Assignment 8

1. The reaction mechanism for the given reaction is as follows:

   2. Why do you think the reaction is exothermic?
   3. What is the mechanism for the reaction?
   4. Draw the transition state for the reaction.

   Answer:

   - The reaction is exothermic because the product has a lower enthalpy than the reactants.
   - The mechanism for the reaction involves a concerted transition state, where the bond formation and bond breaking occur simultaneously.
   - The transition state is represented by the following structure:

   ![Transition State](image_url)

2. Identify the behavior of a student who:

   - Has a high reaction rate and finishes the experiment quickly.
   - Has a low reaction rate and finishes the experiment slowly.
   - Has a high reaction rate but the product is contaminated.
   - Has a low reaction rate but the product is pure.

   Answer:

   - A student who has a high reaction rate and finishes the experiment quickly is likely to be the most efficient, but not necessarily the most accurate.
   - A student who has a low reaction rate and finishes the experiment slowly may have taken more time to ensure accuracy.
   - A student who has a high reaction rate but the product is contaminated may have rushed through the experiment.
   - A student who has a low reaction rate but the product is pure may have been more thorough in their work.

3. The plot below shows the relationship between the rate of a reaction and the concentration of reactant A.

   ![Reaction Rate vs. Concentration](image_url)

   - What is the relationship between the rate of the reaction and the concentration of reactant A?
   - Can you predict the rate at which the reaction will proceed if the concentration of reactant A is doubled?

   Answer:

   - The rate of the reaction increases linearly with the concentration of reactant A.
   - If the concentration of reactant A is doubled, the rate of the reaction will also double.

4. A graph showing the relationship between the temperature of a solution and the solubility of a solute is given.

   ![Solubility vs. Temperature](image_url)

   - What is the relationship between the solubility of a solute and the temperature of the solution?
   - Can you predict the solubility of the solute at a temperature of 50°C?

   Answer:

   - The solubility of a solute increases with an increase in temperature.
   - The solubility of the solute at a temperature of 50°C can be predicted by extrapolating the graph.

5. The following chemical reaction is given:

   \[ A + B \rightarrow C + D \]

   - What is the balanced chemical equation for the reaction?
   - Can you predict the products of the reaction if A and B are both present in excess?

   Answer:

   - The balanced chemical equation is: \[ A + B \rightarrow C + D \]
   - The products of the reaction if A and B are both present in excess are C and D.

6. A diagram showing a simple electrochemical cell is given.

   ![Electrochemical Cell](image_url)

   - What is the principle of operation of an electrochemical cell?
   - Can you explain the role of the electrodes in the reaction?

   Answer:

   - The principle of operation of an electrochemical cell is based on the conversion of chemical energy into electrical energy.
   - The role of the electrodes is to facilitate the transfer of electrons between the reactants and the products of the reaction.

7. A student is conducting an experiment to determine the effect of pH on the rate of a reaction.

   - What is the effect of pH on the rate of the reaction?
   - Can you predict the rate of the reaction at a pH of 10?

   Answer:

   - The rate of the reaction increases with an increase in pH.
   - The rate of the reaction at a pH of 10 can be predicted by extrapolating the graph.

8. A student is conducting an experiment to determine the effect of catalysts on the rate of a reaction.

   - What is the role of a catalyst in a reaction?
   - Can you explain how a catalyst affects the rate of the reaction?

   Answer:

   - A catalyst is a substance that increases the rate of a reaction without being consumed in the process.
   - A catalyst affects the rate of the reaction by lowering the activation energy of the reaction.

9. A student is conducting an experiment to determine the effect of concentration on the rate of a reaction.

   - What is the relationship between the concentration of a reactant and the rate of the reaction?
   - Can you predict the rate of the reaction if the concentration of the reactant is doubled?

   Answer:

   - The rate of the reaction increases linearly with the concentration of the reactant.
   - If the concentration of the reactant is doubled, the rate of the reaction will also double.

10. A student is conducting an experiment to determine the effect of temperature on the rate of a reaction.

    - What is the relationship between the temperature and the rate of a reaction?
    - Can you predict the rate of the reaction if the temperature is increased by 10°C?

    Answer:

    - The rate of the reaction increases exponentially with an increase in temperature.
    - If the temperature is increased by 10°C, the rate of the reaction will increase by a factor of 2.718 (e).

11. A student is conducting an experiment to determine the effect of pressure on the rate of a reaction.

    - What is the relationship between the pressure and the rate of a reaction?
    - Can you predict the rate of the reaction if the pressure is increased by 100 kPa?

    Answer:

    - The rate of the reaction increases directly with an increase in pressure.
    - If the pressure is increased by 100 kPa, the rate of the reaction will increase by a factor of 1.104 (same as doubling the pressure).

12. A student is conducting an experiment to determine the effect of light on the rate of a reaction.

    - What is the role of light in the reaction?
    - Can you explain how light affects the rate of the reaction?

    Answer:

    - Light can be used to initiate a reaction or to accelerate the reaction rate.
    - Light can affect the rate of the reaction by providing energy to the reactants to overcome the activation energy barrier.

13. A student is conducting an experiment to determine the effect of solvent on the rate of a reaction.

    - What is the role of solvent in the reaction?
    - Can you explain how solvent affects the rate of the reaction?

    Answer:

    - Solvent can affect the rate of a reaction by providing a medium for the reactants to mix and react.
    - Solvent can also affect the rate of the reaction by solvating the reactants, which can change their properties and affect the rate of reaction.