

Chapter 12 Study Guide



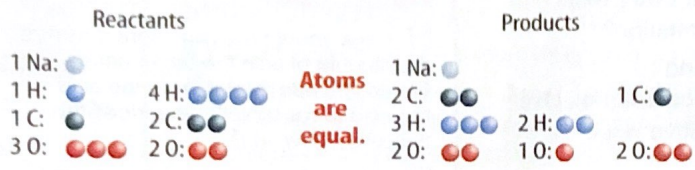
Atoms are neither created nor destroyed in chemical reactions. Energy can be released when chemical bonds form or absorbed when chemical bonds are broken.

Key Concepts Summary

Vocabulary

Lesson 1: Understanding Chemical Reactions

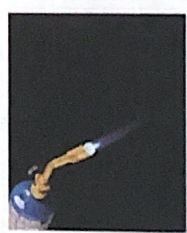
- There are several signs that a **chemical reaction** might have occurred, including a change in temperature, a release of light, a release of gas, a change in color or odor, and the formation of a solid from two liquids.
- In a chemical reaction, atoms of **reactants** rearrange and form **products**.
- The total mass of all the reactants is equal to the total mass of all the products in a reaction.



- chemical reaction p. 419
- chemical equation p. 422
- reactant p. 423
- product p. 423
- law of conservation of mass p. 424
- coefficient p. 426

Lesson 2: Types of Chemical Reactions

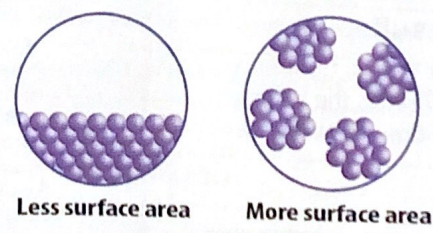
- Most chemical reactions fit into one of a few main categories—synthesis, decomposition, combustion, and single- or double-replacement.
- **Synthesis** reactions create one product.
- **Decomposition** reactions start with one reactant.
- **Single-** and **double-replacement** reactions involve replacing one element or group of atoms with another element or group of atoms.
- **Combustion** reactions involve a reaction between one reactant and oxygen, and they release thermal energy.



- synthesis p. 431
- decomposition p. 431
- single replacement p. 432
- double replacement p. 432
- combustion p. 432

Lesson 3: Energy Changes and Chemical Reactions

- Chemical reactions always involve breaking bonds, which requires energy, and forming bonds, which releases energy.
- In an **endothermic** reaction, the reactants contain less energy than the products. In an **exothermic** reaction, the reactants contain more energy than the products.
- The rate of a chemical reaction can be increased by increasing the surface area, the temperature, or the concentration of the reactants, or by adding a **catalyst**.



- endothermic p. 437
- exothermic p. 437
- activation energy p. 438
- catalyst p. 440
- enzyme p. 440
- inhibitor p. 440

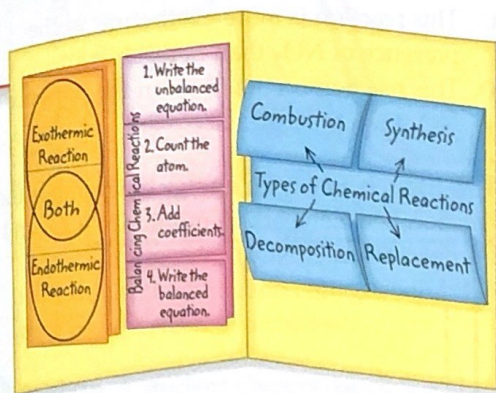
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FOLDABLES®

Chapter Project

Assemble your lesson Foldables as shown to make a Chapter Project. Use the project to review what you have learned in this chapter.



