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Chemistry

Standard level

Paper 1B

16 May 2025

Zone A afternoon | Zone B afternoon | Zone C afternoon

Candidate session number

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1 hour 30 minutes [Paper 1A and Paper 1B]

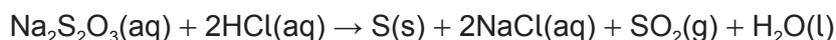
Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- A clean copy of the **chemistry data booklet** is required for this paper.
- The maximum mark for paper 1B is **[25 marks]**.
- The maximum mark for paper 1A and paper 1B is **[55 marks]**.

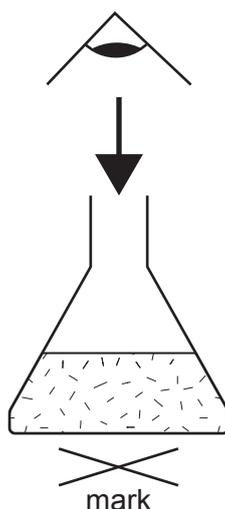


Answer **all** questions. Answers must be written within the answer boxes provided.

1. A student investigated the effect of concentration on the rate of reaction between sodium thiosulfate, $\text{Na}_2\text{S}_2\text{O}_3$, and hydrochloric acid, HCl .



Since the solid sulfur product is insoluble, the rate can be determined by measuring the time it takes for the clear solution to turn off-white or pale yellow until the X mark on a white tile below the flask can no longer be seen.



- (a) Determine the mass of sodium thiosulfate needed to make 500.0 cm^3 of a $0.1500\text{ mol dm}^{-3}$ solution. [2]

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- (b) Explain how to make the $0.1500\text{ mol dm}^{-3}$ solution in a volumetric flask. [3]

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(This question continues on the following page)



(Question 1 continued)

(c) Suggest how to make a 100.0 cm³ solution of 0.03000 mol dm⁻³ sodium thiosulfate from the original 0.1500 mol dm⁻³ solution.

[3]

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(d) The student recorded the following data.

Na ₂ S ₂ O ₃ concentration (mol dm ⁻³)	Reaction Time s ± 0.1 s					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average
0.1500 ± 0.08 %	21.1	19.7	18.1	17.3	19.4	19.1 ± 1.5
0.120 ± 0.1 %	26.4	24.8	26.9	26.2	25.1	25.9 ± 0.9
0.0900 ± 0.1 %	33.8	32.4	31.5	30.8	32.6	32.2 ± 1.2
0.0600 ± 0.2 %	48.3	49.3	45.9	46.4	44.6	46.9 ± 1.9
0.0300 ± 0.4 %	96.2	95.8	97.9	95.9	93.7	95.9 ± 1.0

The solutions of sodium thiosulfate were made as accurately as possible from solid sodium thiosulfate by weighing the appropriate mass with a balance that can measure to one hundredth of a gram (±0.01 g), rather than by dilution of a stock solution.

Explain why the percentage uncertainties of concentrations increase as the concentrations decrease.

[1]

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(This question continues on page 5)



Please **do not** write on this page.

Answers written on this page
will not be marked.



(Question 1 continued)

- (e) State **one** safety concern for a product of this experiment and **one** precaution that should be taken.

[2]

<p>Safety Concern:</p> <p>.....</p> <p>Precaution:</p> <p>.....</p>



08EP05

Turn over

2. A student was given a mixture to separate and collect the individual components. The mixture contained sand, $\text{SiO}_2(\text{s})$, sodium chloride, $\text{NaCl}(\text{s})$, and iron filings, $\text{Fe}(\text{s})$. The student observed the original mixture and made the following hypothesis.

“The iron would have the lowest percent by mass because it appeared to be present in the smallest quantity.”

- (a) Suggest a set of experimental steps required to obtain pure samples of each component of the mixture.

[4]

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- (b) The following data were collected.

Substance	Mass in g \pm 0.01 g	Percentage composition %
Mixture before separation	5.62	N/A
Iron after separation	2.17	
Sand after separation	1.98	
Salt after separation	1.80	32.0%

Calculate the percent composition of the iron and sand in the mixture

[1]

(This question continues on the following page)



(Question 2 continued)

- (c) The percentages in (b) add up to more than 100. Suggest a reason that would explain these results and how to reduce or eliminate this issue. [2]

Reason:

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Reduce or Eliminate:

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- (d) The results did not support the original hypothesis. Suggest why the hypothesis was incorrect. [1]

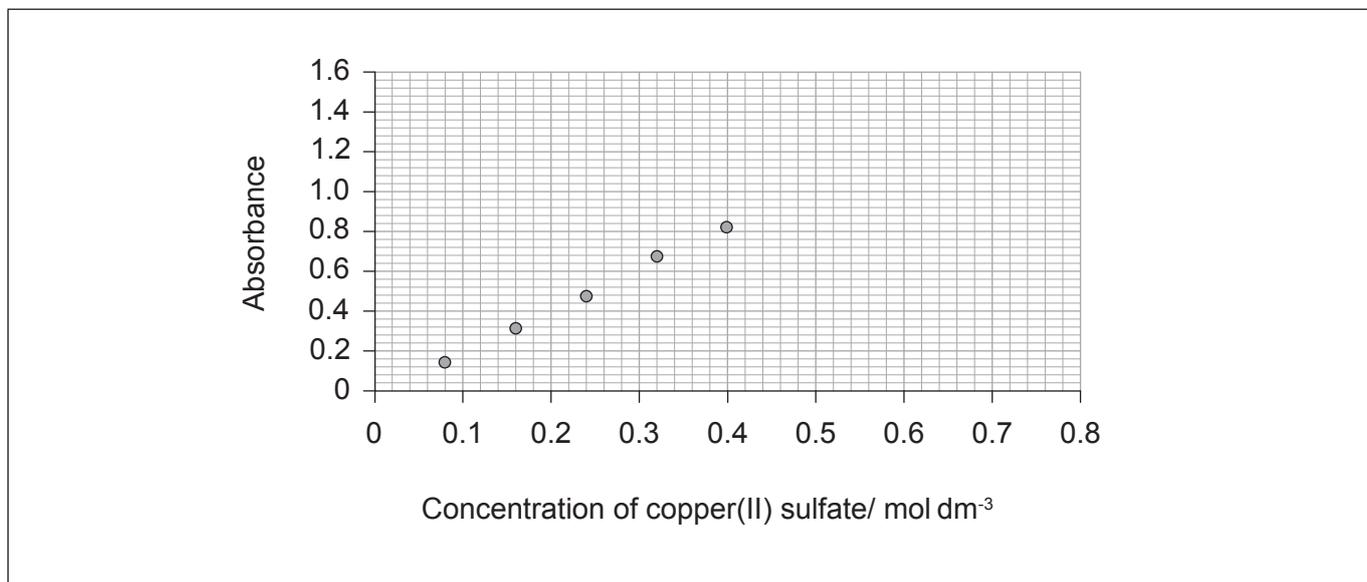
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3. A colorimetry experiment was conducted on a series of solutions of copper(II) sulfate, CuSO_4 . The absorbance versus concentration data were graphed.

(a) Draw a line of best fit in the graph, extrapolating beyond the data given. [2]



(b) State the mathematical relationship between absorbance and concentration. [1]

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(c) Deduce the equation that relates the absorbance to concentration, including the value of the constant. [2]

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(d) Estimate the absorbance value of a $0.600 \text{ mol dm}^{-3}$ CuSO_4 solution. [1]

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