STOICHIOMETRY PROBLEM SET

1. Calculate the number of grams of SF_4 that can be made from 4.00 g of SCl_2 and 2.00 g of NaF by the following reaction:

$$3SCl_2 + 4NaF \rightarrow SF_4 + S_2Cl_2 + 4NaCl$$

2. Calculate the theoretical yield (**in grams**) of B_2H_6 from the reaction of 25.0 g of 85.0% $NaBH_4$ with 54.0 g of BF_3. The reaction is:

$$3NaBH_4 + 4BF_3 \rightarrow 2B_2H_6 + 3NaBF_4$$

3. Calculate the percent purity of a sample of KO_2 if 3.30 g of the sample gave 655 mL of O_2 at STP by the reaction below. The volume of 1 mole of a gas at STP is 22.4 L.

$$4KO_2(s) + 2H_2O(g) + 4CO_2(g) \rightarrow 4KHCO_3(s) + 3O_2(g)$$

4. When 1.00 mg of a mixture of cocaine, $C_{17}H_{21}O_4N$, and table sugar (sucrose), $C_{12}H_{22}O_{11}$, is burned, 1.75 mg of CO_2 are produced. Calculate the percent (**by mass**) of cocaine in the sample.

5. "Proof" of liquour is approximately twice the percent by volume of ethanol, C_2H_5OH. Calculate the **molarity** of 86 proof scotch. The density of pure ethanol is 0.79 g/mL.

6. A sample of hydrated sodium sulfite ($Na_2SO_3 \cdot XH_2O$) of mass 0.4322 g was dissolved in water and oxidized to sodium sulfate byadding exactly 0.8000 g of I_2 (present in excess) according to the net ionic equation shown below:

$$I_2(aq) + SO_3^{2-}(aq) + H_2O(l) \rightarrow 2I^-(aq) + SO_4^{2-}(aq) + 2H^+(aq)$$

The resulting acidic solution was then exactly neutralized by the addition of 40.00 mL of 0.100 *M* NaOH. Determine the value of X in $Na_2SO_3 \cdot XH_2O$.

7. A 10.0 g sample of a Cu/Ag alloy reacted with concentrated HNO_3 according to the following equations:

$$Cu(s) + 4H^+(aq) + 2NO_3^-(aq) \rightarrow Cu^{2+}(aq) + 2NO_2(g) + 2H_2O(l)$$
$$Ag(s) + 2H^+(aq) + NO_3^-(aq) \rightarrow Ag^+(aq) + NO_2(g) + H_2O(l)$$

A total of 10.00 g of NO_2 was isolated. Assuming a 100% yield of NO_2, determine the percent by mass of Ag in the alloy.