Use Vocabulary

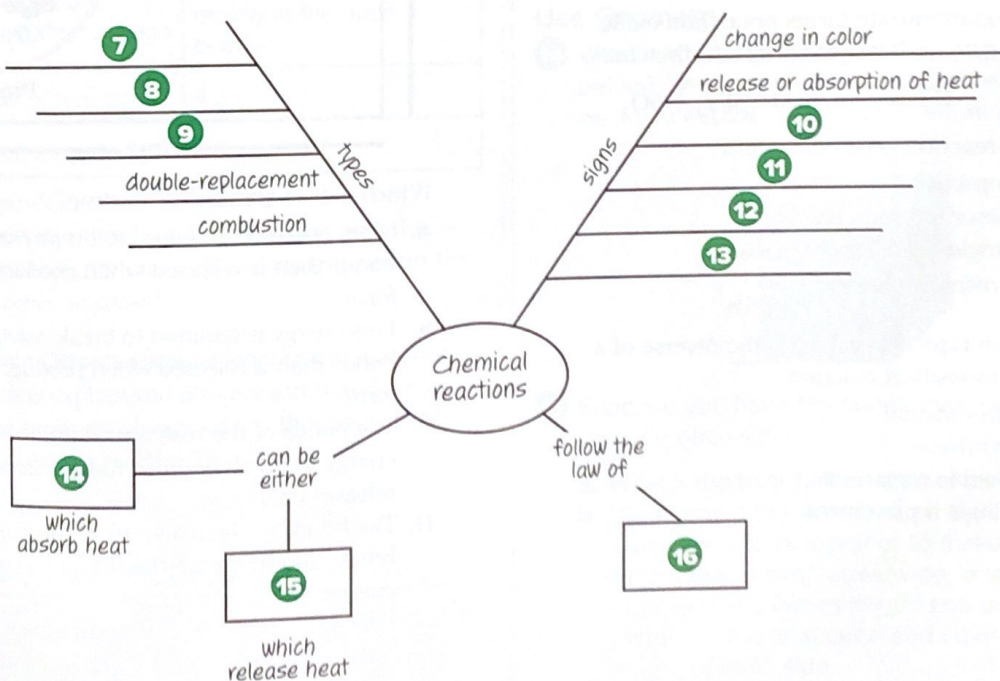
- 1 When water forms from hydrogen and oxygen, water is the _____.
- 2 A(n) _____ uses symbols instead of words to describe a chemical reaction.
- 3 In a(n) _____ reaction, one element replaces another element in a compound.
- 4 When Na_2CO_3 is heated, it breaks down into CO_2 and Na_2O in a(n) _____ reaction.
- 5 The chemical reactions that keep your body warm are _____ reactions.
- 6 Even exothermic reactions require _____ to start.

Link Vocabulary and Key Concepts



Interactive Concept Map

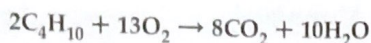
Copy this concept map, and then use vocabulary terms from the previous page and other terms from the chapter to complete the concept map.



Chapter 12 Review

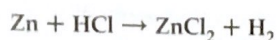
Understand Key Concepts

- 1 How many carbon atoms react in this equation?



- A. 2
- B. 4
- C. 6
- D. 8

- 2 The chemical equation below is unbalanced.



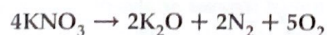
Which is the correct balanced chemical equation?

- A. $\text{Zn} + \text{H}_2\text{Cl}_2 \rightarrow \text{ZnCl}_2 + \text{H}_2$
- B. $\text{Zn} + \text{HCl} \rightarrow \text{ZnCl} + \text{H}$
- C. $2\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$
- D. $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$

- 3 When iron combines with oxygen gas and forms rust, the total mass of the products

- A. depends on the reaction conditions.
- B. is less than the mass of the reactants.
- C. is the same as the mass of the reactants.
- D. is greater than the mass of the reactants.

- 4 Potassium nitrate forms potassium oxide, nitrogen, and oxygen in certain fireworks.



This reaction is classified as a

- A. combustion reaction.
- B. decomposition reaction.
- C. single-replacement reaction.
- D. synthesis reaction.

