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

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