

## Target Reading Skill

**Take Notes** In your notebook, create a two-column note-taking organizer for Section 2: Describing Chemical Reactions. Include summary statements.

Recall Clues and Questions	Notes
What are chemical equations?	Chemical equation: an easy way to show a chemical reaction. <ul style="list-style-type: none"> <li>• Chemical formulas—symbols for elements in a compound</li> <li>• Structure of an equation—</li> </ul>

## Reviewing Key Terms

Choose the letter of the best answer.

- Which of the following is *not* a physical property?
  - flexibility
  - ability to catch fire
  - melting point
  - ability to conduct electricity
- A chemical reaction that gives off heat is likely to be
  - endothermic.
  - a precipitate.
  - a physical change.
  - exothermic.
- You can balance a chemical equation by changing the
  - subscripts.
  - coefficients.
  - reactants.
  - products.
- A chemical reaction in which two elements combine to form a compound is called a
  - synthesis.
  - replacement.
  - decomposition.
  - precipitation.
- The activation energy of a chemical reaction
  - is supplied by a catalyst.
  - is released at the end.
  - starts the reaction.
  - changes with time.
- A chemical reaction in which a fuel combines rapidly with oxygen is a(n)
  - inhibited reaction.
  - combustion reaction.
  - enzyme reaction.
  - endothermic reaction.

Complete the following sentences so that your answers clearly explain the key terms.

- A burning candle is an example of a **chemical change**, or a change in which \_\_\_\_\_.
- The left side of a chemical equation lists the **reactants**, or the substances that \_\_\_\_\_.
- By measuring the masses of the reactants and products of a reaction, you can demonstrate the principle of **conservation of matter**, which states that \_\_\_\_\_.
- One factor that can affect reaction rates is a reactant's **concentration**, which refers to \_\_\_\_\_.

## Writing in Science

**Explanation** You are a writer for a children's book about chemistry. Write a paragraph that young children would understand that explains the concept of "activation energy." Be sure to use examples, such as the burning of wood or gas.

 **Video Assessment**  
Discovery Channel School  
Chemical Reactions

Chapter 6 ♦ 247

## Target Reading Skill

**Take Notes** Students' note-taking organizer should contain recall clues and questions and summary statements drawn from the Section 2 headings. Sample row: What is conservation of matter? The principle stating that matter is neither created nor destroyed during a chemical reaction.

## Reviewing Key Terms

1. b 2. d 3. b 4. a 5. c 6. b
7. the atoms are rearranged to form new substances with different chemical and physical properties
8. undergo change in the reaction
9. during a chemical reaction, matter is neither created nor destroyed
10. the amount of a substance in a given volume

## Writing in Science

 **E-LA: Writing 8.2.0**

**Writing Mode** Expository

### Scoring Rubric

- 4 Exceeds criteria; includes a simply written explanation that clearly and correctly explains the concept with several relevant examples
- 3 Meets criteria
- 2 Includes an explanation and at least one example but contains some errors
- 1 Includes a general description only and/or contains serious errors

## Video Assessment

### Chemical Reactions

Show the Video Assessment to review chapter content and as a prompt for the writing assignment. Discussion question: **What are the results of the chemical reactions that take place in fireworks?** (*The reactions release energy as heat and light.*)

# Review and Assessment

## Checking Concepts

- Two kinds of changes are physical changes and chemical changes. A physical change does not change a substance into another substance. A chemical change does change a substance into another.
- You cannot change the subscripts because that changes the identity of the substances.
- It does not violate the principle of conservation of matter. Not all of the reactants and products were measured, so it is impossible to tell if the total amount of mass changed or remained the same.
- Enzymes lower the activation energy required for chemical reactions in your body to take place. Because of this, the reactions take place at normal body temperatures that are safe for you.
- Water covers the fuel, which keeps it from coming into contact with oxygen. In addition, the evaporation of water uses a large amount of heat, causing the fire to cool.
- Inhibitors decrease the rate of a reaction, such as the spoiling of food. Most inhibitors work by preventing reactants from coming together.

