

## 12.3

## LIMITING REAGENT AND PERCENT YIELD

## Section Review

## Objectives

- Identify and use the limiting reagent in a reaction to calculate the maximum amount of product(s) produced and the amount of excess reagent
- Calculate theoretical yield, actual yield, or percent yield given the appropriate information

## Vocabulary

- limiting reagent
- excess reagent
- theoretical yield
- actual yield
- percent yield

## Key Equations

- percent yield =  $\frac{\text{actual yield}}{\text{theoretical yield}} \times 100$

## Part A Completion

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.

Whenever quantities of two or more reactants are given in a stoichiometric problem, you must identify the 1. This is the reagent that is completely 2 in the reaction. The amount of limiting reagent determines the amount of 3 that is formed.

When an equation is used to calculate the amount of product that will form during a reaction, the value obtained is the 4. This is the 5 amount of product that could be formed from a given amount of reactant. The amount of product that forms when the reaction is carried out in the laboratory is called the 6.

## Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

- \_\_\_\_\_ 7. Normally, the actual yield in a chemical reaction will be equal to or less than the theoretical yield.
- \_\_\_\_\_ 8. The actual yield of a chemical reaction can be calculated using mole ratios.

- \_\_\_\_\_ 9. The amount of product can be determined from the amount of excess reagent.
- \_\_\_\_\_ 10. The percent yield of a product is 100 percent.
- \_\_\_\_\_ 11. If you had 100 steering wheels, 360 tires, and enough of every other part needed to assemble a car, the limiting reagent would be tires.
- \_\_\_\_\_ 12. The theoretical yield is the maximum amount of product that could be formed in a chemical reaction.

## Part C Matching

Match each description in Column B to the correct term in Column A.

### Column A

- \_\_\_\_\_ 13. actual yield
- \_\_\_\_\_ 14. limiting reagent
- \_\_\_\_\_ 15. theoretical yield
- \_\_\_\_\_ 16. percent yield
- \_\_\_\_\_ 17. excess reagent

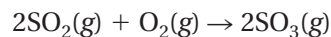
### Column B

- a. the ratio of the actual yield to the theoretical yield  $\times 100$
- b. the amount of product actually formed when a reaction is carried out in the laboratory
- c. the reactant that determines the amount of product that can be formed in a reaction
- d. the reactant that is not completely used up in a chemical reaction
- e. the maximum amount of product that can be formed during a reaction

## Part D Questions and Problems

Answer the following in the space provided.

18. a. What is the limiting reagent when 3.1 mol of  $\text{SO}_2$  react with 2.7 mol of  $\text{O}_2$  according to the equation:



- b. Calculate the maximum amount of product that can be formed and the amount of unreacted excess reagent.