

A chemical stop-clock: iodine clock reaction

Time

1 h.

Curriculum links

Rates of reaction.

Group size

1–2.

Materials and equipment

Materials per group

These solutions are better made up fresh, not more than 24 h before they are required.

- Solution A: 2.1 g potassium iodate(V) is dissolved in 1 dm³ deionised water followed by the addition of 10 cm³ of 1 mol dm⁻³ sulphuric acid.
- Solution B: 4 g of soluble starch is made up into a paste with a little cold water and this is added to 1 dm³ boiling deionised water. 0.9 g of sodium hydrogensulphite and 10 cm³ of 1 mol dm⁻³ sulphuric acid are added to the cooled solution. (Sodium hydrogensulphate is available as a solution from some suppliers.)

Equipment per group

- two 100 cm³ beakers
- two 250 cm³ beakers
- 25 cm³ measuring cylinder
- two 100 cm³ measuring cylinders
- two 250 cm³ measuring cylinders
- white tile
- stirring rod
- stop-watch
- the use of burettes allows more accurate measurements to be made
- safety glasses
- graph paper.

If this problem is used in a competition then a large display digital clock can heighten the excitement at the final stage.

Safety

Eye protection must be worn.

Potassium iodate(V) is harmful if swallowed and a skin/eye/respiratory irritant. The solution is of low hazard.

1 mol dm⁻³ sulphuric acid is a skin/eye irritant

Sodium hydrogensulphate causes serious eye damage. (Wear goggles to BS EN 166 3) The solution is of low hazard.

Disposal: Collect up the blue solutions. Add some thiosulphate (solid or solution) with stirring, until the solution is no longer blue. Then wash to waste.

Risk assessment

A risk assessment must be carried out for this activity.

This is an open-ended problem solving activity, so the guidance given here is necessarily incomplete. Teachers need to be particularly vigilant, and a higher degree of supervision is needed than in activities which have more closed outcomes. Students must be encouraged to take a responsible attitude towards safety, both their own and that of others. In planning an activity students should always include safety as a factor to be considered. Plans should be checked by the teacher before implementing them.

You must always comply with your employer's procedures and in some cases may decide that a particular activity is inappropriate in your situation. Further information on Health and Safety should be obtained from reputable sources such as CLEAPSS [<http://science.cleapss.org.uk/>] in England, Wales and Northern Ireland and, in Scotland, SSERC [<https://www.sserc.org.uk/>].

Commentary

This problem can be approached as a competition, in which case the time available for experimenting should be limited. Sufficient time must be left at the end for judging.

Extension

The competition may be made more difficult by limiting the volume of stock solutions available to each competitor.

Acknowledgement

This activity is based on a problem used at Norwich Chemical Olympiad in 1984.

Credits

© Royal Society of Chemistry

Health & safety checked May 2018

Page last updated October 2018