

## 2 Section Review

### UNDERSTANDING KEY IDEAS

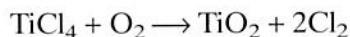
1. Distinguish between limiting reactant and excess reactant in a chemical reaction.
2. How do manufacturers decide which reactant to use in excess in a chemical reaction?
3. How do you calculate the percentage yield of a chemical reaction?
4. Give two reasons why a 100% yield is not obtained in actual chemical manufacturing processes.
5. How do the values of the theoretical and actual yields generally compare?

### PRACTICE PROBLEMS

6. A chemist reacts 8.85 g of iron with an excess of hydrogen chloride to form hydrogen gas and iron(II) chloride. Calculate the theoretical yield and the percentage yield of hydrogen if 0.27 g H<sub>2</sub> are collected.
7. Use the chemical reaction below to answer the questions that follow.



- a. Balance the equation.
  - b. Calculate the theoretical yield if 100.0 g P<sub>4</sub>O<sub>10</sub> react with 200.0 g H<sub>2</sub>O.
  - c. If the actual mass recovered is 126.2 g H<sub>3</sub>PO<sub>4</sub>, what is the percentage yield?
8. Titanium dioxide is used as a white pigment in paints. If 3.5 mol TiCl<sub>4</sub> reacts with 4.5 mol O<sub>2</sub>, which is the limiting reactant? How many moles of each product are produced? How many moles of the excess reactant remain?

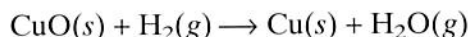


9. If 1.85 g Al reacts with an excess of copper(II) sulfate and the percentage yield of Cu is 56.6%, what mass of Cu is produced?

10. Quicklime, CaO, can be prepared by roasting limestone, CaCO<sub>3</sub>, according to the chemical equation below. When  $2.00 \times 10^3$  g of CaCO<sub>3</sub> are heated, the actual yield of CaO is  $1.05 \times 10^3$  g. What is the percentage yield?



11. Magnesium powder reacts with steam to form magnesium hydroxide and hydrogen gas.
  - a. Write a balanced equation for this reaction.
  - b. What is the percentage yield if 10.1 g Mg reacts with an excess of water and 21.0 g Mg(OH)<sub>2</sub> is recovered?
  - c. If 24 g Mg is used and the percentage yield is 95%, how many grams of magnesium hydroxide should be recovered?
12. Use the chemical reaction below to answer the questions that follow.



- a. What is the limiting reactant when 19.9 g CuO react with 2.02 g H<sub>2</sub>?
- b. The actual yield of copper was 15.0 g. What is the percentage yield?
- c. How many grams of Cu can be collected if 20.6 g CuO react with an excess of hydrogen with a yield of 91.0%?

### CRITICAL THINKING

13. A chemist reacts 20 mol H<sub>2</sub> with 20 mol O<sub>2</sub> to produce water. Assuming all of the limiting reactant is converted to water in the reaction, calculate the amount of each substance present after the reaction.
14. A pair of students performs an experiment in which they collect 27 g CaO from the decomposition of 41 g CaCO<sub>3</sub>. Are these results reasonable? Explain your answer using percentage yield.