OCR (A) Chemistry A-level

PAG 10: Rates of Reaction - Initial Rates Method

10.1 Rates - Iodine Clock

Method

1. Add 5 cm^3 potassium iodide, 2 cm^3 sodium thiosulfate, and 1 cm^3 starch solution to a conical flask and mix well.
2. Add 2 cm^3 of potassium peroxodisulfate to the conical flask and start the stopwatch.
3. As soon as the mixture turns blue-black, stop the stopwatch and record the time.
4. Repeat the experiment with different concentrations of potassium iodide.

Calculations

- Set up a table as shown below:

$K_2S_2O_8$ / cm^3	$Na_2S_2O_3$ / cm^3	H_2O / cm^3	KI / cm^3	Total volume / cm^3	Time / s	$[I^-]$ / mol dm^{-3}	Initial rate / mol dm^{-3} s^{-1}

- $[I^-] = \frac{volume\ of\ KI\ (cm^3)}{total\ volume\ (cm^3)} \times conc.\ of\ original\ potassium\ iodide\ solution$
- Plot a graph of initial rate against iodide concentration $[I^-]$

$$initial\ rate = \frac{2\times10^{-3}}{t}$$

- Calculate the gradient of the graph and deduce the order of reaction with respect to the iodide ions.
- Use this to write down the rate equation, then calculate the rate constant and its units.
- The rate equation for this reaction is:

$$rate = k[I^-][S_2O_8{}^{2-}]$$

Errors

- Inaccurate timing of the appearance of blue colour:
  - An average value of the time recorded by 2 students could be used.
- Adding starch slightly increases the volume which affects the concentrations of the reactants and thus the amount they change over time.

Safety

- Potassium iodide - harmful if swallowed; causes skin irritation and serious eye irritation; may cause respiratory irritation.
- Sodium thiosulfate - causes skin irritation and serious eye irritation; may cause respiratory irritation.
- Potassium peroxodisulfate - harmful if swallowed; causes skin irritation and serious eye irritation; may cause respiratory irritation.