CH1020 Exercises (Worksheet 5)

1. A reaction vessel contains 10.0 g CO and 10.0 g O_2 which combine to form CO_2:

$$2\ CO(g) + O_2(g) \rightarrow 2\ CO_2(g)$$

   a. Which reactant is the limiting reactant?

   b. How many grams of CO_2 could be produced?

   c. How many grams of the non-limiting reactant are left over?

2. For the reaction below, determine the limiting reactant for each of the initial amounts of reactants.

$$2\ Na(s) + Br_2(g) \rightarrow 2\ NaBr(s)$$

   a. 2 mol Na, 2 mol Br_2

   b. 1.8 mol Na, 1.4 mol Br_2

   c. 2.5 mol Na, 1 mol Br_2

   d. 12.6 mol Na, 6.9 mol Br_2

3. For the reaction shown, calculate the theoretical yield (in grams) for each initial amount of reactants

$$2\ Al(s) + 3\ Cl_2(g) \rightarrow 2\ AlCl_3(s)$$

   a. 2.0 g Al; 2.0 g Cl_2

   b. 7.5 g Al; 24.8 g Cl_2

   c. 0.235 g Al; 1.15 g Cl_2

4. One reaction in the production of sulfuric acid involves the conversion of sulfur dioxide to sulfur trioxide. In the presence of excess O_2, 88 kg SO_2 produces 106 kg SO_3. What is the percent yield?

5. Baking soda ($NaHCO_3$) is produced on an industrial scale by the Solvay process. A key reaction in the process is

$NaCl(aq) + NH_3(aq) + CO_2(aq) + H_2O(\ell) \rightarrow NaHCO_3(s) + NH_4Cl(aq)$

Suppose a reaction vessel initially contains 58.5 kg NaCl, 18.8 kg NH_3, and excess CO_2 and H_2O. If 66 kg $NaHCO_3$ is produced, what is the percent yield?

6. After you burn 4.62 mL of ethanol (C_2H_5OH, density, ρ = 0.789 g mL^{-1}) in the presence of 15.5 g of oxygen gas, you collect 3.72 mL water (density, ρ = 1.000 g mL^{-1}).

    a. Write the balance chemical reaction for the combustion of ethanol in an air ambient.

    b. What's the limiting reactant in this reaction?

    c. What's the theoretical yield of water?

    d. What's the percent yield of water for this reaction?

7. Magnesium oxide can be made by heating magnesium metal in the presence of oxygen. When 10.1 g of Mg reacts with 10.5 g O_2, 11.9 MgO is collected. Determine the percent yield for the reaction.