




## 2.4 Chemical Reactions and Enzymes

### Lesson Objectives

-  Explain how chemical reactions affect chemical bonds.
-  Describe how energy changes affect how easily a chemical reaction will occur.
-  Explain why enzymes are important to living things.

### Lesson Summary

**Chemical Reactions** Everything that happens in an organism is based on chemical reactions. A chemical reaction is a process that changes one set of chemicals into another set of chemicals.

- ▶ The elements or compounds that enter into the reaction are the reactants.
- ▶ The elements or compounds produced by the reaction are the products.
- ▶ Chemical reactions involve changes in the chemical bonds that join atoms in compounds.

**Energy in Reactions** Some chemical reactions release energy; others absorb energy.

- ▶ Chemical reactions that release energy often occur on their own.
- ▶ Chemical reactions that absorb energy require a source of energy. The energy needed to get a reaction started is called the activation energy.

**Enzymes** An enzyme is a protein that acts as biological catalyst. A catalyst is a substance that speeds up the rate of a chemical reaction. Catalysts work by lowering a reaction's activation energy.

- ▶ In an enzyme-catalyzed reaction, the reactants are known as substrates. Substrates bind to a part of an enzyme called the active site and remain bound to the enzyme until the reaction is complete, when the products are released.
- ▶ Temperature, pH, and regulatory molecules can affect the activity of enzymes.

### Chemical Reactions

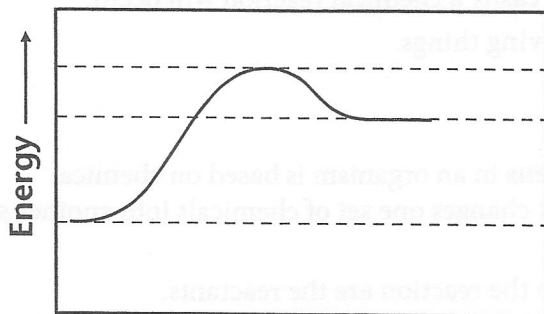
1. What is a chemical reaction?

2. Complete the table about chemicals in a chemical reaction.

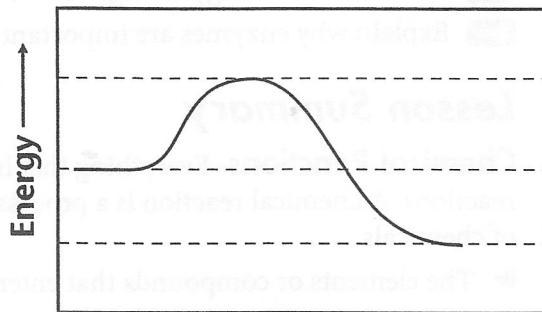
Chemicals in a Chemical Reaction	
Chemicals	Definition
Reactants	
Products	

## Energy in Reactions

3. The graphs below show the amount of energy present during two chemical reactions. One of the reactions is an energy-absorbing reaction, the other is an energy-releasing reaction. Label the type of reaction for each, label the energy level for the reactants and products, then draw an arrow on each to show the energy of activation.



Course of Reaction →



Course of Reaction →

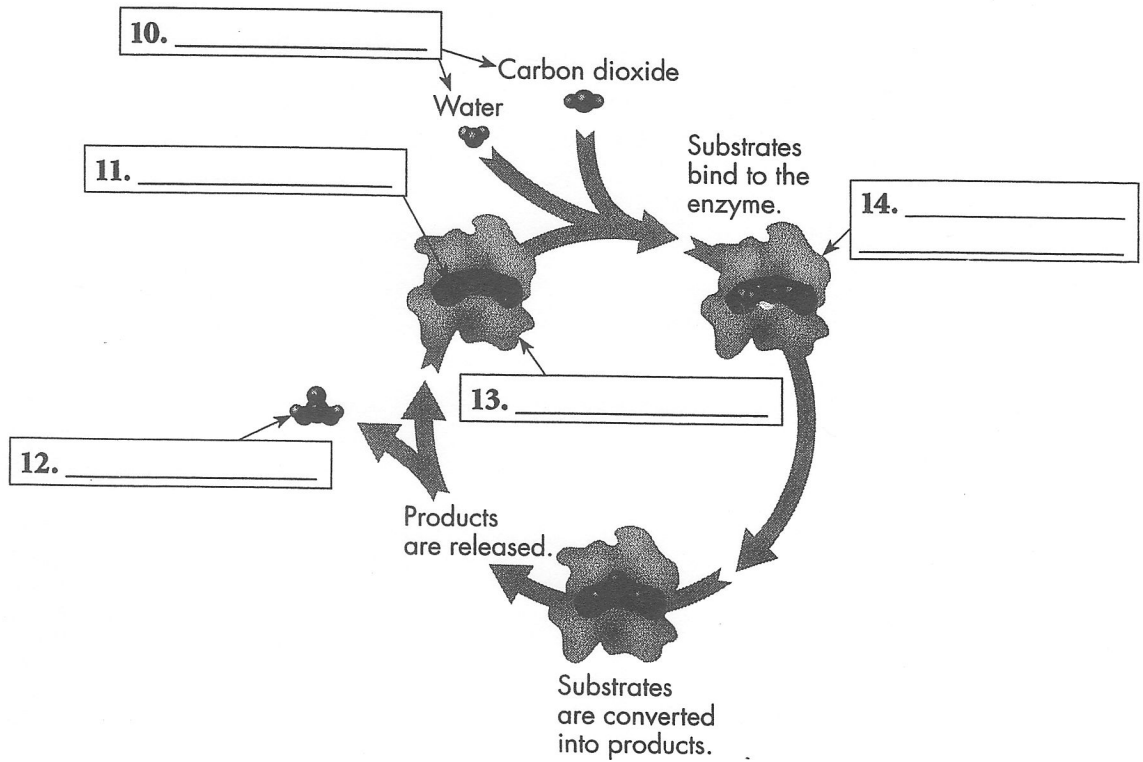
Type of reaction: \_\_\_\_\_ Type of reaction: \_\_\_\_\_

4. What is released or absorbed whenever chemical bonds form or are broken?  
 \_\_\_\_\_  
 \_\_\_\_\_
5. What is the energy of activation?  
 \_\_\_\_\_  
 \_\_\_\_\_
6. Of the two reactions shown, which one is more likely to start spontaneously and why?  
 \_\_\_\_\_  
 \_\_\_\_\_

## Enzymes

7. How does the addition of a catalyst affect the energy of activation of a chemical reaction?  
 \_\_\_\_\_  
 \_\_\_\_\_
8. What type of catalysts affect biochemical reactions?  
 \_\_\_\_\_  
 \_\_\_\_\_
9. What makes proteins the ideal types of compounds to act as enzymes?  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Label the diagram below with the following terms: *active site*, *enzyme*, *enzyme-substrate complex*, *product*, and *substrate*. Then, answer the questions below.



15. What type of organic molecule are enzymes? (proteins, lipids, carbohydrates, or nucleic acids)  
\_\_\_\_\_
16. What do enzymes do in cells?  
\_\_\_\_\_  
\_\_\_\_\_
17. What is activation energy?  
\_\_\_\_\_  
\_\_\_\_\_
18. How do enzymes affect activation energy?  
\_\_\_\_\_  
\_\_\_\_\_
19. What factors can affect the activity of an enzyme?  
\_\_\_\_\_  
\_\_\_\_\_