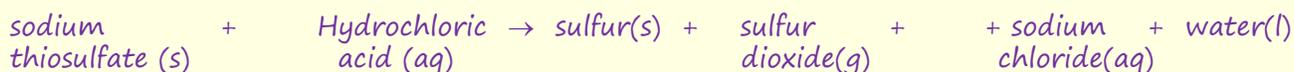


Rate of reaction and temperature

Answer all the questions below then check your answers.

1. Sodium thiosulfate reacts with hydrochloric acid according to the equation below.

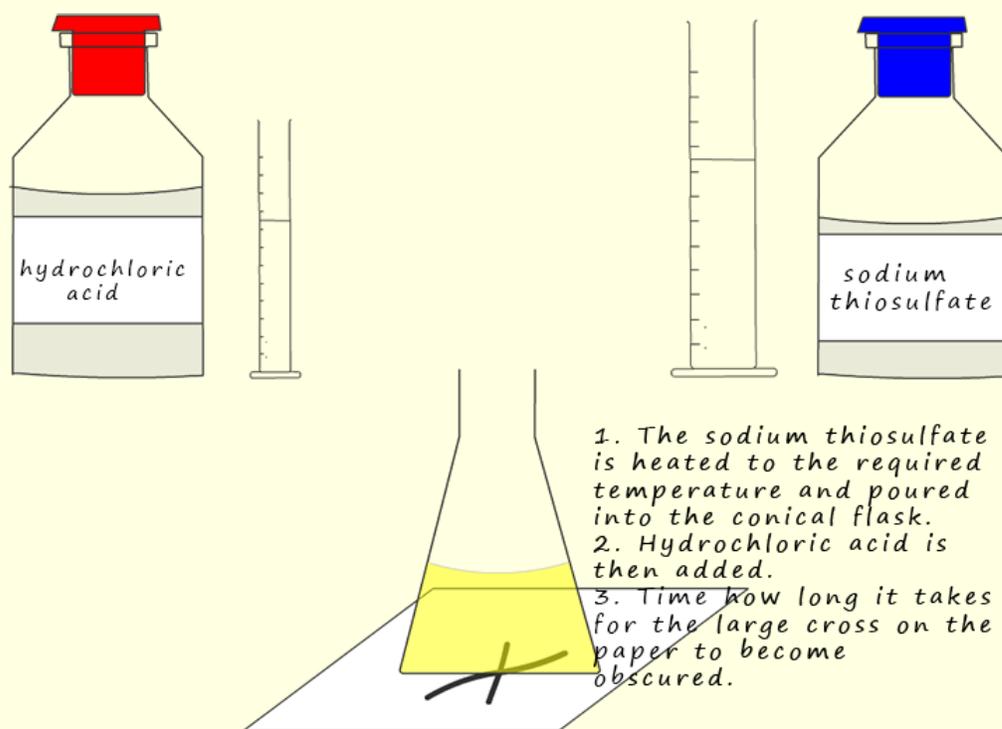


A student carried out an investigation to find out how temperature affects the rate of this reaction. Here is an outline of what she did:

- Measured out 50ml of sodium thiosulfate into a conical flask using a 100ml measuring cylinder.
- Measured out 30ml of water using a 50ml measuring cylinder and placed it into the conical flask containing the sodium thiosulfate .
- The conical flask was then heated to the required temperature in a water bath.
- Measured out 5ml of hydrochloric acid using a 10ml measuring cylinder.
- The heated conical flask with the sodium thiosulfate and water was placed on a square of paper with a large X marked on it. The 5ml of acid was then tipped into it and the stop clock started..
- The student timed how long it took for the X to disappear or become obscured. Her results are shown below:

Temperature/ $^{\circ}\text{C}$	22	25	30	35	40	45	50	55
Time for solution to turn yellow/s	175	150	110	87	55	25	15	9

- What was the independent variable in this experiment and what type of variable is it?
- What was the dependent variable in this experiment?
- To make this experiment a fair test what variables would have to be controlled?
- What type of variable was the independent variable? Categorical or continuous?
- Write a hypothesis that predicts a link between the temperature and the time it takes for the X to become obscured.



