

Chemical Reactions

By studying the Vocabulary and Notes listed for each section below, you can gain a better understanding of this chapter.

SECTION 1

Vocabulary

In your own words, write a definition for each of the following terms in the space provided.

1. chemical reaction _____

2. chemical formula _____

3. chemical equation _____

4. reactants _____

5. products _____



Chemical Reactions, continued

6. law of conservation of mass _____

Notes

Read the following section highlights. Then, in your own words, write the highlights in your ScienceLog.

- Chemical reactions form new substances with different properties than the starting substances.
- Clues that a chemical reaction is taking place include formation of a gas or solid, a color change, and an energy change.
- A chemical formula tells the composition of a compound using chemical symbols and subscripts. Subscripts are small numbers written below and to the right of a symbol in a formula.
- Chemical formulas can sometimes be written from the names of covalent compounds and ionic compounds.
- A chemical equation describes a reaction using formulas, symbols, and coefficients.
- A balanced equation uses coefficients to illustrate the law of conservation of mass, which states that mass is neither created nor destroyed during a chemical reaction.

SECTION 2

Vocabulary

In your own words, write a definition for each of the following terms in the space provided.

1. synthesis reaction _____

2. decomposition reaction _____

Chemical Reactions, continued**3.** single-replacement reaction _____

4. double-replacement reaction _____

Notes

- Many chemical reactions can be classified as one of four types by comparing reactants with products.
- In synthesis reactions, the reactants form a single product.
- In decomposition reactions, a single reactant breaks apart into two or more simpler products.
- In single-replacement reactions, a more-reactive element takes the place of a less-reactive element in a compound. No reaction will occur if a less-reactive element is placed with a compound containing a more-reactive element.
- In double-replacement reactions, ions in two compounds switch places. A gas or precipitate is often formed.

SECTION 3**Vocabulary**

In your own words, write a definition for each of the following terms in the space provided.

1. exothermic _____

2. endothermic _____



Chemical Reactions, continued

3. law of conservation of energy _____

4. activation energy _____

5. catalyst _____

6. inhibitor _____

Notes

Read the following section highlights. Then, in your own words, write the highlights in your ScienceLog.

- Energy is released in exothermic reactions. The energy released can be written as a product in a chemical equation.
- Energy is absorbed in endothermic reactions. The energy absorbed can be written as a reactant in a chemical equation.
- The law of conservation of energy states that energy is neither created nor destroyed.
- Activation energy is the energy needed to start a chemical reaction.
- Energy diagrams indicate whether a reaction is exothermic or endothermic by showing whether energy is given off or absorbed during the reaction.
- The rate of a chemical reaction is affected by temperature, concentration, surface area, and the presence of a catalyst or inhibitor.
- Raising the temperature, increasing the concentration, increasing the surface area, and adding a catalyst can increase the rate of a reaction.

Chemical Reactions



USING VOCABULARY

To complete the following sentences, choose the correct term from each pair of terms listed below, and write the term in the space provided.

1. Adding a(n) _____ will slow down a chemical reaction.
(catalyst or inhibitor)
2. A chemical reaction that gives off light is called _____.
(exothermic or endothermic)
3. A chemical reaction that forms one compound from two or more substances is called a _____. (synthesis reaction or decomposition reaction)
4. The 2 in the formula Ag_2S is a _____. (subscript or coefficient)
5. The starting materials in a chemical reaction are _____.
(reactants or products)

UNDERSTANDING CONCEPTS

Multiple Choice

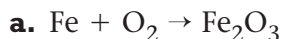
6. Balancing a chemical equation so that the same number of atoms of each element is found in both the reactants and the products is an illustration of
 - a. activation energy.
 - b. the law of conservation of energy.
 - c. the law of conservation of mass.
 - d. a double-replacement reaction.
7. What is the correct chemical formula for calcium chloride?
 - a. CaCl
 - b. CaCl_2
 - c. Ca_2Cl
 - d. Ca_2Cl_2
8. In which type of reaction do ions in two compounds switch places?
 - a. synthesis
 - b. decomposition
 - c. single-replacement
 - d. double-replacement
9. Which is an example of the use of activation energy?
 - a. plugging in an iron
 - b. playing basketball
 - c. holding a lit match to paper
 - d. eating

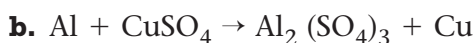
Chemical Reactions, continued

10. Enzymes in your body act as catalysts. Thus, the role of enzymes is to
- a. increase the rate of chemical reactions.
 - b. decrease the rate of chemical reactions.
 - c. help you breathe.
 - d. inhibit chemical reactions.

