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CHAPTER 17 STUDY GUIDE FOR CONTENT MASTERY

# Reaction Rates

## Section 17.1 A Model for Reaction Rates

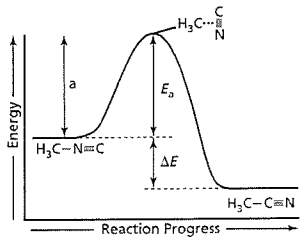
*In your textbook, read about expressing reaction rates and explaining reactions and their rates.*

**Use each of the terms below just once to complete the passage.**

| | | |
|---|---|---|
| collision theory | activated complex | transition state |
| activation energy | reaction rate | mol/(L·s) |

According to the **(1)** collision theory, atoms, ions, and molecules must collide in order to react. Once formed, the **(2)** activated complex is a temporary, unstable arrangement of atoms that may then form products or may break apart to reform the reactants. This physical arrangement is known as the **(3)** transition state. Every chemical reaction requires energy, and the minimum amount of energy that reacting particles must have to form the activated complex is the **(4)** activation energy. In a chemical reaction, the **(5)** reaction rate is the change in concentration of a reactant or product per unit time. It may be expressed using the units of **(6)** mol/L·s.

**Use the energy diagram for the rearrangement reaction of methyl isonitrile to acetonitrile to answer the following questions.**




7. What kind of reaction is represented by this diagram, endothermic or exothermic?
   exothermic

8. What is the chemical structure identified at the top of the curve on the diagram?
   the activated complex

9. What does the symbol $E_a$ represent?
   the activation energy

10. What does the symbol $\Delta E$ represent?
    the net energy released from the exothermic reaction



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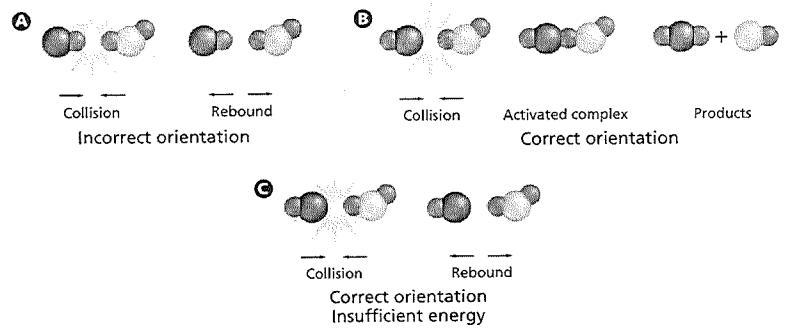
**Section 17.1** *continued*

**For each item in Column A, write the letter of the matching item in Column B.**

| Column A | Column B |
|---|---|
| c 11. Expresses the average rate of loss of a reactant | a. average reaction rate |
| a 12. Expressed as Δquantity/Δtime | b. positive number |
| b 13. Expresses the average rate of formation of a product | c. negative number |

**Use the figure below to answer the following questions.**




14. What molecules collided in collisions A, B, and C?
    CO and $NO_2$

15. What do the arrows represent?
    The arrows represent the direction and the amount of energy of the moving molecules.

16. Which collision(s) formed products? What were the products?
    Collision B; $CO_2$ and NO

17. Explain why the other collision(s) did not form products.
    Collision A did not form products because the carbon atom in the CO molecule did not contact an oxygen atom in the $NO_2$ molecule. Collision C did not form products because the CO molecule and the $NO_2$ molecule did not collide with sufficient energy.

18. Which collision(s) formed an activated complex? Identify the activated complex.
    Collision B; the activated complex is an OCONO molecule.