

# OCR (A) Chemistry A-level

## PAG 10: Rates of Reaction - Initial Rates Method

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## 10.1 Rates - Iodine Clock

### Method

1. Add 5 cm<sup>3</sup> potassium iodide, 2 cm<sup>3</sup> sodium thiosulfate, and 1 cm<sup>3</sup> starch solution to a conical flask and mix well.
2. Add 2 cm<sup>3</sup> 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:

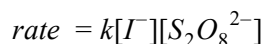
K <sub>2</sub> S <sub>2</sub> O <sub>8</sub> / cm <sup>3</sup>	Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> / cm <sup>3</sup>	H <sub>2</sub> O / cm <sup>3</sup>	KI / cm <sup>3</sup>	Total volume / cm <sup>3</sup>	Time / s	[I <sup>-</sup> ] / mol dm <sup>-3</sup>	Initial rate / mol dm <sup>-3</sup> s <sup>-1</sup>
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- ❖  $[I^-] = \frac{\text{volume of KI (cm}^3\text{)}}{\text{total volume (cm}^3\text{)}} \times \text{conc. of original potassium iodide solution}$

- ❖ Plot a graph of initial rate against iodide concentration [I<sup>-</sup>]

$$\text{initial rate} = \frac{2 \times 10^{-3}}{t}$$

- ❖ 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:



### 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.

