**Chemistry**  Name:

**Chapter 9:** Stoichiometry

9-1: Introduction to Stoichiometry

* **Composition stoichiometry** - mass relationships of
* - mass relationships between reactants and products in a chemical reaction
* **mole ratio -** conversion factor that relates the of any two substances involved in a chemical reaction

**Example:** 2Al2O3(*l*) → 4Al(*s*) + 3O2(*g*)

**Mole Ratios:** 2 mol Al2O3 2 mol Al2O3 4 mol Al

4 mol Al 3 mol O2 3 mol O2

9-2: Ideal Stoichiometric Calculations

grams → moles → moles → grams

Conversion Factors

* mole ratio
* molar mass
* Avogadro’s number

**Sample Problem A** moles(mol) to moles(mol)

In a spacecraft, the carbon dioxide exhaled by astronauts can be removed by its reaction with lithium hydroxide, LiOH, according to the following chemical equation.

CO2(*g*) + 2LiOH(*s*) → Li2CO3(*s*) + H2O(*l*)

How many moles of lithium hydroxide are required to react with 20 mol CO2, the average amount exhaled by a person each day?

**Sample Problem B** moles(mol) to mass(g)

In photosynthesis, plants use energy from the sun to produce glucose, C6H12O6, and oxygen from the reaction of carbon dioxide and water.

What mass, in grams, of glucose is produced when 3.00 mol of water react with carbon dioxide?

**Sample Problem D** mass (g) to moles (mole)

The first step in the industrial manufacture of nitric acid is the catalytic oxidation of ammonia.

NH3(*g*) + O2(*g*) → NO(*g*) + H2O(*g*) (unbalanced)

The reaction is run using 824 g NH3 and excess oxygen.

1. How many moles of NO are formed?
2. How many moles of H2O are formed?

**Sample Problem E**  mass(g) to mass(g)

Tin(II) fluoride, SnF2, is used in some toothpastes. It is made by the reaction of tin with hydrogen fluoride according to the following equation.

Sn(*s*) + 2HF(*g*) → SnF2(*s*) + H2(*g*)

How many grams of SnF2 are produced from the reaction of 30.00 g HF with Sn?

9-3: Limiting Reactants and Percent Yield

* **limiting reactant** - reactant that limits the amount of the other reactant that can combine and the amount of
* **reactant** - substance that is not used up completely in a reaction.

**Sample Problem F**

Silicon dioxide (quartz) is usually quite unreactive but reacts readily with hydrogen fluoride according to the following equation.

SiO2(s) + 4HF(g) → SiF4(g) + 2H2O(l)

If 6.0 mol HF is added to 4.5 mol SiO2, which is the limiting reactant?

**Percentage Yield**

* **theoretical yield** - of product that can be produced from a given amount of reactant
* **actual yield** - of the product obtained from a reaction
* - ratio of the actual yield to the theoretical yield, multiplied by 100

**Sample Problem H**

Chlorobenzene, C6H5Cl, is used in the production of many important chemicals, such as aspirin, dyes, and disinfectants. One industrial method of preparing chlorobenzene is to react benzene, C6H6, with chlorine, as represented by the following equation.

C6H6 (l) + Cl2(g) → C6H5Cl(l) + HCl(g)

When 36.8 g C6H6 react with an excess of Cl2, the actual yield of C6H5Cl is 38.8 g.

* What is the percentage yield of C6H5Cl?