g \times \frac{1\ mole}{84} = .0902$

$\frac{H_2O}{MgCO_3} = \frac{.449}{.0902} \sim 5$

$MgCO_3 \cdot 5H_2O$

changed question

5. 95.6 g of menthol (molar mass = 156 g/mol) are burned in oxygen gas (combusted) to give 269 g $CO_2$ and 110g $H_2O$. What is menthol's empirical formula? $C_xH_yO_z + O_2 \rightarrow CO_2 + H_2O$

$\#g\ C = .2829g\ CO_2 \times \frac{1\ mole\ CO_2}{44g\ CO_2} \times \frac{1\ mole\ C}{1\ mole\ CO_2} \times \frac{12g}{1\ mole\ C} = .0772g \times \frac{1\ mole}{12g} = .0064$

$\#g\ H = .1159g\ H_2O \times \frac{1\ mole\ H_2O}{18g\ H_2O} \times \frac{2\ mole\ H}{1\ mole\ H_2O} \times \frac{1g}{1\ mole\ H} = .0129g \times \frac{1\ mole}{1g} = .0129$

$\#g\ O = .1005 - (.0772 + .0129) = .0104g \times \frac{1\ mole}{16} = \frac{6.5 \times 10^{-4}}{6.5 \times 10^{-4}}$

$\frac{.0064}{6.5 \times 10^{-4}}$ $\frac{.0129}{6.5 \times 10^{-4}}$

$C_{10}H_{20}O$

6. A 1.50 g sample of hydrocarbon undergoes complete combustion to produce 4.40 g of $CO_2$ and 2.70 g of $H_2O$. What is the empirical formula of this compound? In addition, its molecular weight has been determined to be about 78. What is the molecular formula?

see back

7. The police have confiscated a substance that they believe to be heroin, ($C_{21}H_{23}NO_5$). The police suspect that the substance is not pure, but is a mixture of heroin and quinine,($C_{20}H_{24}N_2O_2$). Analysis reveals that a 150 g sample contains 15.5 g of quinine. What is the percent purity of heroin in the sample?

$\frac{15.5g}{150g} \times 100\%$ 10.3 quinine heroin is 89.7% pure

IV. Concept Questions

1. What is a binary compound? 2 element bonded
2. What are the two types of bonding that hold atoms together? covalent, ionic, metallic
3. What are the characteristics of the two types of bonds? ionic-transfer $e^-$ covalent share
4. What is the smallest unit called when a metal and a nonmetal are bonded together? formula unit
5. What is the smallest unit called when two nonmetals are bonded together? molecule unit
6. Which atoms form cations? metals
7. Which atoms form anions? non metals
8. Which atoms do not have a fixed oxidation number? transition metals except AZCA

$C_xH_yBr_z + O_2 \rightarrow CO_2 + H_2O$

1.50g 4.40g 2.70g

$$\#g\,C = 4.40g\,CO_2 \times \frac{1\,mole\,CO_2}{44g\,CO_2} \times \frac{1\,mole\,C}{1\,mole\,CO_2} \times \frac{12g}{1\,mole\,C} = 1.20g\,C$$

$$\#g\,H = 2.70g\,H_2O \times \frac{1\,mole}{18g\,H_2O} \times \frac{2\,mole\,H}{1\,mole\,H_2O} \times \frac{1g}{1\,mole\,H} = .3g\,H$$