

Lab Report: Kinetics of Iodine Clock Reaction

3 pages | 671 words

Introduction

Kinetics is defined as "the branch of chemistry concerned with measuring and studying the rates of reactions." The rate of a chemical reaction can be influenced by various factors, including temperature, reactant concentrations, the presence of catalysts, and the type of reactants. As reactants come together in a chemical reaction, there is typically a decrease in their molecular amounts and an increase in the products formed.

In this experiment, we investigated how the concentration of reactants affects the rate of the reaction using an Iodine clock reaction. The specific reaction we conducted involved Potassium iodate and a sodium bisulfate/starch solution. We collected data and analyzed it to determine the order of the reaction.

The formation of the Iodine clock reaction can be represented by the following equations:

1. $\text{IO}_3^- + 3 \text{HSO}_3^- \rightarrow \text{I}^- + 3 \text{HSO}_4^-$ (Equation 1)
2. $\text{IO}_3^- + 5 \text{I}^- + 6 \text{H}^+ \rightarrow 3 \text{I}_2 + 3 \text{H}_2\text{O}$ (Equation 2)
3. $\text{I}_2 + \text{HSO}_3^- + \text{H}_2\text{O} \rightarrow 2 \text{I}^- + \text{HSO}_4^- + 2 \text{H}^+$ (Equation 3)
4. $2 \text{I}^- (\text{aq}) \rightarrow \text{I}_2$ (Equation 4)
5. $\text{I}_2 (\text{aq}) + \text{Starch} \rightarrow \text{Dark blue product}$ (Equation 5)

Procedure

Materials: The experiment required the following materials: seven 50-ml beakers, eight 10-ml graduated cylinders, pure distilled water (H_2O), potassium iodate (Solution A), sodium bisulfate/starch (Solution B), and a stopwatch.

Procedure: The concentration of Solution B remained constant throughout the experiment. The steps of the procedure were as follows:

1. Fill seven 50-ml beakers with 10-ml of sodium bisulfate/starch using a 10-ml graduated cylinder.
2. Prepare graduated cylinders with decreasing concentrations of potassium iodate (Solution A), starting with the highest concentration of approximately 0.010 M. Dilute the solution in each graduated cylinder with distilled water as necessary to achieve the desired concentrations.
3. With one partner holding the highest concentration of Solution A, another with the stopwatch, and the last with Solution B, pour Solution A into Solution B, mix quickly, and start the timer immediately upon mixing. Stop the timer when the mixture turns blue. Repeat the process for all beakers.

Effect of Concentration

Reaction	# of ml Solution A	# of ml H_2O	Concentration $[\text{IO}_3^-]$ mol/L	# of ml Solution B	Concentration $[\text{HSO}_3^-]$ mol/L	Reaction Time in Seconds
1	10	0	0.010 M	10	0.03	10.46
2	9	1	0.009 M	10	0.03	12.00
3	8	2	0.008 M	10	0.03	13.15
4	7	3	0.007 M	10	0.03	14.88
5	6	4	0.006 M	10	0.03	18.03
6	5	5	0.005 M	10	0.03	21.12

Results and Discussion

The results of the experiment showed that as the concentration of Solution B decreased, the reaction took longer to occur. This indicates that the reaction rate is inversely proportional to the concentration of Solution B, meaning that the more diluted the solution, the longer it takes for the reaction to proceed.

Analysis of the data and the corresponding graphs revealed that the reaction followed second-order kinetics. This conclusion is supported by the linearity of the graph, with an R^2 value of 0.9964.

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Clock Reaction Lab Report

Dennis D. Staley



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