

Chemical Kinetics Practice Problems And Answers

description of how a reaction proceeds. Each step involves a single molecular event called an elementary reaction. Practice Problem 4: The following mechanism has been proposed for the reaction $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$. Step 1: $2\text{NO} \rightarrow \text{N}_2\text{O}_2$ fast. Step 2: $\text{N}_2\text{O}_2 + \text{O}_2 \rightarrow 2\text{NO}_2$ slow. a. Identify the rate-determining step. b. Derive the rate law for the overall reaction.

Solution: a. The slow step in a reaction mechanism is the rate-determining step, as it determines the overall rate of the reaction. In this case, Step 2 is the rate-determining step.

b. Rate law: The rate law for the overall reaction is based on the rate-determining step. Rate = $k_2\text{N}_2\text{O}_2\text{O}_2$. However, N_2O_2 is an intermediate and its concentration cannot be measured directly. We need to express N_2O_2 in terms of reactants using the equilibrium constant for the fast step: $K_1 = \frac{\text{N}_2\text{O}_2}{\text{NO}^2}$. Substitute this back into the rate law: Rate = $k_2K_1\text{NO}^2\text{O}_2$. Where $k_2 = k_2/K_1$.

Key Takeaways: Chemical kinetics deals with the rate and mechanism of chemical reactions. Rate laws describe how the rate of a reaction depends on reactant concentrations. Integrated rate laws relate reactant concentration to time. Activation energy is the minimum energy required for a reaction to occur.

5. Reaction mechanisms provide a detailed description of how a reaction proceeds step-by-step. Further Practice: To further enhance your understanding of chemical kinetics, explore additional practice problems from textbooks and online resources. Focus on understanding the concepts behind each problem and applying the appropriate equations. Remember, chemical kinetics is a vast field with numerous applications. By mastering the fundamental principles, you'll be well-equipped to tackle real-world problems and contribute to scientific advancements.

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