

OCR (B) Chemistry A-Level

PAG 10: Rates of reaction - initial rates
method



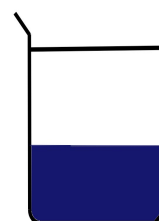
10.1 Rates - Iodine clock

Equipment list

- 1.00 mol dm⁻³ KI_(aq)
- 0.0400 mol dm⁻³ K₂S₂O_{8(aq)}
- 0.0100 mol dm⁻³ Na₂S₂O_{3(aq)}
- Starch
- Distilled water
- Syringes of different volumes
- Stopwatch
- Measuring cylinders
- Beakers

Method

1. Add 5 cm³ potassium iodide, 2 cm³ sodium thiosulfate and 1 cm³ starch solution into a conical flask and mix well.
2. Add 2 cm³ of potassium peroxodisulfate and start the stopwatch.
3. Stop the stopwatch when the mixture turns blue-black.
4. Repeat the experiment with varying concentrations of potassium iodide.



For this experiment you need to identify what the different variables are:

- The volumes of potassium peroxodisulfate, sodium thiosulfate and starch need to be kept constant as they are **control** variables.
- The concentration of KI is the **independent** variable.
- The time taken for the solution to go blue-black is the **dependent** variable.

Processing data

1. Set up a spreadsheet with a table with these headings:

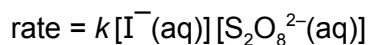
Vol. KI _(aq) / cm ³	Vol. H ₂ O / cm ³	Vol. S ₂ O ₃ ²⁻ _(aq) / cm ³	Vol. S ₂ O ₈ ²⁻ _(aq) / cm ³	Vol. Starch / cm ³	Total vol. / cm ³	[I _(aq) ⁻] / cm ³	Time / s	Initial rate / mol dm ⁻³ s ⁻¹

Add your data to the spreadsheet

- ❖ Calculate [I_(aq)⁻] using the formula, $[I_{(aq)}^-] = \frac{\text{Volume of KI (in cm}^3\text{)}}{10}$
- ❖ Calculate initial rate, using the formula, $\text{initial rate} = \frac{2 \times 10^{-3}}{t}$



2. Use the spreadsheet program to plot your data points of initial rate against iodine concentration.
3. Use the graph to find the **order** of reaction with respect to $[I^-]_{(aq)}$.
4. Determine the gradient of the line of best fit.
5. The rate equation for this reaction:



Work out the concentration of $S_2O_8^{2-}(aq)$ that you used in each experiment.

Find the **rate constant** for the reaction using the equation above.

Errors

- ❑ Inaccurate timing of the appearance of blue colour:
Could use two students to time simultaneously and use an average value.
- ❑ Adding starch slightly increases the volume which affects the concentrations of the reactants and thus the amount they change over time.
Take into account starch volume

Safety

➤ Potassium peroxodisulfate - may cause respiratory irritation and asthma symptoms. Also a strong oxidiser so keep away from flammable materials.

