

Science Expo Report: Chemical Reaction Rates in Ultraviolet Beads

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Introduction

Ultraviolet is a type of wave that has a higher frequency than that of the violet end of the visible light spectrum, cannot be seen, and comes from the sun. There is a type of dye called Photochromic dye, which is a dye that changes color when it is exposed to Ultraviolet light. This dye is in many things, one of those things are beads, which were used in this experiment. When these beads are exposed to Ultraviolet light, they change color. When taken away from the Ultraviolet light, and heat is applied to it, then the beads change back into their original color (Solar - Powered Chemistry: Study Chemical Reaction Rates in Ultraviolet Beads). In this experiment, the independent variable is the temperature the water is at in °C, the dependent variable that is affected by this independent variable is the time it takes for the Ultraviolet light to wear off of the beads. The hypothesis for this experiment is when the temperature of the water is increased, then the time for the beads to lose their color will decrease.

Materials

These are the materials that are needed for this experiment:

- A package of UV Beads, at least 100
- Thermometer
- Microwave or a Heating Device
- Refrigerator or Ice
- UV light from a Clear Sun
- Stopwatch or Timer
- Water

- Measuring Cup that holds at least 250ml
- Lab Notebook and Pencil

Procedure

This is the procedure that was used for this experiment:

1. Get the measuring cup and put 250ml of water into it
2. Heat or cool the measuring cup with the water to the desired temperature, then put 10 of the UV beads into that measuring cup
3. Get the stopwatch and start it once the measuring cup is outside, into the clear (unblocked) sun, for one minute
4. Once one minute has passed, take the measuring cup inside, and once it is inside, start another (or the same) stopwatch
5. Keep the stopwatch going, until all of the beads have lost their color, and then record that time into the lab notebook
6. Repeat steps 2 - 5 until all of the desired temperatures have been completed and done multiple times for accurate results



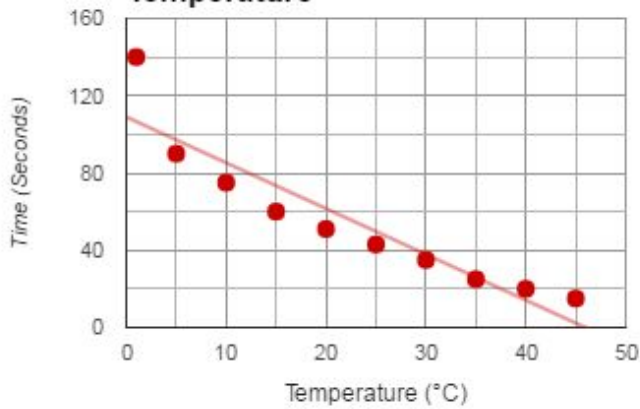
Data Table and Graph

The following are data tables, and the graphs for those data tables, revealing the results for this experiment:

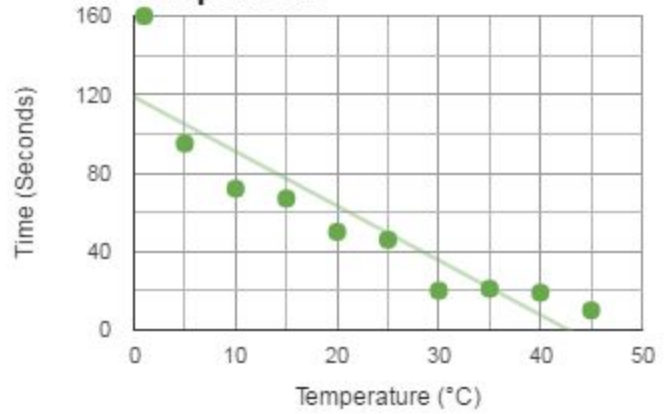
Temperature of Water (°C)	Time for UV to Wear Off (Seconds) (Results 1 / Results 2 / Results 3 / Average)
1°C	140 / 160 / 155 / 152
5°C	90 / 95 / 93 / 93
10°C	75 / 72 / 70 / 73
15°C	60 / 67 / 58 / 62
20°C	51 / 50 / 59 / 54
25°C	43 / 46 / 40 / 43
30°C	35 / 20 / 32 / 29
35°C	25 / 21 / 22 / 23

40°C	20 / 19 / 15 / 18
45°C	15 / 10 / 14 / 13

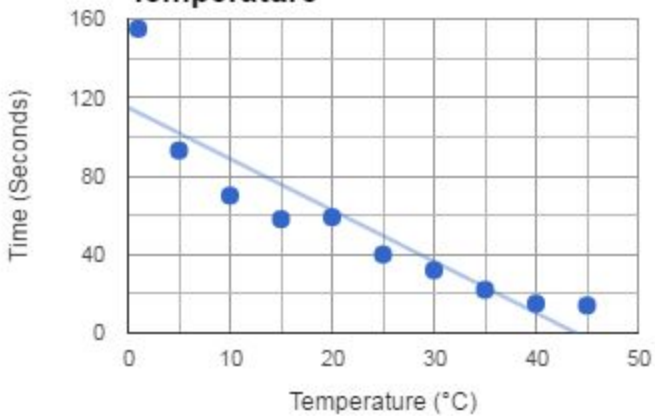
Results 1 of Time vs. Temperature



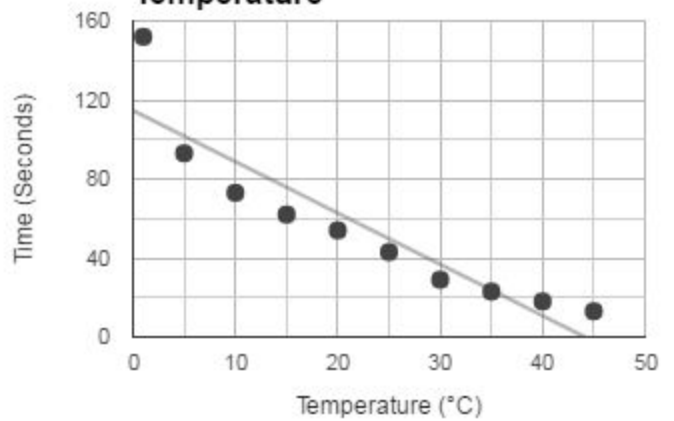
Results 2 of Time vs. Temperature



Results 3 of Time vs. Temperature



Average Results of Time vs. Temperature



Conclusion

If the temperature of the water is decreased, then the UV beads will keep their color longer. This hypothesis is stating that the relationship between temperature and time in this experiment is inversely proportional, and since this hypothesis turned out to be true, then this proportion is also true. Two examples that prove that this hypothesis is correct is at the points 1°C and 45°C. At 1°C, the average time for this temperature is 152 seconds, while at 45°C, it has an average of 13 seconds, which is a lot shorter than 1°C. These examples prove that this hypothesis is true. Extrapolating a temperature of -10°C, it should take 140 seconds for the beads to have no color in them. Even though there is a linear line, there are still some points that are not on the line, some of these include the 1°C, 15°C, and 45°C temperatures. Still, even with great results, there were still some errors in this experiment. One of these errors was that when the UV beads were outside absorbing ultraviolet, clouds would come over the sun, which can affect the absorption of the ultraviolet, if done again, this experiment would happen on a clearer day with no clouds. Another error was trying to get the timing to the exact moment the beads lost their color, to do this better, there would be a better timing system. Finally, another mistake was when the UV was wearing off the beads, they were slightly exposed to sunlight, if this experiment were to be done again, the UV would gone while the wearing off of the UV was happening.

Bibliography

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