Short Answer

11. Classify each of the following reactions:







12. Name two ways that you could increase the rate of a chemical reaction.

13. Acetic acid, a compound found in vinegar, reacts with baking soda to produce carbon dioxide, water, and sodium acetate. Without writing an equation, identify the reactants and the products of this reaction.

Chemical Reactions, continued

CONCEPT MAPPING

14. Use the following terms to create a concept map: *chemical reaction, chemical equation, chemical formulas, reactants, products, coefficients, subscripts.*



Chemical Reactions, continued

CRITICAL THINKING AND PROBLEM SOLVING

15. Your friend is very worried by rumors he has heard about a substance called dihydrogen monoxide. What could you say to your friend to calm his fears? (Be sure to write the formula of the substance.)

16. As long as proper safety precautions have been taken, how can explosives be transported long distances without exploding?

MATH IN SCIENCE

17. Calculate the number of atoms of each element shown in each of the following:

a. CaSO_4

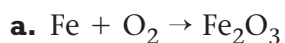
b. 4NaOCl

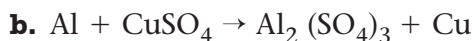
c. $\text{Fe}(\text{NO}_3)_2$

d. $2\text{Al}_2(\text{CO}_3)_3$

Chemical Reactions, continued

18. Write balanced equations for the following:







19. Write and balance chemical equations from each of the following descriptions:

a. Bromine reacts with sodium iodide to form iodine and sodium bromide.

b. Phosphorus reacts with oxygen gas to form diphosphorus pentoxide.

c. Lithium oxide decomposes to form lithium and oxygen.

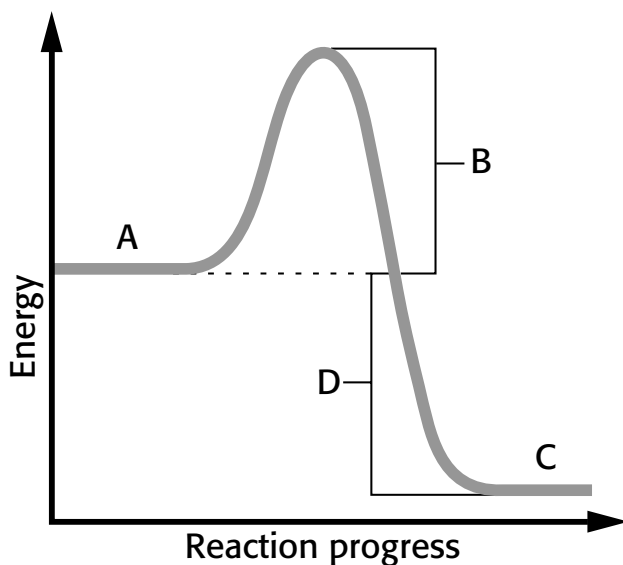


Chemical Reactions, continued

INTERPRETING GRAPHICS

20. Look at the picture on page 49 in the top right side of the page. What evidence in the picture supports the claim that a chemical reaction is taking place?

21. Use the energy diagram below to answer the questions that follow.



a. Which letter represents the energy of the products?

b. Which letter represents the activation energy of the reaction?

c. Is energy given off or absorbed by this reaction?

READING CHECK-UP

Take a minute to review your answers to the ScienceLog questions at the beginning of the chapter. Have your answers changed? If necessary, revise your answers based on what you have learned since you began this chapter. Record your revisions in your ScienceLog.

Chemical Reactions

By studying the Vocabulary and Notes listed for each section below, you can gain a better understanding of this chapter.

SECTION 1

Vocabulary

In your own words, write a definition for each of the following terms in the space provided.

1. chemical reaction the process by which one or more substances undergo change to produce one or more different substances

2. chemical formula a shorthand notation for a compound or a diatomic element using chemical symbols and numbers

3. chemical equation a shorthand description of a chemical reaction using chemical formulas and symbols

4. reactants the starting materials in a chemical reaction

5. products the substances formed from a chemical reaction

Chemical Reactions, continued

6. law of conservation of mass the law that states that mass is neither created nor destroyed in ordinary chemical and physical changes

Notes

Read the following section highlights. Then, in your own words, write the highlights in your ScienceLog.

- Chemical reactions form new substances with different properties than the starting substances.
- Clues that a chemical reaction is taking place include formation of a gas or solid, a color change, and an energy change.
- A chemical formula tells the composition of a compound using chemical symbols and subscripts. Subscripts are small numbers written below and to the right of a symbol in a formula.
- Chemical formulas can sometimes be written from the names of covalent compounds and ionic compounds.
- A chemical equation describes a reaction using formulas, symbols, and coefficients.
- A balanced equation uses coefficients to illustrate the law of conservation of mass, which states that mass is neither created nor destroyed during a chemical reaction.