## Thinking Critically

- Students may say that they would paint the steel or cover it with some other protective coating to prevent the steel from coming into contact with water and salt.
- a.** Replacement **b.** Synthesis  
**c.** Decomposition **d.** Synthesis
- Sample answer: Opening the door suddenly lets oxygen into the room. The added oxygen allows the fire to flare up.
- Sample answer: Detailed carvings provide more surface area for the acid rain to react with.

## Math Practice

- $\text{MgO} + 2 \text{HBr} \rightarrow \text{MgBr}_2 + \text{H}_2\text{O}$
- $2 \text{N}_2 + 5 \text{O}_2 \rightarrow 2 \text{N}_2\text{O}_5$
- $\text{C}_2\text{H}_4 + 3 \text{O}_2 \rightarrow 2 \text{CO}_2 + 2 \text{H}_2\text{O}$
- $\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2$

## Checking Concepts

- What are the two kinds of changes that occur in matter? Describe how you can tell one from the other.
- Why can't you balance a chemical equation by changing the subscripts of the reactants or the products?
- You find the mass of a piece of iron metal, let it rust, and measure the mass again. The mass has increased. Does this violate the principle of conservation of matter? Explain.
- How do enzymes in your body make chemical reactions occur at safe temperatures?
- Why does spraying water on a fire help to put the fire out?
- How are inhibitors useful in controlling chemical reactions?

## Thinking Critically

- Problem Solving** Steel that is exposed to water and salt rusts quickly. If you were a shipbuilder, how would you protect a new ship? Explain why your solution works.
- Classifying** The following are balanced equations for chemical reactions. Classify each of the equations as synthesis, decomposition, or replacement.
  - $2 \text{Al} + \text{Fe}_2\text{O}_3 \rightarrow 2 \text{Fe} + \text{Al}_2\text{O}_3$
  - $2 \text{Ag} + \text{S} \rightarrow \text{Ag}_2\text{S}$
  - $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
  - $2 \text{NO} + \text{O}_2 \rightarrow 2 \text{NO}_2$
- Relating Cause and Effect** Firefighters open doors very carefully because sometimes a room will burst violently into flames when the door is opened. Based on your knowledge of the fire triangle, explain why this happens.
- Inferring** Some statues are made of materials that can react in acid rain and begin to dissolve. It has been observed that statues with smooth surfaces are dissolved by acid rain much slower than statues with very detailed carvings. Explain this observation.

## Math Practice

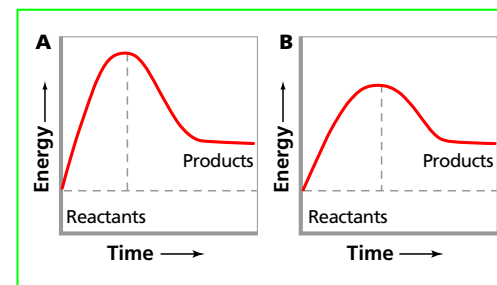
Balance the chemical equations in Questions 21–24.

- $\text{MgO} + \text{HBr} \rightarrow \text{MgBr}_2 + \text{H}_2\text{O}$
- $\text{N}_2 + \text{O}_2 \rightarrow \text{N}_2\text{O}_5$
- $\text{C}_2\text{H}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- $\text{Fe} + \text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2$

## Applying Skills

Use the energy diagram to answer Questions 25–27.

The two graphs below represent the same chemical reaction under different conditions.



- Interpreting Data** How does the energy of the products compare with the energy of the reactants?
- Classifying** Tell whether this reaction is exothermic or endothermic.
- Applying Concepts** What change in condition might account for the lower “hump” in the second graph? Explain.

## Standards Investigation

**Performance Assessment** Make a poster of your test results. Display your reaction chamber for the class. Discuss how your chamber was built to the specifications agreed upon by the class. Describe its safety features. Based on your results, rate how effectively your chamber works as a closed system.

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## Applying Skills

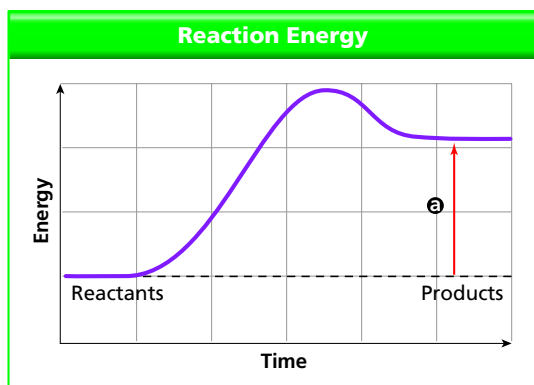
- The energy of the products is greater than the energy of the reactants.
- The reaction is endothermic.

