



Chemistry
Standard level
Paper 1B

31 October 2025

Zone A afternoon | Zone B afternoon | Zone C afternoon

Candidate session number

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

A	N	S	W	E	R	S	(?)		
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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]**.

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Section B

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

1. A student needed to make 500.0 cm³ of a 0.2500 mol dm⁻³ solution of sodium hydroxide, NaOH, from the solid for a titration.

(a) Calculate the mass of sodium hydroxide needed.

[1]

$$n = cV = 0.2500 \text{ mol dm}^{-3} \times \frac{500.0 \text{ cm}^3}{1000} = 0.1250 \text{ mol}$$

$$m = n \times M_r = 0.1250 \text{ mol} \times (22.99 + 16.00 + 1.01 \text{ g mol}^{-1})$$

$$= 5.00 \text{ g}$$

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

- 1) Take beaker and add 5.00g of NaOH(s) on a scale
- 2) Dissolve NaOH(s) in small amount of water (less than 150.00 cm³)
- 3) Transfer contents of beaker to a 250.00 cm³ vol. flk.
- 4) Add distilled water up to 250.00 cm³ mark. Bottom of meniscus on the line.

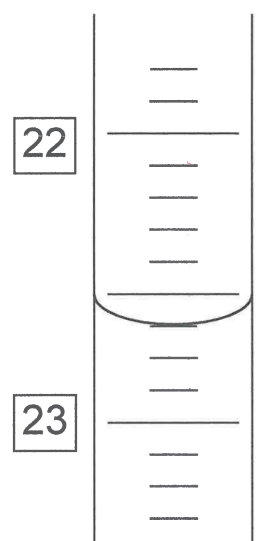
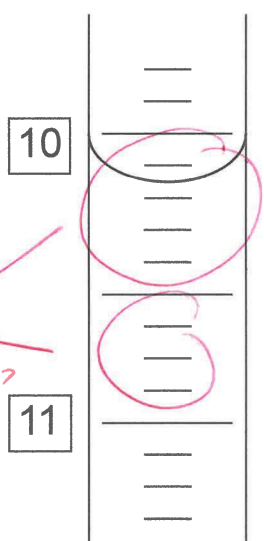
(c) A 10.00 cm³ sample of the sodium hydroxide solution was titrated with 0.2000 mol dm⁻³ solution of hydrochloric acid, HCl(aq).

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Initial Volume

Final Volume



Will assess increments of '4' which made sense

BIG ERROR !! INCREMENTS OF 4 or 3??

(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	10.15
Final volume/cm ³	22.60
Volume used/cm ³	12.45

Concentration: $n_{NaOH} = 0.2000 \times 12.45 / 1000 = 2.490 \times 10^{-3} \text{ mol}$
 $n_{NaOH} = n_{HCl} \therefore n_{HCl} = 2.490 \times 10^{-3} \text{ mol}$
 $\therefore c_{NaOH} = \frac{n}{V} = \frac{2.490 \times 10^{-3} \text{ mol}}{10 / 1000} = 2.490 \times 10^{-1} \text{ mol dm}^{-3}$

- (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]

$\frac{0.2500 - 0.2490}{0.2500} \times 100\% = 0.4\%$

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

NaOH is reactive with atmospheric H₂O / CO₂
 \therefore impure.
 Mass will not be of all NaOH \therefore concentration is less than intended.

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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$$q = mc\Delta T = 5.65 \text{ g} \times 4.18 \text{ J K}^{-1} \text{ g}^{-1} \times (26.77 - 25.00) \text{ (1)}$$

$$= 41.8 \text{ J. (1)}$$

- (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 40.5 J although this is not the correct answer. [2]

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$$q = mc\Delta T, \quad 41.8 \text{ J} = 1.28 \text{ g} \times c \times (100 - 26.77) \text{ (1)}$$

$$c = \frac{41.8 \text{ J}}{93.73 \text{ gK}} = 0.446 \text{ J K}^{-1} \text{ g}^{-1} \text{ (1)}$$

(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

IRON (1)