SECTION 2

Vocabulary

In your own words, write a definition for each of the following terms in the space provided.

1. synthesis reaction a reaction in which two or more substances combine to form a single compound

2. decomposition reaction a reaction in which a single compound breaks down to form two or more simpler substances

Chemical Reactions, continued

3. single-replacement reaction a reaction in which an element takes the place of another element in a compound

4. double-replacement reaction a reaction in which ions in two compounds switch places

Notes

- Many chemical reactions can be classified as one of four types by comparing reactants with products.
- In synthesis reactions, the reactants form a single product.
- In decomposition reactions, a single reactant breaks apart into two or more simpler products.
- In single-replacement reactions, a more-reactive element takes the place of a less-reactive element in a compound. No reaction will occur if a less-reactive element is placed with a compound containing a more-reactive element.
- In double-replacement reactions, ions in two compounds switch places. A gas or precipitate is often formed.

SECTION 3**Vocabulary**

In your own words, write a definition for each of the following terms in the space provided.

1. exothermic the term used to describe a physical or a chemical change in which energy is released or removed

2. endothermic the term used to describe a physical or a chemical change in which energy is absorbed



Chemical Reactions, continued

3. law of conservation of energy the law that states that energy is neither created nor destroyed

4. activation energy the minimum amount of energy needed for substances to react

5. catalyst a substance that speeds up a reaction without being permanently changed

6. inhibitor a substance that slows down or stops a chemical reaction

Notes

Read the following section highlights. Then, in your own words, write the highlights in your ScienceLog.

- Energy is released in exothermic reactions. The energy released can be written as a product in a chemical equation.
- Energy is absorbed in endothermic reactions. The energy absorbed can be written as a reactant in a chemical equation.
- The law of conservation of energy states that energy is neither created nor destroyed.
- Activation energy is the energy needed to start a chemical reaction.
- Energy diagrams indicate whether a reaction is exothermic or endothermic by showing whether energy is given off or absorbed during the reaction.
- The rate of a chemical reaction is affected by temperature, concentration, surface area, and the presence of a catalyst or inhibitor.
- Raising the temperature, increasing the concentration, increasing the surface area, and adding a catalyst can increase the rate of a reaction.

Chemical Reactions

USING VOCABULARY

To complete the following sentences, choose the correct term from each pair of terms listed below, and write the term in the space provided.

1. Adding a(n) _____ **inhibitor** _____ will slow down a chemical reaction. (catalyst or inhibitor)
2. A chemical reaction that gives off light is called _____ **exothermic** _____. (exothermic or endothermic)
3. A chemical reaction that forms one compound from two or more substances is called a _____ **synthesis reaction** _____. (synthesis reaction or decomposition reaction)
4. The 2 in the formula Ag_2S is a _____ **subscript** _____. (subscript or coefficient)
5. The starting materials in a chemical reaction are _____ **reactants** _____. (reactants or products)

UNDERSTANDING CONCEPTS

Multiple Choice

6. Balancing a chemical equation so that the same number of atoms of each element is found in both the reactants and the products is an illustration of
 - a. activation energy.
 - b. the law of conservation of energy.
 - c.** the law of conservation of mass.
 - d. a double-replacement reaction.
7. What is the correct chemical formula for calcium chloride?
 - a. CaCl
 - b.** CaCl_2
 - c. Ca_2Cl
 - d. Ca_2Cl_2
8. In which type of reaction do ions in two compounds switch places?
 - a. synthesis
 - b. decomposition
 - c. single-replacement
 - d.** double-replacement
9. Which is an example of the use of activation energy?
 - a. plugging in an iron
 - b. playing basketball
 - c.** holding a lit match to paper
 - d. eating

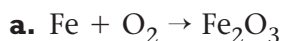
Chemical Reactions, continued

10. Enzymes in your body act as catalysts. Thus, the role of enzymes is to

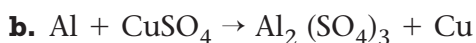
- a. increase the rate of chemical reactions.
- b. decrease the rate of chemical reactions.
- c. help you breathe.
- d. inhibit chemical reactions.

Short Answer

11. Classify each of the following reactions:



This is a synthesis reaction.



This is a single-replacement reaction.



This is a double-replacement reaction.

12. Name two ways that you could increase the rate of a chemical reaction.

Answers should include two of the following: raise the temperature, increase the concentration of a reactant, increase the surface area of a reactant, or add a catalyst.

