

Chapter 6 Chemical Reactions ▪ Section 3 Summary

Controlling Chemical Reactions

Key Concepts

- How is activation energy related to chemical reactions?
- What factors affect the rate of a chemical reaction?

Activation energy is the minimum amount of energy needed to start a chemical reaction. **All chemical reactions require a certain amount of activation energy to get started.** Whether or not a reaction needs still more energy from the environment to keep going depends on whether it is exothermic or endothermic. At the end of an exothermic reaction, the products have less energy than the reactants. This difference results in the release of heat. Endothermic reactions need energy to keep going. The energy of their products is higher than that of their reactants.

Chemical reactions don't all occur at the same rate. How fast a reaction happens depends on how often and with how much energy the particles of the reactants come together. **Factors that affect rates of reaction include surface area, temperature, concentration, and the presence of catalysts and inhibitors.**

When a solid reacts with a liquid or a gas, only the particles on the surface of the solid come in contact with the other reactant. To increase the rate of reaction, you can break the solid into smaller pieces that have more surface area. More material is exposed, so the reaction happens faster.

Another way to increase the rate of a reaction is to increase its temperature. When you heat a substance, its particles move faster. Faster-moving particles come into contact more often, which means there are more chances for a reaction to happen. Faster-moving particles also have more energy. This increased energy helps the reactants get over the activation energy "hump."

A third way to increase the rate of a reaction is to increase the concentration of the reactants. **Concentration** is the amount of a substance in a given volume. Increasing the concentration of reactants supplies more particles to react.

Another way to control the rate of a reaction is to change the activation energy needed. If you decrease the activation energy, the reaction happens faster. A **catalyst** is a material that increases the rate of a reaction by lowering the activation energy. Catalysts affect the reaction rate, but they are not considered reactants. The cells in your body contain biological catalysts, called **enzymes**. Enzymes increase the reaction rates of chemical reactions necessary for life.

Sometimes a reaction is more useful when it can be slowed down rather than speeded up. A material used to decrease the rate of a reaction is called an **inhibitor**. Most inhibitors work by preventing reactants from coming together.

Chemical Reactions ▪ *Reading/Notetaking Guide***Controlling Chemical Reactions** (pp. 234–239)

This section explains what all chemical reactions require to get started. It also describes how the rates of chemical reactions can be controlled.

Use Target Reading Skills

Fill in the graphic organizer as you read. Under “Notes,” write key ideas, using phrases and abbreviations. Include a few important details. Under “Recall Clues and Questions,” write study questions that your notes help you answer.

Controlling Chemical Reactions	
Recall Clues and Questions	Notes

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Energy and Reactions (pp. 235–236)

1. The _____ is the minimum amount of energy needed to start a chemical reaction.
2. Is the following sentence true or false? All chemical reactions need a certain amount of activation energy to get started.

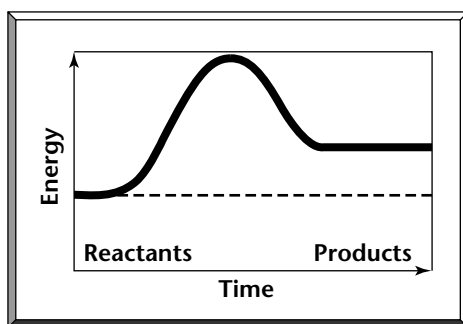
3. In a reaction that makes water from hydrogen gas and oxygen gas, where does the activation energy come from?

4. A reaction that releases energy is called a(n) _____.

5. A reaction that absorbs energy is called a(n) _____.

6. Why does an exothermic reaction need activation energy?

7. On the graph below, how does the energy of the products compare with the energy of the reactants?



8. Label the graph above as either an exothermic or endothermic reaction.
9. What part of the graph in question 7 represents the activation energy for the reaction?

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Controlling Chemical Reactions (*continued*)

Rates of Chemical Reactions (pp. 237–239)

10. What are five factors that affect the rate of a chemical reaction?

11. Why does surface area of a reactant influence the rate of the reaction?

12. In what way is temperature related to chemical reaction rates?

13. Circle the letter of each of the following that would increase the rate of a reaction.

- | | |
|-------------------------------|-------------------------------|
| a. Add heat. | b. Decrease the surface area. |
| c. Increase the surface area. | d. Reduce heat. |

14. The amount of substance in a given volume is called

15. To increase the rate of a reaction, why would you increase the concentration of the reactants?

16. Is the following sentence true or false? Another way to control the rate of a reaction is to change the activation energy needed.

17. What is a catalyst?

18. Is the following sentence true or false? Catalysts are always permanently changed in a reaction. _____

19. A biological catalyst is called a(n) _____.

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20. Why must living things rely on thousands of catalysts for chemical reactions necessary for life?

21. What is an inhibitor?

22. How do most inhibitors work?