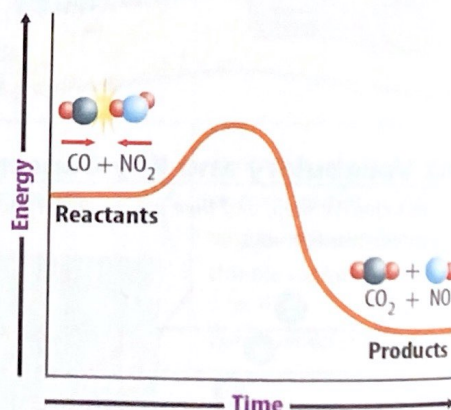
- 5 Which type of reaction is the reverse of a decomposition reaction?

- A. combustion
- B. synthesis
- C. double-replacement
- D. single-replacement

- 6 The compound NO_2 can act as a catalyst in the reaction that converts ozone (O_3) to oxygen (O_2) in the upper atmosphere. Which statement is true?

- A. More oxygen is created when NO_2 is present.
- B. NO_2 is a reactant in the chemical reaction that converts O_3 to O_2 .
- C. This reaction is more exothermic in the presence of NO_2 than in its absence.
- D. This reaction occurs faster in the presence of NO_2 than in its absence.

- 7 The graph below is an energy diagram for the reaction between carbon monoxide (CO) and nitrogen dioxide (NO_2).

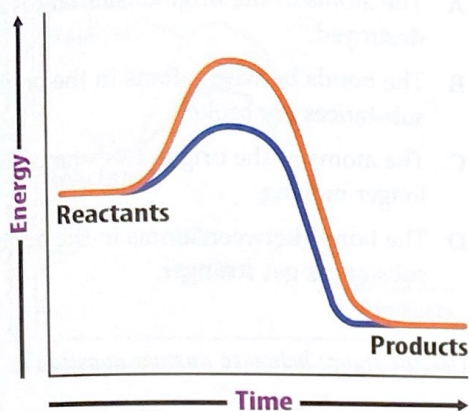


Which is true about this reaction?

- A. More energy is required to break reactant bonds than is released when product bonds form.
- B. Less energy is required to break reactant bonds than is released when product bonds form.
- C. The bonds of the reactants do not require energy to break because the reaction releases energy.
- D. The bonds of the reactants require energy to break, and therefore the reaction absorbs energy.

Critical Thinking

- 8 Predict** The diagram below shows two reactions—one with a catalyst (blue) and one without a catalyst (orange).



How would the blue line change if an inhibitor were used instead of a catalyst?

- 9 Analyze** A student observed a chemical reaction and collected the following data:

Observations before the reaction	A white powder was added to a clear liquid.
Observations during the reaction	The reactants bubbled rapidly in the open beaker.
Mass of reactants	4.2 g
Mass of products	4.0 g

The student concludes that mass was not conserved in the reaction. Explain why this is not a valid conclusion. What might explain the difference in mass?

- 10 Explain Observations** How did the discovery of atoms explain the observation that the mass of the products always equals the mass of the reactants in a reaction?

Writing in Science

- 11 Write instructions** that explain the steps in balancing a chemical equation. Use the following equation as an example.



REVIEW

THE BIG IDEA

- 12** Explain how atoms and energy are conserved in a chemical reaction.
- 13** When a car air bag inflates, sodium azide (NaN_3) decomposes and produces nitrogen gas (N_2) and another product. What element does the other product contain? How do you know?

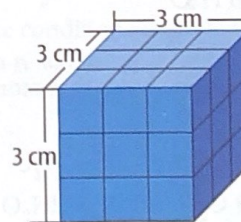


Math Skills

Math Practice

Use Geometry

- 14** What is the surface area of the cube shown below? What would the total surface area be if you cut the cube into 27 equal cubes?



- 15** Suppose you have ten cubes that measure 2 cm on each side.
- What is the total surface area of the cubes?
 - What would the surface area be if you glued the cubes together to make one object that is two cubes wide, one cube high, and five cubes long? Hint: draw a picture of the final cube and label the length of each side.

