

The effect of concentration and temperature on reaction rate – teacher notes

Introduction

Students react potassium iodate and a starch solution. They vary the concentration and temperature to affect the reaction time.

Equipment

Apparatus

- Eye protection
- Beakers, 250 cm³, x2
- Water bath (or some means of warming solution A)

Chemicals

- Solution A – 4.3 g of KIO₃ per dm³
- Solution B – starch solution

Health, safety and technical notes

- Read our standard health and safety guidance here <https://rsc.li/3HwQTTK>
- Always wear eye protection.
- Both solutions are of low hazard.

Notes

The colour change takes about 5–6 minutes.

A colorimeter sensor or a light sensor set up as a colorimeter can be used to monitor colour change on the computer.

The result, in the form of graphs on the computer, provides very useful material for analysis using data logging software.

While a colorimeter sensor is ideal, it is easy to substitute a light sensor clamped against a plastic cuvette filled with the reactants.

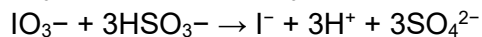
The data logging software should clearly show the change occurring on a graph.

Measure the rate of change by using its slope or the time taken for a change to occur.

Background theory

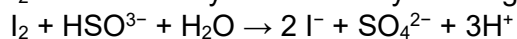
The mechanism is not clearly understood, but the following simplified sequence has been proposed.

IO₃⁻ reacts with HSO₃⁻ to form I⁻:



I⁻ reacts with IO₃⁻ to form I₂.

I₂ is immediately consumed by reacting with HSO₃⁻:



When all of the HSO₃⁻ has been used up, I₂ accumulates.

Iodine reacts with starch to form a coloured complex.

Answers

1. There are more molecules of reactant in the solution, therefore more chance of reacting.
2. Increasing the temperature has two effects. Since the particles are moving faster, they will travel a greater distance in a given time and so will be involved in more collisions. In addition, because the particles are moving faster, a larger proportion of

the collisions will exceed the activation energy, the energy needed to react. The rate of the reaction therefore increases.

3. Depending on the results of the experiment, increase/decrease concentration to a specific amount AND/OR increase/decrease the temperature by a specific amount.