

Name:

CHEMISTRY Calculation Review

All calculations are based on

rounded
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.

$$AAW = \left(\frac{75.53}{100} \times 34.969 \right) + \left(\frac{24.47}{100} \times 36.966 \right)$$
$$= \underline{\hspace{2cm}} \text{ amu.}$$



2. **Mole Triangle 1:** Determine the mass of 14.8 mol of BaCrO₄.

$$m = n \times M$$
$$= 14.8 \times 253$$
$$= 3744.4 \text{ g}$$

3. a) **Mole Triangle 2:** How many molecules of BF₃ 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 BF₃?

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

4. **Combination of Mole Triangle 1 and 2:** Calculate the mass of Cl₂ when there is 1.23 x 10²² molecules of Cl₂?

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

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

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

$$\text{Hg}_2\text{O} \quad \% \text{O} = \frac{16}{417} \times 100 = 3.84\%$$

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.

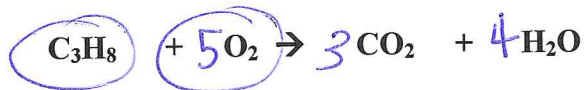
	m	n	ratio
C	80.2	6.6833	10.5 x 2 = 21
O	10.18	0.63625	1 x 2 = 2
H	9.62	9.62	15 x 2 = 30

$\text{C}_{21}\text{O}_2\text{H}_{30}$

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

$$\frac{\text{M.F.W}}{\text{E.F.W}} = \frac{628 \text{ g/mol}}{314 \text{ g/mol}} = 2 \quad \text{C}_{42}\text{H}_{60}\text{O}_4$$

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 .



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

$$x = 2.5 \text{ mol of } \text{O}_2$$

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



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

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

$$= 0.2830 \text{ mol Na}_2\text{CO}_3$$



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

$$x = 0.56603 \text{ mol NaNO}_3$$

$$\begin{aligned} m_{\text{NaNO}_3} &= n_{\text{NaNO}_3} \times \text{MM}_{\text{NaNO}_3} \\ &= 0.56603 \times 85 \\ &= 48.11 \text{ g} \end{aligned}$$

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

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

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

$$= 94.6\%$$

$$\% \text{ error} = \frac{|\text{theoretical} - \text{actual}|}{\text{theoretical}} \times 100$$

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

$$= 5.4\%$$

9. Balance the following equation:



a) If 10.0 g of $\text{Al}_2(\text{SO}_3)_3$ is reacted with 10.0 g of NaOH, determine the limiting reactant.

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

c) Determine how much excess reactant is left over.

$$\begin{aligned} &\text{Al}_2(\text{SO}_3)_3 \\ n &= \frac{10}{294} \\ &= 0.0340 \end{aligned}$$

$$\begin{aligned} &\text{Al}_2(\text{SO}_3)_3 : \text{Na}_2\text{SO}_3 \\ &\frac{1}{0.0340} : \frac{3}{x} \\ &x = 0.102 \text{ mol Na}_2\text{SO}_3 \end{aligned}$$

$$\begin{aligned} m_{\text{Na}_2\text{SO}_3} &= n_{\text{Na}_2\text{SO}_3} \times \text{MM}_{\text{Na}_2\text{SO}_3} \\ &= 0.102 \text{ mol} \times 126 \end{aligned}$$

$$= 12.85 \text{ g}$$

$\therefore \text{Al}_2(\text{SO}_3)_3$ is L.R.

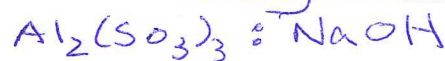
$$\begin{aligned} &\text{NaOH} \\ n &= \frac{10}{40} \\ &= 0.25 \end{aligned}$$

$$\begin{aligned} &\text{NaOH} : \text{Na}_2\text{SO}_3 \\ &\frac{6}{0.25} : \frac{3}{x} \end{aligned}$$

$$x = 0.125 \text{ mol Na}_2\text{SO}_3$$

$$m_{\text{Na}_2\text{SO}_3} = n_{\text{Na}_2\text{SO}_3} \times \text{MM}_{\text{Na}_2\text{SO}_3}$$

$$\begin{aligned} m &= 0.125 \times 126 \\ &= 15.75 \text{ g} \end{aligned}$$



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

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

Definitions you should know:

Isotope

Empirical Formula

Percent Error

Molar Mass

Isotopic abundance

Limiting Reactant

Percent Yield

Law of Definite Proportions

Excess Reactant

Mole

$$m = 0.204 \times 40$$

$$= 8.16 \text{ g}$$

\therefore Left over =

$$10 - 8.16 \text{ g}$$

$$= 1.84 \text{ g}$$