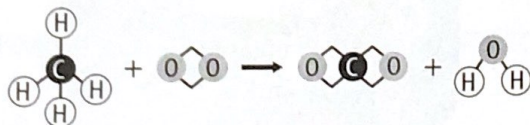
Standardized Test Practice

Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

Multiple Choice

- 1 How can you verify that a chemical reaction has occurred?
- A Check the temperature of the starting and ending substances.
 - B Compare the chemical properties of the starting substances and ending substances.
 - C Look for a change in state.
 - D Look for bubbling of the starting substances.

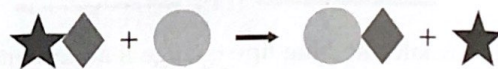
Use the figure below to answer questions 2 and 3.



- 2 The figure above shows models of molecules in a chemical reaction. Which substances are reactants in this reaction?
- A CH_4 and CO_2
 - B CH_4 and O_2
 - C CO_2 and H_2O
 - D O_2 and H_2O
- 3 Which equation shows that atoms are conserved in the reaction?
- A $\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
 - B $\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
 - C $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
 - D $2\text{CH}_4 + \text{O}_2 \rightarrow 2\text{CO}_2 + \text{H}_2\text{O}$

- 4 Which occurs before new bonds can form during a chemical reaction?
- A The atoms in the original substances are destroyed.
 - B The bonds between atoms in the original substances are broken.
 - C The atoms in the original substances are no longer moving.
 - D The bonds between atoms in the original substances get stronger.

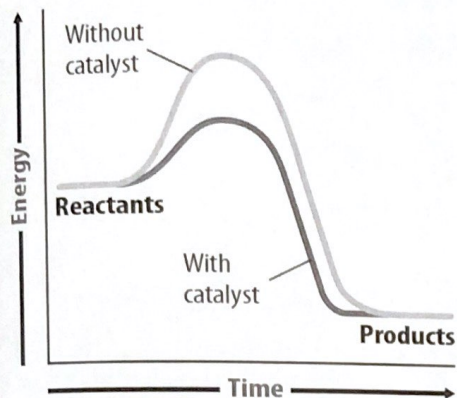
Use the figure below to answer question 5.



- 5 The figure above uses shapes to represent a chemical reaction. What kind of chemical reaction does the figure represent?
- A decomposition
 - B double replacement
 - C single replacement
 - D synthesis
- 6 Which type of chemical reaction has only one reactant?
- A decomposition
 - B double replacement
 - C single replacement
 - D synthesis
- 7 Which element is always a reactant in a combustion reaction?
- A carbon
 - B hydrogen
 - C nitrogen
 - D oxygen



Use the figure below to answer question 8.

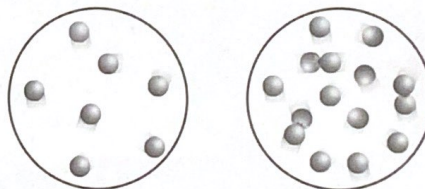


- 8 The figure above shows changes in energy during a reaction. The lighter line shows the reaction without a catalyst. The darker line shows the reaction with a catalyst. Which is true about these two reactions?
- A The reaction with the catalyst is more exothermic than the reaction without the catalyst.
 - B The reaction with the catalyst requires less activation energy than the reaction without the catalyst.
 - C The reaction with the catalyst requires more reactants than the reaction without the catalyst.
 - D The reaction with the catalyst takes more time than the reaction without the catalyst.

Constructed Response

- 9 Explain the role of energy in chemical reactions.
- 10 How does a balanced chemical equation illustrate the law of conservation of mass?
- 11 Many of the reactions that occur when something decays are decomposition reactions. What clues show that this type of reaction is taking place? What happens during a decomposition reaction?

Use the figure below to answer questions 12 and 13.



- 12 Compare the two gas samples represented in the figure in terms of pressure and concentration.
- 13 Describe the conditions that would increase the rate of a reaction.

NEED EXTRA HELP?

If You Missed Question...

Go to Lesson...

1	2	3	4	5	6	7	8	9	10	11	12	13
1	1	1	1	2	2	2	3	3	1	2	3	3