The Determination of the Activation Energy of the Briggs - Rauscher Reaction Via Temperature - Dependant Oscillation Period

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Abstract. My experiment is important because it determines the activation energy of an oscillating chemical reaction. To conduct my experiment I used a traditional Briggs – Rauscher reaction. Then once the oscillation began, I cooled the solution with ice that had a covering to keep it from diluting the solution. I recorded and graphed the data, placed the information into the Arhenius equation and found that the activation energy for the Briggs – Rauscher Reaction is approximately 160 joules per mole. I also found that cooler temperatures increase the oscillation period.
Keywords: Briggs – Rauscher Reaction, chemistry, oscillating chemical reaction

INTRODUCTION

This experiment is important due to the fact that it finds a fundamental aspect of the Briggs – Rauscher reaction. The Briggs – Rauscher Reaction is a demonstration of an oscillating chemical reaction. It is a mixture of three colorless solutions. These solutions change from colorless, to amber, and then to bluish green repeatedly. Eventually the oscillation stops and the solution turn brownish purple. Also, the experiment finds the activation energy of an oscillating chemical reaction. Oscillating chemical reactions are very rare.

METHODS

To conduct my experiment I used a traditional Briggs – Rauscher Reaction formula. To create Solution A, 205 ml of 30% hydrogen peroxide was diluted ½ a liter with distilled water. For Solution B 21.5 g of potassium iodate was placed in approximately 400 ml of distilled water. Then 2.15 ml of concentrated H_2SO_4 was added. Next, the mixture was warmed and stirred until the potassium iodate dissolved. The solution was then diluted to ½ liter with distilled water. Solution C is a combination of 2 mixtures. To make the first mixture dissolve 8g of malonic acid and 1.7 of manganese sulfate monohydrate in about 250 ml of distilled water. To make the next solution mix 0.15g of soluble starch with about 2.5 ml of distilled water and stir the mixture to form a slurry. Pour the slurry into 25ml of boiling water and continue heating and stirring the mixture until the starch dissolves. Then I poured the starch solution into the malonic acid and manganese solution. Then the mixture was diluted .5 a liter with distilled water.

To conduct the experiment 150ml of each solution is placed into a beaker and stir on a magnetic stirrer. The colors changed. Then I placed frozen water into the solution to cool it down. Once the temperature dropped I timed the oscillation period. Once I fit the data to the graph, it made a curve similar to those made by the Arhenius equation. The Arhenius Equation is used to find the amount of energy used by a chemical reaction.

RESULTS

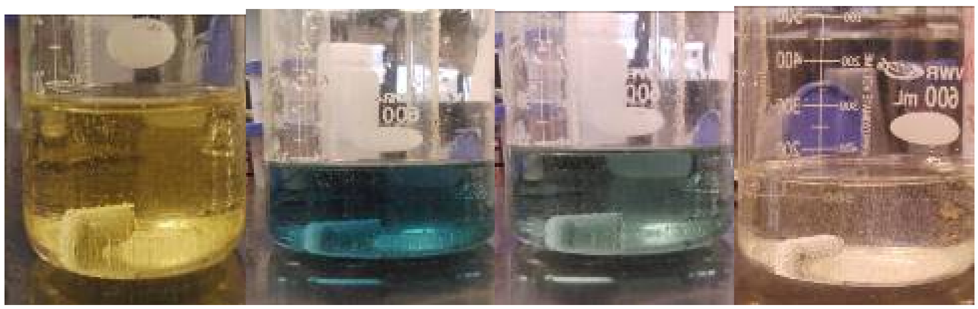

Fig. 1: This shows the colors of the solution during the oscillation period

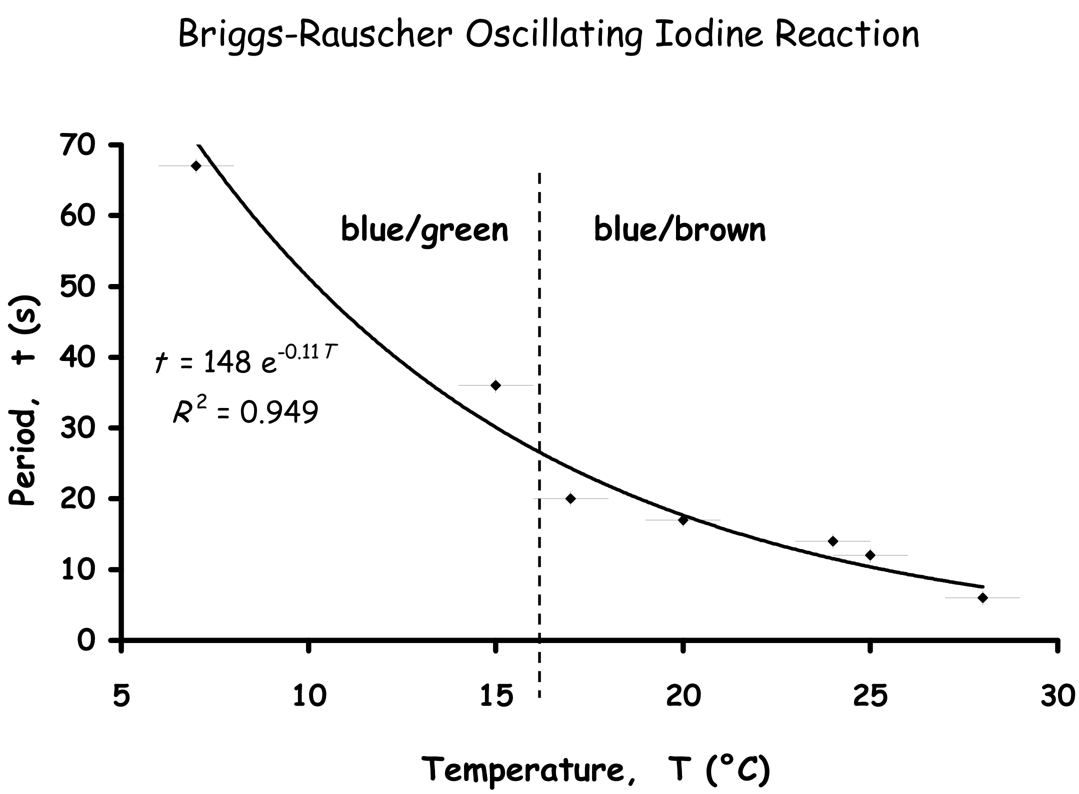

Fig. 2: This is an indirect graph showing the various data collected. The period and temperature are corresponding. The equation in the graph shows the data fit into the Arhenius equation. Cooler temperatures increase the oscillation period. The Briggs – Rauscher reaction has an activation energy of approximately 160 joules per mole.

DISCUSSION

There are many limitations in this experiment. For example, instead of pre-cooling the solutions, they were cooled while they were oscillating. Therefore, once the temperature was calculated and recorded, the solution itself was still reducing in temperature. This led to miscalculations which can lead to assumptions that my data and graph is incorrect.

CONCLUSIONS

The oscillation period increases due to cooler temperatures. Also, the information fitted into the Arhenius Equation shows that the activation energy is about 160 joules per mole. Joule per mole is a unit of energy per amount of material, in this case solution. Energy is measured in joules and the amount of material in moles.

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