CHEQ 1094 **STOICHIOMETRY**

1. Oxygen can be made by heating $KClO_3$. The reaction is

$$2KClO_3 \rightarrow 2KCl + 3O_2$$

(a) What mass of oxygen can be made from 3.00 g of $KClO_3$?

(b) What is the mass of KCl formed in the reaction in (a)?

(c) What mass of $KClO_3$ is needed to give 3.00 g of oxygen?

(d) If 3.30 g of oxygen is obtained from 9.00 g of $KClO_3$, what is the percentage yield of oxygen?

2. How many grams of CaO will react with 23.8 g of NH_4Cl and how much NH_3 will be formed? The reaction is

$$2NH_4Cl + CaO \rightarrow 2NH_3 + CaCl_2 + H_2O$$

3. If CH_4 is obtained in 93.5% yield from the reaction of Al_4C_3 with water, what mass of Al_4C_3 is required to yield 10.0 g of CH_4? The reaction is

$$Al_4C_3 + 12H_2O \rightarrow 3CH_4 + 4Al(OH)_3$$

4. If ethyl alcohol is isolated in 88.0% yield from the fermentation of glucose, what volume of ethyl alcohol can be produced from 454 g (1 lb) of glucose? The density of ethyl alcohol is 0.789 g/mL. The reaction is

$$\underset{\textbf{glucose}}{C_6H_{12}O_6} \rightarrow \underset{\textbf{ethyl alcohol}}{2C_2H_5OH} + 2CO_2$$

5. The reaction of magnesium nitride with water produces magnesium hydroxide and ammonia.

$$Mg_3N_2 + 6H_2O \rightarrow 3Mg(OH)_2 + 2NH_3$$

(a) Calculate the mass of NH_3 that can be made from 47.5 g of 86.0% Mg_3N_2.

(b) Calculate the mass of 91.0% Mg_3N_2 that is required to make 62.6 g of NH_3.

(c) 31.0 g of a sample of Mg_3N_2 gave 8.50 g of NH_3. What is the percent purity of the Mg_3N_2 sample?

6. What mass of $Na_2CO_3 \cdot 10H_2O$ is needed to make 25.0 g of Na_3PO_4 by the following reaction?

$$3Na_2CO_3 + 2H_3PO_4 \rightarrow 2Na_3PO_4 + 3CO_2 + 3H_2O$$

7. (a) How many grams of Fe_2S_3 can be formed by the reaction of 3.50 g of $FeBr_3$ and 6.40 g of Na_2S ? The reaction is:

$$2FeBr_3 + 3Na_2S \rightarrow Fe_2S_3 + 6NaBr$$

(b) Calculate the mass of the excess reactant remaining at the end of the reaction.

8. Diborane, B_2H_6, is formed by the reaction shown below.

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

Calculate the theoretical yield of B_2H_6 from the reaction of 1.30 g of $NaBH_4$ and 2.50 g of BF_3 and the mass of the excess reactant left over.

9. When 3.00 g of PH_3 were reacted with 5.50 g of O_2, 5.60 g of P_4O_{10} were obtained. Calculate the percentage yield of P_4O_{10} in the reaction. The reaction is

$$4PH_3 + 8O_2 \rightarrow P_4O_{10} + 6H_2O$$

10. The combustion of propane (C_3H_8) is given by the equation below.

$$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l) + 2200\text{ kJ}$$

(a) Is the reaction **exothermic** or **endothermic**?

(b) Calculate the heat change when 222 g of $C_3H_8(g)$ is completely burned.

(c) What mass of $CO_2(g)$ is produced when the reaction produces a heat change of 456 J?

11. Calcium hydroxide can be decomposed as shown below.

$$Ca(OH)_2(s) + 66\text{ kJ} \rightarrow CaO(s) + H_2O(l)$$

(a) Is the reaction **exothermic** or **endothermic**?

(b) How many kilojoules of heat are required to decompose 454 g of $Ca(OH)_2(s)$?