Stoichiometry

Moles
Conversions

Balancing
Equations

Stoichiometry

The mathematical study of the quantitative relationships that exist in chemical reactions

Stoichiometry

Introduction

- Stoichiometric ratios
  - The molar ratio of one reactant/product to another reactant/product

$$N_2 + 3\ H_2 \rightleftharpoons 2\ NH_3$$

$$2H_2 + O_2 \rightleftharpoons 2\ H_2O$$

Stoichiometry

Steps for Problem Solving

- Mass-Mass problems
  - A stoichiometric process that allows us to predict how much reactant (or product) will be consumed (or created) in a chemical reaction.
- Steps:
  - 1. Write a balanced equation
  - 2. Convert mass to moles
  - 3. Apply the stoichiometric ratio from the balanced equation
  - 4. Convert moles to grams

Stoichiometry

Sample #1

- How much water will be produced when 12.5 grams of methane (CH_4) are consumed in a combustion reaction?

$$CH_4 + 2O_2 \Rightarrow CO_2 + 2H_2O$$

$$\frac{12.5\text{g } CH_4}{} \left| \frac{1 \text{ mol } CH_4}{16.0\text{g } CH_4} \right| \frac{2 \text{ mol } H_2O}{1 \text{ mol } CH_4} \left| \frac{18.0\text{g } H_2O}{1 \text{ mol } H_2O} \right. = \text{g } H_2O$$

$$28.1\text{g } H_2O$$

Stoichiometry

Sample #2

- How much copper II nitrate will be consumed when 10.2 grams of sodium chloride is reacted with it.

$$\overset{+2\ -1}{Cu(NO_3)_2} + 2\overset{+1\ -1}{NaCl} \Rightarrow CuCl_2 + 2\,NaNO_3$$

$$\frac{10.2\text{g NaCl}}{} \left| \frac{1 \text{ mol NaCl}}{58.5 \text{ NaCl}} \right| \frac{1 \text{ mol } Cu(NO_3)_2}{2 \text{ mol NaCl}} \left| \frac{187.5\text{g } Cu(NO_3)_2}{1 \text{ mol } Cu(NO_3)_2} \right. = \text{g } Cu(NO_3)_2$$

$$16.3\text{g } Cu(NO_3)_2$$