Name:

CHEMISTRY Calculation Review

All calculations are based on rounded molar mass

1. Naturally occurring chlorine that is put in pools is 75.53 percent Cl-35 (exact mass = 34.969 amu) and 24.47 percent Cl-37 (exact mass = 36.966 amu). Calculate the average atomic mass.

$$AAm = \left(\frac{75.53}{100} \times 34.969\right) + \left(\frac{24.47}{100} \times 36.966\right)$$

$$= \underline{\qquad\qquad} \text{ amu.}$$

2. **Mole Triangle 1**: Determine the mass of 14.8 mol of $BaCrO_4$.

$$m = n \times M$$
$$= 1.48 \times 253$$
$$= 374.44 \text{ g}$$

3. a) **Mole Triangle 2**: How many molecules of BF_3 are there in 0.72 mols?

$$\#\text{molecules} = n \times N_A$$
$$= 0.72 \times 6.022 \times 10^{23}$$
$$= 4.34 \times 10^{23} \text{ molecules.}$$

b) How many atoms of F are there when you have 0.72 mols of BF_3?

$$\#\text{atoms} = 3 \times 4.34 \times 10^{23}$$
$$= 1.302 \times 10^{24} \text{ atoms.}$$

4. **Combination of Mole Triangle 1 and 2**: Calculate the mass of Cl_2 when there is 1.23×10^{22} molecules of Cl_2?

$$m = n \times MM$$
$$= 0.0204 \times 70$$
$$= 1.43 \text{ g}$$

$$n = \frac{1.23 \times 10^{22}}{6.022 \times 10^{23}}$$
$$= 0.0204 \text{ mol.}$$

5. **Percent Composition**: Determine the percentage of oxygen in mercury (I) oxide.

Hg_2O $\quad \%O = \frac{16}{417} \times 100$

$= 3.84\%$

6. a) **Empirical Formula**: Progesterone, a hormone is made up of 80.2% carbon, 10.18 % oxygen and 9.62% hydrogen. Determine the empirical formula.

	m	n	ratio	
C	80.2	6.6833	10.5	$\times 2 = 21$
O	10.18	0.63625	1	$\times 2 = 2$
H	9.62	9.62	15	$\times 2 = 30$

$C_{21}O_2H_{30}$

b) If the true molecular mass of progesterone is 628 g/mol. Determine the True **Molecular Formula**.

$\frac{M.FW}{E.FW} = \frac{628\ g/mol}{314\ g/mol} = 2$ $\quad C_{42}H_4O_{60}$

7. **Mole Ratio**: Balance the complete combustion reaction below. Then determine the number of moles of O_2 needed to react with 0.5 moles of C_3H_8.

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

$\frac{1}{0.5} : \frac{5}{x}$

$x = 2.5$ mol of O_2

8. **Mass-Mass:** Sodium carbonate reacts with nitric acid according to the following *balanced* equation:

$$Na_2CO_3\ (s) + 2\ HNO_3\ (aq) \rightarrow 2\ NaNO_3\ (aq) + H_2O\ (l) + CO_2\ (g)$$

a. If 30 grams of sodium carbonate react with excess nitric acid, how many grams of sodium nitrate should be produced?

$n = \frac{30}{106}$

$= 0.2830\ mol\ Na_2CO_3$

$Na_2CO_3 : NaNO_3$

$\frac{1}{0.283} : \frac{2}{x}$

$x = 0.56603\ mol\ NaNO_3$

$m_{NaNO_3} = n_{NaNO_3} \times MM_{NaNO_3}$

$= 0.56603 \times 85$

$= 48.11g$

b. If the final mass of sodium nitrate is 45.5 grams, what is the percent yield? What is the percent error?

$\%\ yield = \frac{actual}{theoretical} \times 100$

$= \frac{45.5}{48.11} \times 100$

$= 94.6\%$

$\%\ error = \left| \frac{theoretical - actual\ (experimental)}{theoretical} \right| \times 100$

$= \left| \frac{48.11 - 45.5}{48.11} \right| \times 100$

$= 5.4\%$

9. Balance the following **equation:**

$$Al_2(SO_3)_3 + 6NaOH \text{ ------> } 3Na_2SO_3 + 2Al(OH)_3$$

a) If 10.0 g of $Al_2(SO_3)_3$ is reacted with 10.0 g of NaOH, determine the limiting reactant. $Al_2(SO_3)_3$

b) Determine the maximum mass (grams) of Na_2SO_3 that can be produced. 12.85g.

c) Determine how much excess reactant is left over.

$Al_2(SO_3)_3$.

$n = \frac{10}{294}$

$= 0.0340$

$Al_2(SO_3)_3 : Na_2SO_3$

$\frac{1}{0.0340} : \frac{3}{x}$

$x = 0.102 \text{ mol } Na_2SO_3$

$m_{Na_2SO_3} = n_{Na_2SO_3} \times MM_{Na_2SO_3}$

$= 0.102 \text{ mol} \times 126$

$= 12.85 g$

$\therefore Al_2(SO_3)_3$ is L.R.

NaOH.

$n = \frac{10}{40}$

$= 0.25$

$NaOH : Na_2SO_3$

$\frac{6}{0.25} : \frac{3}{x}$

$x = 0.125 \text{ mol } Na_2SO_3$

$m_{Na_2SO_3} = n_{Na_2SO_3} \times MM_{Na_2SO_3}$

$m = 0.125 \times 126$

$= 15.75 g$

$Al_2(SO_3)_3 : NaOH$

$\frac{1}{0.0340} : \frac{6}{x}$

$x = 0.204 \text{ mol of NaOH reacted}$

$m = 0.204 \times 40$

$= 8.16 g$

$\therefore$ Left over $=$

$10 - 8.16 g$

$= 1.84 g$.

Definitions you should know:

Isotope	Isotopic abundance	Law of Definite Proportions
Empirical Formula	Limiting Reactant	Excess Reactant
Percent Error	Percent Yield	Mole
Molar Mass		