3 COMPUTE Use the periodic table to determine the molar masses of C_6H_6 and C_6H_5Cl.

$$1 \text{ mol } C_6H_6 = 78.12 \text{ g}$$
$$1 \text{ mol } C_6H_5Cl = 112.56 \text{ g}$$

$$36.8 \text{ g } C_6H_6 \times \frac{1 \text{ mol } C_6H_6}{78.12 \text{ g } C_6H_6} \times \frac{1 \text{ mol } C_6H_5Cl}{1 \text{ mol } C_6H_6} \times \frac{112.56 \text{ g } C_6H_5Cl}{1 \text{ mol } C_6H_5Cl} = 53.0 \text{ g } C_6H_5Cl \text{ (theoretical yield)}$$

$$\text{percentage yield} = \frac{38.8 \text{ g}}{53.0 \text{ g}} \times 100 = 73.2\%$$

4 EVALUATE The answer is correctly rounded to three significant figures to match those in 36.8 g C_6H_6. The units have canceled correctly. The theoretical yield is close to an estimated value of 50 g, (one-half of 100 g). The percentage yield is close to an estimated value of 80%, (40/50 × 100).

PRACTICE

Answers in Appendix E

1. Methanol can be produced through the reaction of CO and H_2 in the presence of a catalyst.

$$CO(g) + 2H_2(g) \xrightarrow{\text{catalyst}} CH_3OH(l)$$

If 75.0 g of CO reacts to produce 68.4 g CH_3OH, what is the percentage yield of CH_3OH?

2. Aluminum reacts with excess copper(II) sulfate according to the reaction given below. If 1.85 g of Al react and the percentage yield of Cu is 56.6%, what mass of Cu is produced?

$$Al(s) + CuSO_4(aq) \longrightarrow Al_2(SO_4)_3(aq) + Cu(s) \text{ (unbalanced)}$$

extension
Go to **go.hrw.com** for more practice problems that ask you to calculate percentage yield.
Keyword: HC6STCX

SECTION REVIEW

1. Carbon disulfide burns in oxygen to yield carbon dioxide and sulfur dioxide according to the following chemical equation.

$$CS_2(l) + 3O_2(g) \longrightarrow CO_2(g) + 2SO_2(g)$$

   a. If 1.00 mol CS_2 is combined with 1.00 mol O_2, identify the limiting reactant.

   b. How many moles of excess reactant remain?

   c. How many moles of each product are formed?

2. Metallic magnesium reacts with steam to produce magnesium hydroxide and hydrogen gas.
   a. If 16.2 g Mg are heated with 12.0 g H_2O, what is the limiting reactant?

   b. How many moles of the excess reactant are left?

   c. How many grams of each product are formed?

3. Quicklime, CaO, can be prepared by roasting limestone, $CaCO_3$, according to the following reaction.

$$CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g).$$

When 2.00×10^3 g $CaCO_3$ are heated, the actual yield of CaO is 1.05×10^3 g. What is the percentage yield?

Critical Thinking

4. **ANALYZING DATA** A chemical engineer calculated that 15.0 mol H_2 was needed to react with excess N_2 to prepare 10.0 mol NH_3. But the actual yield is 60.0%. Write a balanced chemical equation for the reaction. Is the amount of H_2 needed to make 10.0 mol NH_3 more, the same, or less than 15 mol? How many moles of H_2 are needed?