9/21 Lecture Outline

Molar Mass: mass of a single molecule in amu is numerically equal to the mass in grams of a mole of molecules

Molar Mass give us conversion factors between grams and moles.

$$\frac{Molecular\ Weight\ g}{1\ mole\ of\ substance}$$

Lots of problem solving in class today! Here are the outlines for the 4 different types of problems we talked about today.

Steps to determine **Empirical Formula** from percentage compositions:

1) Assume 100 g sample. Multiply percent compositions by 100.
2) Convert to moles using the molar mass
3) Divide all moles by the smallest to get the relative ratios.
4) Use relative ratios as subscripts.

Steps to determine **Chemical Formulas**

1) Follow above steps to first determine the empirical formula
2) Divide the molecular weight by the empirical weight to get the multiplication factor.
3) Multiply empirical subscripts by multiplication factor to get chemical formula.

**Obtaining quantitative information from balanced reactions**

1) Identify chemicals and reactions from the word problem.
2) Balance the chemical reaction
3) Make a Unit Conversion Plan.
    a) Determine how you will convert from grams of one molecule to moles of that molecule.
    b) Then determine how you will convert from moles of that molecule to moles of another molecule.
    c) Usually, you will need to convert back to grams of your final molecule.
4) Multiply out the numbers.
5) Don't forget Significant Figures!

**Combustion Analysis**

1) Determine the mass of C and H in the combustion sample from $CO_2$ and $H_2O$.
2) Subtract mass of C and H from sample's mass to get the mass of the 3rd element (usually oxygen)
3) Convert masses of C, H, and O (if present) to moles.
4) Divide all moles by the smallest to get the relative ratios. Use relative ratios as subscripts.

5) If the Molecular Weight is given, divide the molecular weight by the empirical weight to get the multiplication factor. Multiply empirical subscripts by multiplication factor to get chemical formula.

Limiting Reagents: The reagent that is completely consumed in a reaction. When the limiting reagent runs out, the reaction stops.

In each of the three Erlenmeyer flask there is 50 g of 5% (by mass) acetic acid. In flask #1, 2.0 g of sodium bicarbonate (a.k.a. sodium hydrogen carbonate) was added. In flask #2, 4.0 g of sodium bicarbonate was added. In flask #3, 8.0 g of sodium bicarbonate was added.

How did the relative balloon sizes compare in this demo? Which was largest? Which was the smallest?

Calculate how many grams of sodium bicarbonate was left over in flask # 3?