- g. Draw a sketch graph of the results obtained.*
- h. How is the rate of reaction affected by temperature? Were there any patterns in the results?*
- i. What is an anomalous result? Did the student get any anomalous results?*
- j. What was the range for the independent variable in this experiment?*
- k. How could the student make her results more accurate and reliable.*

Temperature and rate of reaction

Answers

Temperature/°C	22	25	30	35	40	45	50	55
Time for solution to turn yellow./s	175	150	110	87	55	25	15	9

a. What was the independent variable in this experiment? *Temperature*

b. What was the dependent variable in this experiment?

Time for the X to become obscured. The dependent variable is the results! What you measure!

c. To make this experiment a fair test what variables would have to be controlled?

The acid concentration for each experiment would have to be the same.

The volume of water added would also have to be the same for each experiment.

The same person should observe when the X has disappeared.

d. What type of variable was the independent variable? *Categoric or continuous?*

Continuous - it's a number variable, that is one where any value is allowed.

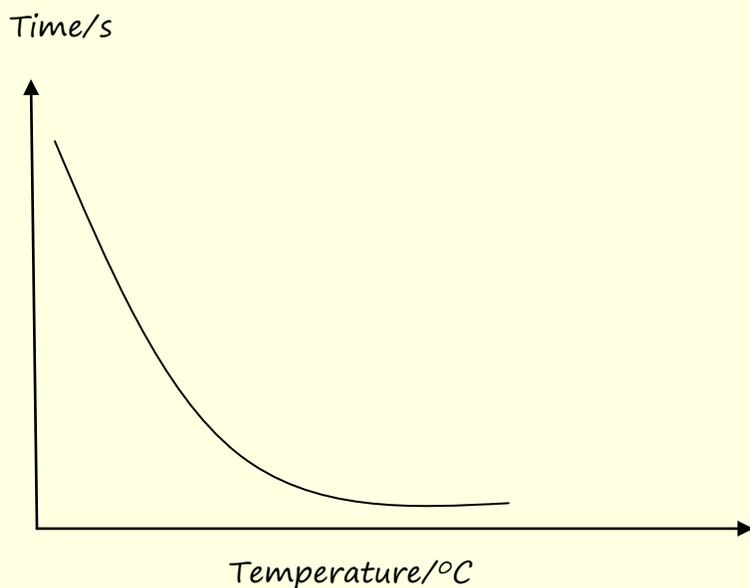
f. Write a hypothesis that predicts a link between the temperature and the time it takes for the X to become obscured. *The hypothesis must include references to the independent and dependent variable and an explanation as to why you think this will happen e.g.*

As the temperature is increased the time it takes for the X to become obscured will decrease. I think this because as the temperature increases the particles have more kinetic energy, this will lead to more successful collisions and the rate of the reaction will increase, that is the time will decrease.

g. Draw a sketch graph of the results obtained.

When drawing graphs- in general :

- The independent variable - goes across the x-axis
- The dependent variable (the results) go on the y-axis



h. How is the rate of reaction affected by temperature? Were there any patterns in the results?

As the temperatures increases the rate of reaction increases. At 25°C the reaction took 150s, doubling the temperature to 50°C caused a the time to decrease to 15s, a tenfold decrease. The rate of decrease in time with temperature is not linear, the graph is a curve, so the rate of decrease in time decreases with a rise in temperature.

i. What is an anomalous result? Did the student get any anomalous results?

A result which did not fit the expected pattern. The student should repeat the experiment to identify an anomalies.

j. What was the range for the independent variable in this experiment?

$22-55^{\circ}\text{C}$ or 33°C .

k. How could the student make her results more accurate and reliable.

Repeat the experiment and calculate a mean value from her repeated results. Any anomalous results should be ignored when calculating a mean.