




## 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

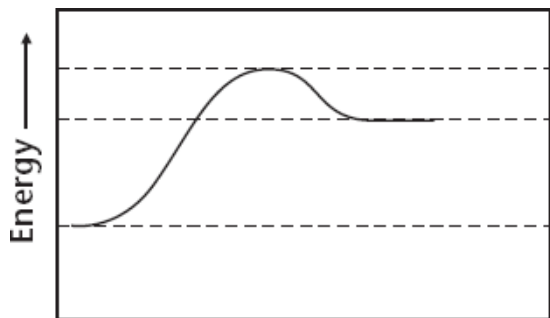
1. What is a chemical reaction?

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

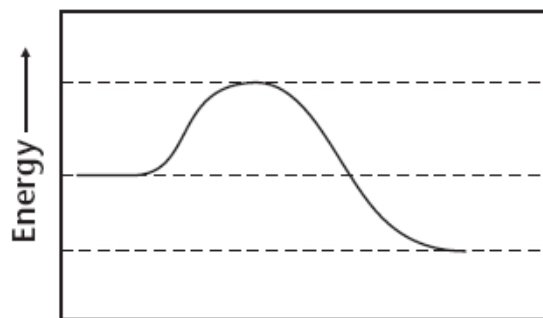
| Chemicals in a Chemical Reaction |            |
|----------------------------------|------------|
| Chemicals                        | Definition |
| Reactants                        |            |
| Products                         |            |

## Energy in Reactions

3. **THINK VISUALLY** 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.



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



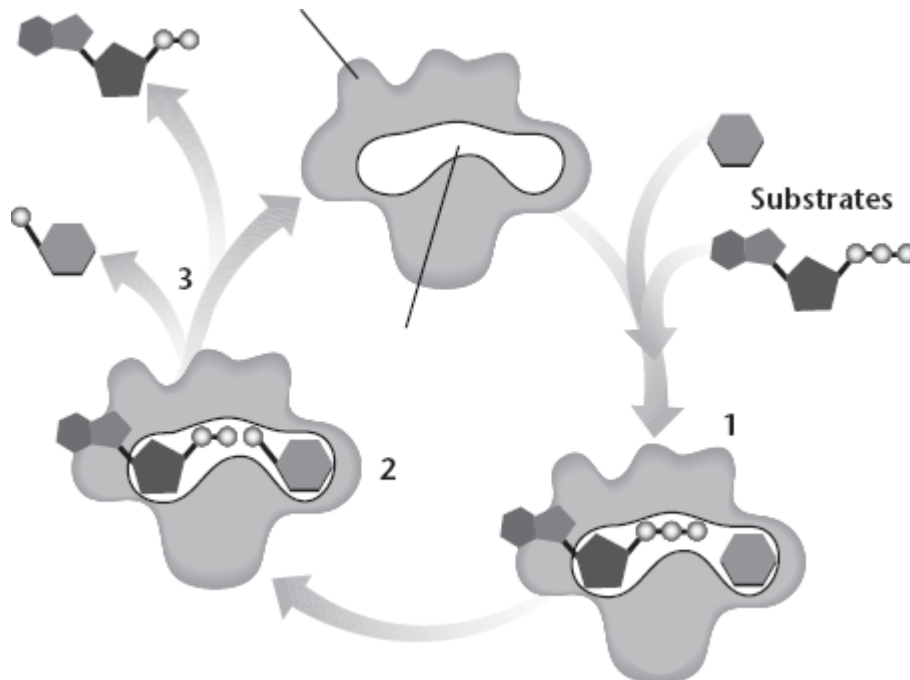
Type of reaction: \_\_\_\_\_

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?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Use the diagram to answer Questions 10–11.



10. **THINK VISUALLY** Label the enzyme, the active site, and the products in the diagram.

11. Write what is happening at each numbered part of the diagram.

- (1) \_\_\_\_\_  
 (2) \_\_\_\_\_  
 (3) \_\_\_\_\_

For Questions 12–13, refer to the Visual Analogy comparing the action of enzymes to a lock and key.

12. **VISUAL ANALOGY** How is a substrate and its enzyme like a lock and its key?

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



13. What is being unlocked in this analogy?

\_\_\_\_\_

### Apply the Big idea

14. In terms of an organism and how it interacts with its environment, what is the benefit of having controls on the chemical reactions that take place in its body?

\_\_\_\_\_  
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