- The use of a catalyst might account for the lower “hump” in the second graph, because a catalyst is a material that lowers the activation energy.

Choose the letter of the best answer.

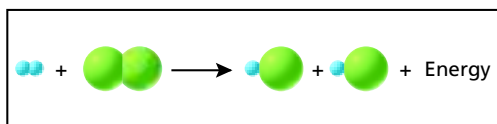
- Which of the following is the *best* evidence for a chemical reaction?  
 A gas bubbles  
 B formation of a new substance  
 C change of state  
 D change in temperature **S 8.5.a**
- Which statement best describes what happens to chemical bonds in a reaction?  
 A Bonds are only broken, not formed  
 B Bonds are only formed, not broken.  
 C Bonds in the reactants are broken, and bonds in the products are formed.  
 D Bonds are neither formed nor broken. **S 8.5.c**
- Which shows a balanced chemical equation for the decomposition of aluminum oxide ( $\text{Al}_2\text{O}_3$ )?  
 A  $\text{Al}_2\text{O}_3 \rightarrow 2 \text{Al} + \text{O}_2$   
 B  $\text{Al}_2\text{O}_3 \rightarrow 2 \text{Al} + 3 \text{O}_2$   
 C  $2 \text{Al}_2\text{O}_3 \rightarrow 4 \text{Al} + \text{O}_2$   
 D  $2 \text{Al}_2\text{O}_3 \rightarrow 4 \text{Al} + 3 \text{O}_2$  **S 8.5.b**

Use the diagram below to answer Question 4.



- The quantity (a) in the diagram represents the  
 A activation energy of the reaction.  
 B energy absorbed by the reaction.  
 C energy released by the reaction.  
 D temperature of the reactants. **S 8.5.c**

Base your answers to Questions 5 and 6 on the diagram below. The diagram represents molecules of two different elements that are gases. The elements react chemically to produce a third gas.



- The diagram represents a(n)  
 A endothermic reaction in which energy is released.  
 B exothermic reaction in which energy is absorbed.  
 C exothermic reaction in which energy is released.  
 D reaction in which energy is destroyed. **S 8.5.c**
- What can be inferred from the diagram?  
 A Matter is not created or destroyed in a chemical reaction.  
 B The rate of a reaction depends on the surface area of the reactants.  
 C A gas molecule always consists of two identical atoms.  
 D The product is carbon monoxide gas. **S 8.5.b**

### Apply the BIG Idea

- The major component of natural gas is methane ( $\text{CH}_4$ ). When methane burns in oxygen gas ( $\text{O}_2$ ), carbon dioxide ( $\text{CO}_2$ ) and water vapor ( $\text{H}_2\text{O}$ ) are produced. Write a balanced equation for this reaction. Explain why the burning of methane is a chemical change, not a physical change. Does this change absorb heat or liberate heat? **S 8.5**

### Standards Practice

- B; **S 8.5.a**
- C; **S 8.5.c**
- D; **S 8.5.b**
- B; **S 8.5.c**
- C; **S 8.5.c**
- A; **S 8.5.b**

### Apply the BIG Idea

- $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ . The burning of methane is a chemical change because atoms are rearranged to form new substances with different chemical and physical properties. This change liberates heat. **S 8.5**

### Lab zone Standards Investigation

S 8.5.b

**Performance Assessment** Students' presentations should include a description of the design process they went through to construct and test their reaction chambers. Students can use posters, overhead transparencies, or handouts of tables or graphs to show the masses of reactants and products in the chemical reaction they

undertook in their chambers. Students are expected to explain whether their data support the principle of conservation of matter. Urge students to make comparisons between their data and those of their classmates. Ask them to try to explain any discrepancies.

### Teaching Resources

#### Laboratory Manual

- Standards Investigation Scoring Rubric

The Standards Investigation Scoring Rubric will help you evaluate students' work. If you share the rubric in advance, students will know what is expected of them.