CHEMICAL REACTIONS PART 1

WRITING AND BALANCING CHEMICAL EQUATIONS (REVIEW).

All chemical equations must obey the Law of Conservation of Matter ie: they must be balanced using coefficients.

Molecular Equations:

- Show the complete formulas of each element and compound in the reaction.

Ex: $Pb(NO_3)_{2\,(aq)} + 2KI_{(aq)} \rightarrow PbI_{2\,(s)} + 2KNO_{3\,(aq)}$ (molecular equation)

Ionic Equations:

- Instead of writing formulas for the substances as molecular formulas, they are written as the ions that would be present in an aqueous solution.

Ex: $Pb^{2+}_{(aq)} + 2NO_3^-{}_{(aq)} + 2K^+_{(aq)} + 2I^-_{(aq)} \rightarrow PbI_{2(s)} + 2K^+_{(aq)} + 2NO_3^-{}_{(aq)}$ (ionic equation)

- Substances written as ions are: **Soluble salts, strong acids, strong bases (see below)**

Net Ionic Equations:

- Show only the ions actually involved with the reaction.
- Once the ionic equation is written, any spectator ions (ions that appear in the same form on both sides of the equation) are deleted..

Ex: $Pb^{2+}_{(aq)} + 2I^-_{(aq)} \rightarrow PbI_{2(s)}$ (net ionic equation)

REACTION STOICHIOMETRY

Ex's:

a) How many grams of magnesium metal are required to convert 83.6 g $TiCl_4$ to titanium metal?

b) Upon being heated or exposed to severe mechanical shock, ammonium nitrate decomposes into nitrogen and oxygen gases and water vapor. If 75.5 g of ammonium nitrate decomposes, how many grams of nitrogen and how many grams of oxygen are produced?

c) How many milliliters of liquid water should be produced by the combustion in abundant oxygen of 775 mL of octane $C_8H_{18(l)}$? Assume that all volumes are measured at 20 ºC where the densities are 0.7025 g/mL for octane and 0.9982 g/mL for water.

A) Limiting reactants:

- The reactant that is completely consumed in a chemical reaction and that limits the amount of product formed.
- Calculate the expected yield using each of the given reactant amounts.
- Whichever reactant gives the least product is the limiting reactant.

Ex: a) Iron (II) sulfide reacts with hydrochloric acid to give hydrogen sulfide and iron (II) chloride. If 10.2 g HCl is added to 13.2 g FeS, how many grams of H_2S can be formed? What is the mass of the excess reactant remaining?

B) Yields of Chemical reactions:

- Theoretical yield = the calculated quantity of product.
- Actual yield = the measured quantity of product.
- Percent yield = $\frac{\text{actual yield}}{\text{theoretical yield}} \times 100$

Ex: 1) In the reaction: $Fe_2O_{3(s)} + 3CO_{(g)} \rightarrow 2Fe_{(s)} + 3CO_{2(g)}$

a) If you start with 150 g of Fe_2O_3 as the limiting reagent, what is the theoretical yield of Fe?

b) If the actual yield was 87.9 g, what was the percentage yield?

2) An iron ore sample contains Fe_2O_3 and other impurities. A 752g sample of impure iron ore is heated with excess carbon producing 453 g of pure iron by the following reaction:

$$Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$$

What is the mass percent of Fe_2O_3 in the original sample assuming that Fe_2O_3 is the only source of iron and the reaction goes to completion?