Stoichiometry

Stoichiometry

Equations, Reaction Types, AAM

- 3.1 Balancing Chemical Equations
- 3.2 Patterns of reactivity
  - Combustion
  - Synthesis
  - Decomposition
- 3.3 Atomic Weight
  - Why are they not whole numbers?
  - Average Atomic Weights

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The Mole

- 3.4 Mass, Mole, Particle conversions....

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Empirical Formulas

- Empirical
  - Based on experimentation
- Empirical formulas tell us the relative number of atoms of each element in a compound
- Steps in calculating
  - Assume a 100 g sample
  - Convert grams to moles
  - Find the whole number ratio by dividing by the smallest value
- Ethylene glycol is composed of 38.7% carbon, 9.7% hydrogen and 51.6% oxygen. What is its empirical formula?

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Molecular Formula

- A molecular formula represents a compound as it actually exists
- Molecular formulas can be found from empirical formulas
  - Must know the molecular weight of the compound
  - Steps:
    - Calculate the empirical mass
    - Divide the molecular mass by the empirical mass
    - Apply this "multiplier" to the empirical formula

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Molecular Formula

- What is the molecular formula of ethylene glycol, if its molecular mass is 62.1 g/mol?

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Specific Stoichiometry Calculations

- 3.6 Quantitative Information
  - Mass-Mass Problems
- 3.7 Limiting Reactants
  - The reactant which is consumed first in a chemical reaction
  - Steps:
    - Convert mass to moles
    - Divide by coefficients
    - Smallest number is limiting
- Theoretical Yield
  - The maximum amount of a product allowed, given the limiting reactant

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Summary

- 2 C_6H_{12} + 5O_2 ==> 2 $H_2C_6H_8O_4$ + 2 H_2O
  - Assume you use 25.0 grams of cyclohexane and 25.0 grams of oxygen
    - What is the limiting reactant?
    - What is the theoretical yield for adipic acid?
    - If you receive 33.5 grams of the acid, what is the percent yield?

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Summary

$$2\ C_6H_{12} + 5O_2 \Longrightarrow 2\ H_2C_6H_8O_4 + 2\ H_2O$$

25.0g 25.0g 33.5g

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Homework

- 3, 5, 7, 16, 21, 27, 39, 47a, 51, 59, 63, 81
- Outline Chapter 4 - due in 2 class periods
- Summarize Table 4.1 (p.125) in a way that easily summarizes the significant trends in solubility