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Chemistry Higher level Paper 1B

31 October 2025

Zone A afternoon | Zone B afternoon | Zone C afternoon

Candidate session number

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2 hours [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 **[35 marks]**.
- The maximum mark for paper 1A and paper 1B is **[75 marks]**.



Section B

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

1. A student needed to make 500.0 cm^3 of a $0.2500\text{ mol dm}^{-3}$ solution of sodium hydroxide, NaOH, from the solid for a titration.

(a) Calculate the mass of sodium hydroxide needed.

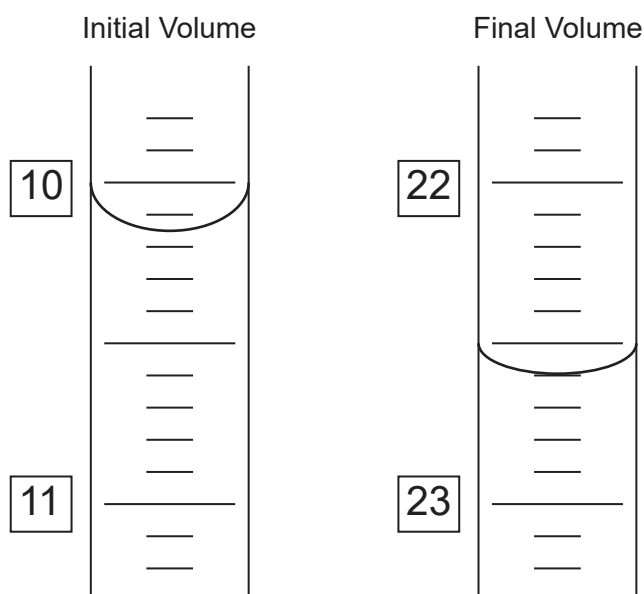
[1]

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(b) Describe the process of preparing a standard solution from a solid using a volumetric flask. [3]

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(c) A 10.00 cm^3 sample of the sodium hydroxide solution was titrated with $0.2000\text{ mol dm}^{-3}$ solution of hydrochloric acid, HCl (aq).



(This question continues on the following page)



(Question 1 continued)

Determine the actual concentration of the sodium hydroxide solution for this titration trial. Record the initial and final volume in the data table to the correct number of significant figures. [2]

	NaOH trial
Initial volume / cm ³	
Final volume / cm ³	
Volume used / cm ³	

Concentration:
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(d) Calculate the percentage error for the concentration of the sodium hydroxide based on the calculation from (c) and the intended value of 0.2500 mol dm⁻³.

If you did not determine a concentration value for (c) use 0.2155 mol dm⁻³ although this is not the correct answer. [1]

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(e) Explain why the sodium hydroxide solution must be standardized. Assume there are no systematic errors. [2]

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(This question continues on the following page)



(Question 1 continued)

(f) The standardized sodium hydroxide solution from (c) was used to titrate a propanoic acid solution of unknown concentration.

(i) Calculate the concentration of the propanoic acid if 15.00 cm³ of its solution was neutralized with 20.00 cm³ of standardized sodium hydroxide.

If you did not determine the concentration of sodium hydroxide in part (c), use 0.2155 mol dm⁻³ although this is not the correct answer.

[1]

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(ii) Determine the pH of the propanoic acid from (f)(i). Propanoic acid has a pK_a of 4.87.

If you did not determine a concentration for the propanoic acid in (f)(i) use 0.2755 mol dm⁻³ although this is not the correct answer.

[2]

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(iii) Evaluate the use of an indicator versus a pH probe to determine the end point of the titration of propanoic acid with sodium hydroxide.

[3]

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(iv) State the name of an indicator which could be used for the titration of propanoic acid with sodium hydroxide using section 18 of the data booklet.

[1]

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2. A student was asked to identify an unknown metal with a mass of 1.28 g using calorimetry. The metal was placed in beaker **A** with boiling water at 100.00 °C until the metal reached the same temperature as the water. The metal was then quickly transferred to beaker **B** with 5.65 g of water which had an initial temperature of 25.00 °C. The final temperature of the water in beaker **B** and the metal was 26.77 °C.

