

- 3 COMPUTE** Use the periodic table to determine the molar masses of C_6H_6 and $\text{C}_6\text{H}_5\text{Cl}$.

$$\begin{aligned}1 \text{ mol C}_6\text{H}_6 &= 78.12 \text{ g} \\1 \text{ mol C}_6\text{H}_5\text{Cl} &= 112.56 \text{ g}\end{aligned}$$

$$36.8 \text{ g C}_6\text{H}_6 \times \frac{1 \text{ mol C}_6\text{H}_6}{78.12 \text{ g C}_6\text{H}_6} \times \frac{1 \text{ mol C}_6\text{H}_5\text{Cl}}{1 \text{ mol C}_6\text{H}_6} \times \frac{112.56 \text{ g C}_6\text{H}_5\text{Cl}}{1 \text{ mol C}_6\text{H}_5\text{Cl}} = 53.0 \text{ g C}_6\text{H}_5\text{Cl} \text{ (theoretical yield)}$$

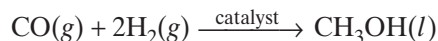
$$\text{percentage yield} = \frac{38.8 \text{ g}}{53.0 \text{ g}} \times 100 = 73.2\%$$

- 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%, $(40/50 \times 100)$.

PRACTICE

Answers in Appendix E

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



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?



extension

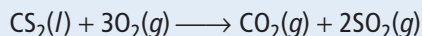
Go to go.hrw.com for more practice problems that ask you to calculate percentage yield.



Keyword: HC6STCX

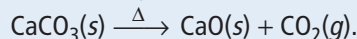
SECTION REVIEW

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



- If 1.00 mol CS_2 is combined with 1.00 mol O_2 , identify the limiting reactant.
 - How many moles of excess reactant remain?
 - How many moles of each product are formed?
2. Metallic magnesium reacts with steam to produce magnesium hydroxide and hydrogen gas.
- If 16.2 g Mg are heated with 12.0 g H_2O , what is the limiting reactant?
 - How many moles of the excess reactant are left?
 - How many grams of each product are formed?

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



When $2.00 \times 10^3 \text{ g CaCO}_3$ are heated, the actual yield of CaO is $1.05 \times 10^3 \text{ g}$. 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?