

Collision Theory and Reaction Mechanisms

Aim

- Explain the mechanisms by which reactions occur

Notes

Chemical kinetics - reaction rates and mechanisms

- ★ Collision theory - in order for a reaction to occur, particles of the reactant must collide
 - ☆ Effective collision - one in which the colliding particles approach each other at the proper angle and with the proper amount of energy
 - ☆ The greater the rate of effective collisions, the greater the reaction rate is
- ★ Reaction mechanisms
 - ☆ Effective collisions between more than two particles at a time are rare
 - ☆ If all the particles shown on the reactant side of a balanced equation had to collide for a reaction to occur, the reaction would not take place
 - ☆ Chemical reactions occur by a series of intermediate steps between the initial reactants and final products
 - ☆ Each step probably involves a collision of only two particles
 - ☆ The series of steps that lead from reactants to products is called a **reaction mechanism**
 - ☆ The slowest step of the reaction mechanism is called the **rate determining step**
 - ☆ increasing the concentration of the reactant(s) that enter the rate determining step increases the reaction rate
 - ☆ increasing the concentration of only reactants not involved in the rate determining step has little effect on the reaction rate
 - ☆ Transition state theory - intermediate products form that exist for only brief periods of time while the atoms rearrange themselves
 - ☆ intermediate products have high energy because they are formed by high energy collisions
 - ☆ the high energy product is unstable and breaks apart to form the final product(s)
 - ☆ the high energy product is called an **activated complex** or a **transition state complex**
 - ☆ the energy needed to form the activated complex is the **activation energy**

Answer the questions below by circling the number of the correct response

1. An increase in temperature increases the rate of chemical reactions. This is primarily because the
 - (1) concentration of the reactants increases
 - (2) number of effective collisions increases
 - (3) activation energy increases
 - (4) average kinetic energy decreases
2. An increase in temperature increases the rate of a chemical reaction because the
 - (1) activation energy increases
 - (2) activation energy decreases
 - (3) number of molecular collisions increases
 - (4) number of molecular collisions decreases