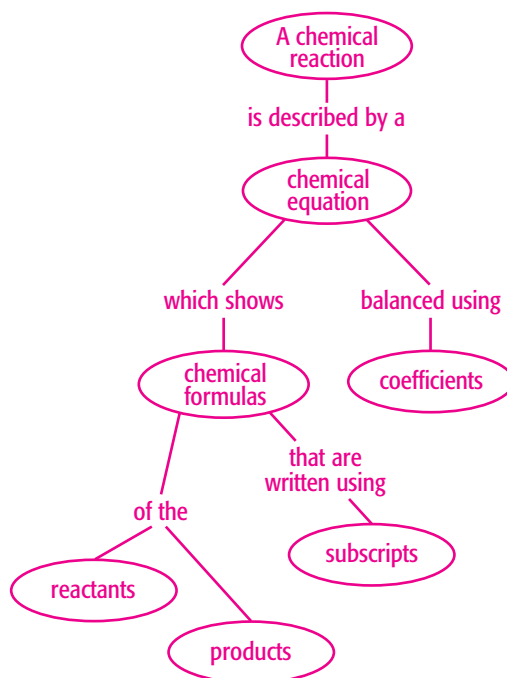
13. Acetic acid, a compound found in vinegar, reacts with baking soda to produce carbon dioxide, water, and sodium acetate. Without writing an equation, identify the reactants and the products of this reaction.

The reactants are acetic acid and baking soda. The products are carbon dioxide, water, and sodium acetate.

Chemical Reactions, continued

CONCEPT MAPPING

14. Use the following terms to create a concept map: *chemical reaction*, *chemical equation*, *chemical formulas*, *reactants*, *products*, *coefficients*, *subscripts*.



Chemical Reactions, continued

CRITICAL THINKING AND PROBLEM SOLVING

15. Your friend is very worried by rumors he has heard about a substance called dihydrogen monoxide. What could you say to your friend to calm his fears? (Be sure to write the formula of the substance.)

The compound is water, H_2O

16. As long as proper safety precautions have been taken, how can explosives be transported long distances without exploding?

Explosives need to absorb energy to begin the reaction. As long as precautions are taken to prevent the activation energy from being absorbed by the explosives, they should be safe to transport.

MATH IN SCIENCE

17. Calculate the number of atoms of each element shown in each of the following:



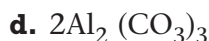
1 calcium atom, 1 sulfur atom, 4 oxygen atoms



4 sodium atoms, 4 oxygen atoms, 4 chlorine atoms



1 iron atom, 2 nitrogen atoms, 6 oxygen atoms

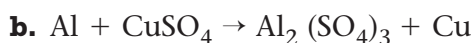
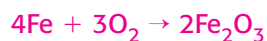


4 aluminum atoms, 6 carbon atoms, 18 oxygen atoms

Chemical Reactions, continued



18. Write balanced equations for the following:

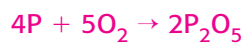


19. Write and balance chemical equations from each of the following descriptions:

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b. Phosphorus reacts with oxygen gas to form diphosphorus pentoxide.



c. Lithium oxide decomposes to form lithium and oxygen.



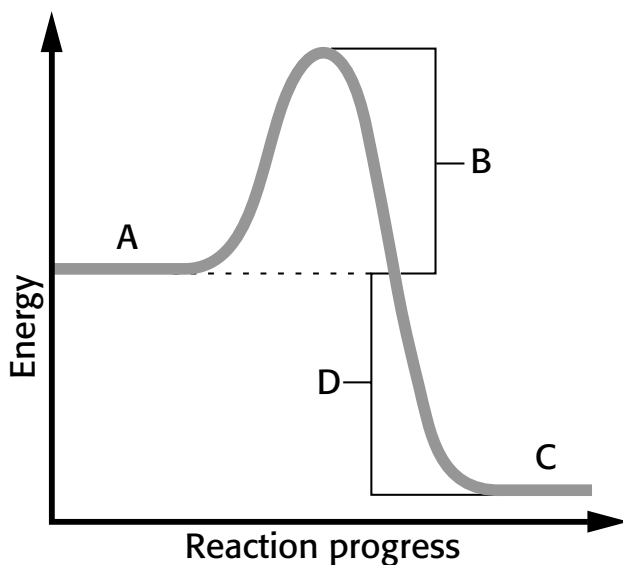
Chemical Reactions, continued

INTERPRETING GRAPHICS

20. Look at the picture on page 49 in the top right side of the page. What evidence in the picture supports the claim that a chemical reaction is taking place?

Gas is produced and light is given off.

21. Use the energy diagram below to answer the questions that follow.



a. Which letter represents the energy of the products?

C

b. Which letter represents the activation energy of the reaction?

B

c. Is energy given off or absorbed by this reaction?

Energy is given off.

READING CHECK-UP

Take a minute to review your answers to the ScienceLog questions at the beginning of the chapter. Have your answers changed? If necessary, revise your answers based on what you have learned since you began this chapter. Record your revisions in your ScienceLog.