Data for unknown metal sample	
Mass of unknown metal/g	1.28
Initial temperature of metal/°C	100.00
Mass of cool water in beaker B /g	5.65
Initial temperature of water in beaker B /°C	25.00
Final temperature of water in beaker B and metal/°C	26.77

- (a) Determine the amount of energy transferred from the metal to the water in beaker **B** using sections 1 and 2 of the data booklet. [2]

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- (b) Determine the specific heat capacity of the metal assuming the heat absorbed by the water in beaker **B** in (a) is equal to the heat released by the metal.

Use section 1 of the data booklet.

If you did not get an answer to (a) use 40.5J although this is not the correct answer. [2]

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(This question continues on the following page)



(Question 2 continued)

- (c) State the name of the unknown metal using the table. [1]

Metal	Specific heat capacity (Jg ⁻¹ K ⁻¹)
Lead	0.129
Silver	0.235
Iron	0.449
Aluminium	0.897

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- (d) Deduce **two** sources of systematic error for this experiment based on the results. [2]

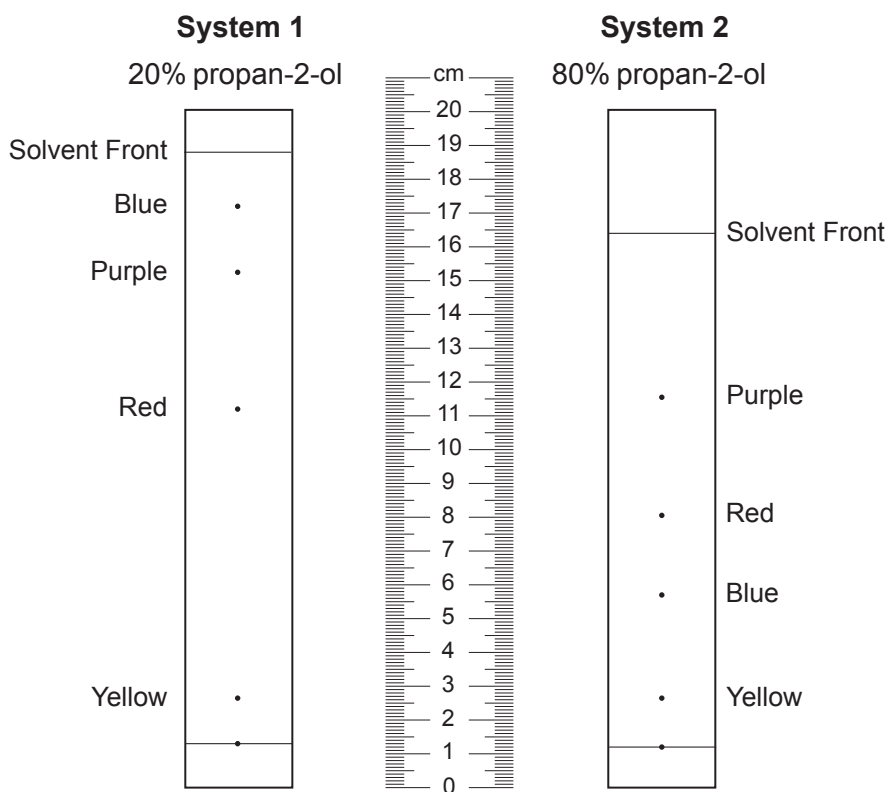
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- (e) State another physical property that could be used to identify the metal without damaging the sample. [1]

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3. A student wanted to determine what colour inks were mixed to produce black ink and their relative polarities using paper chromatography. The student decided to use two different solvent systems for the separation, both a mixture of propan-2-ol and water. System 1 was 20% propan-2-ol and system 2 was 80% propan-2-ol.



- (a) Chromatography chambers are sealed while the solvent is moving up the paper.

Explain why it is important to seal the chamber for proper experimental design.

[2]

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- (b) Explain why it is important to keep the start line horizontal and above the solvent level when running the chromatograph

[2]

Horizontal start line:

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Above the solvent level:

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(This question continues on the following page)



08EP07

Turn over

(Question 3 continued)

(c) Calculate the retardation factor, R_F , of the red ink in both chromatograms. [2]

Substances	R_F values
Red ink separated with 20% propan-2-ol	
Red ink separated with 80% propan-2-ol	

(d) Deduce, with a reason, which coloured ink is more polar, red or blue. [2]

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(e) The student hypothesized there were more than four coloured inks in the mixture.

Suggest how the student could modify this chromatography experiment to evaluate the hypothesis. [1]

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(f) Explain how the separation of inks is achieved using paper chromatography. [2]

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