

Chapter 6 Chemical Reactions ▪ Section 2 Summary

Describing Chemical Reactions

Key Concepts

- What information does a chemical equation contain?
- How is matter conserved during a chemical reaction?
- What must a balanced chemical equation show?
- What are three types of chemical reactions?

A **chemical equation** is a short, easy way to show a chemical reaction. **Chemical equations use chemical formulas and other symbols instead of words to summarize a reaction.** A chemical equation tells you the substances you start with in a reaction and the substances you get at the end. The substances you have at the beginning are called the reactants. When the reaction is complete, you have new substances called the products. The formulas for the reactants are written on the left, followed by an arrow (\rightarrow). You read the arrow as “yields.” The formulas for the products are written on the right. When there are two or more reactants or products, they are separated by plus signs.

The principle called **conservation of matter** was first demonstrated in the late 1700s. The idea of atoms explains the conservation of matter. **In chemical reactions, the number of atoms stays the same no matter how they are arranged. So, their total mass stays the same.** In an **open system**, matter can enter from or escape to the surroundings. A match burning in the air is an example of an open system. You cannot measure the mass of all the reactants and products in an open system. A **closed system** is a system in which matter cannot enter from or escape to the surroundings. A reaction in a sealed plastic bag is an example of a closed system. A closed system allows you to measure the mass of all reactants and products in a reaction.

To describe a reaction accurately, a chemical equation must show the same number of each type of atom on both sides of the equation. An equation is balanced when it accurately represents conservation of matter. To balance a chemical equation, you may have to use coefficients. A **coefficient** is a number placed in front of a chemical formula in an equation. It tells you how many atoms or molecules of a reactant or a product take part in the reaction.

Three general types of chemical reactions are synthesis, decomposition, and replacement. When two or more elements or compounds combine to make a more complex substance, the reaction is called a **synthesis** reaction. The reaction of hydrogen and oxygen to make water is a synthesis reaction. A reaction called a **decomposition** reaction breaks down compounds into simpler products. For example, hydrogen peroxide decomposes into water and oxygen gas. When one element replaces another in a compound, or when two elements in different compounds trade places, the reaction is called a **replacement** reaction.

Chemical Reactions ▪ *Reading/Notetaking Guide***Describing Chemical Reactions** (pp. 224–231)

This section explains how reactants and products are expressed in a chemical equation. It describes what happens to the total number of atoms during a chemical reaction and what a balanced chemical equation must show. It also describes the three types of chemical reactions.

Use Target Reading Skills

After you read the section, reread the paragraphs that contain definitions of Key Terms. Use all of the information you have learned to write a meaningful sentence using each Key Term.

a. chemical equation: _____

b. reactant: _____

c. product: _____

d. conservation of matter: _____

e. open system: _____

f. closed system: _____

g. coefficient: _____

h. synthesis: _____

i. decomposition: _____

j. replacement: _____

Chemical Reactions ▪ *Reading/Notetaking Guide***What Are Chemical Equations?** (p. 225)

1. What is a chemical equation?

2. Is the following sentence true or false? Chemical equations use symbols instead of words to summarize chemical reactions.

3. If a molecule of carbon dioxide is involved in a chemical reaction, how is it represented in the chemical equation for the reaction?

4. The substances you have at the beginning of a chemical reaction are called the _____.

5. The substances you have when a chemical reaction is complete are called the _____.

6. What do you read the arrow in a chemical equation as meaning?

7. Label each formula in the chemical equation below as either a reactant or a product.



a. Fe _____ b. S _____

c. FeS _____

8. Circle the letter of each statement that is true about chemical equations.

a. Chemical equations have no real structure.

b. A chemical equation summarizes a reaction.

c. The formulas for the reactants are written on the right.

d. Symbols in the equation show the reactants and the products.

Conservation of Matter (pp. 226–227)

9. Is the following sentence true or false? All the atoms present at the start of a reaction are present at the end. _____

10. At the end of a chemical reaction, what is the total mass of the reactants compared to the total mass of the products?

Chemical Reactions ▪ *Reading/Notetaking Guide*

Describing Chemical Reactions *(continued)*

11. What is the principle called the conservation of matter?

12. Describe an open system.

13. What is an example of a closed system?

Balancing Chemical Equations (pp. 228–229)

14. When is a chemical equation balanced?

15. How many atoms of oxygen are there on each side of the following chemical equation: $2 \text{Mg} + \text{O}_2 \rightarrow 2 \text{MgO}$?

16. Circle the letter of each chemical equation that is balanced.

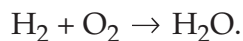
- a. $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$
- b. $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$
- c. $\text{Na} + \text{O}_2 \rightarrow \text{Na}_2\text{O}$
- d. $2 \text{H}_2\text{O}_2 \rightarrow 2 \text{H}_2\text{O} + \text{O}_2$

17. A number placed in front of a chemical formula in a chemical equation is called a(n) _____.

18. What does a coefficient tell you?

Chemical Reactions ▪ *Reading/Notetaking Guide*

19. Tell why this chemical equation is not balanced:



20. Write a balanced equation for this reaction: Oxygen reacts with hydrogen to yield water.

Classifying Chemical Reactions (pp. 230–231)

21. In what three categories can chemical reactions be classified?

22. Which category of chemical reactions comes from a term that means “to put things together”?

23. Complete the table about the three categories of chemical reactions.

Categories of Chemical Reactions		
Category	Description	Example Chemical Equation
a.	Two or more substances combine to make a more complex compound.	$2 \text{SO}_2 + \text{O}_2 + 2 \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$
Decomposition	b.	$2 \text{H}_2\text{O}_2 \rightarrow 2 \text{H}_2\text{O} + \text{O}_2$
c.	One element replaces another in a compound, or two elements in different compounds trade places.	$2 \text{CuO} + \text{C} \rightarrow 2 \text{Cu} + \text{CO}_2$

Chemical Reactions ▪ *Reading/Notetaking Guide***Describing Chemical Reactions** *(continued)*

Classify each of the following equations as synthesis, decomposition, or replacement.

