

OCR (A) Chemistry A-Level

PAG 10: Rates of reaction - initial rates method



10.1 Rates - Iodine clock

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 stop clock.
3. When the mixture turns to blue black, stop the stop watch and record the time.
4. Repeat the experiment with varying concentration of potassium iodide.

Calculations

- ❖ Set up a table as shown below:

K ₂ S ₂ O ₈ / cm ³	Na ₂ S ₂ O ₃ / cm ³	H ₂ O / cm ³	KI / cm ³	Total volume / cm ³	Time / s	[I ⁻] / mol dm ⁻³	Initial rate / mol dm ⁻³
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- ❖ Calculate [I⁻] using the formula, $[I^-] = \frac{\text{volume of KI (in cm}^3\text{)}}{10}$
- ❖ Calculate initial rate, using the formula, $\text{initial rate} = \frac{2 \times 10^{-3}}{t}$
- ❖ Use the calculated values to plot initial rate against the iodine concentration
- ❖ Using the graph calculate the gradient and deduce the order of reaction with respect to I⁻ ions.
- ❖ Rate equation of the reaction is:

$$\text{Rate} = k [I^-] [S_2O_8^{2-}]$$
- ❖ Calculate the rate constant and units, 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.

Safety

- Potassium peroxodisulfate - may cause respiratory irritation and asthma symptoms.