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

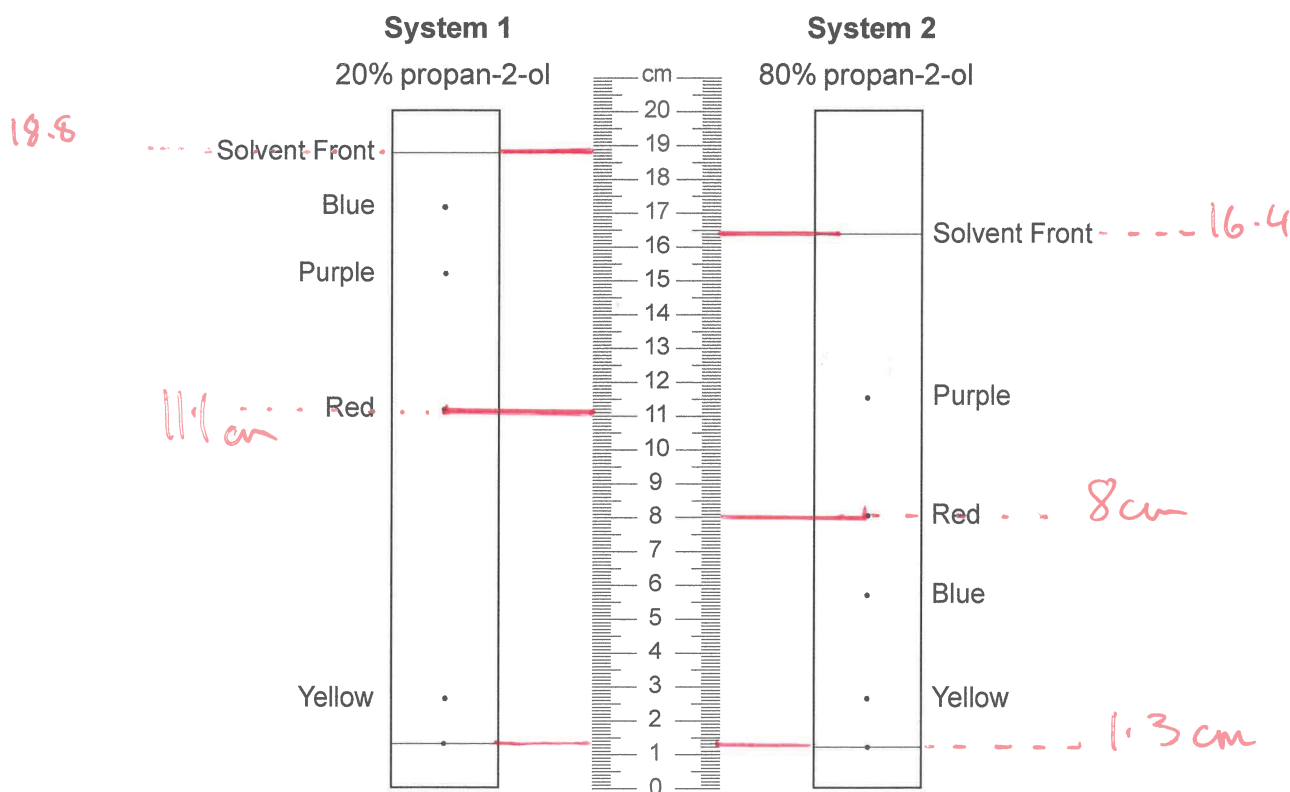
[2]

+ Heat capacity of the beaker/thermometer (1)
+ Heat loss to the surroundings during transfer from Beaker A to Beaker B (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]

Propan-2-ol is a volatile compound and will evaporate. Evaporation changes the solvent concentration/composition. After this, how far the solvent/pigment can travel.

- (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: So all 'spots' begin at the same location, giving equal path lengths for comparable R_F values.
 Above the solvent level: Prevents sample from dissolving directly into solvent, and so sample travel only with rising solvent.

(This question continues on the following page)

$$20\% : R_F = \frac{11.1 - 1.3}{18.8 - 1.3} = 0.56$$

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(Question 3 continued)

$$80\% : R_F = \frac{8 - 1.3}{16.4 - 1.3} = 0.44$$

(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	0.56
Red ink separated with 80% propan-2-ol	0.44

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

[2]

Blue. In the less polar solvent (80% propan-2-ol) the polar dye interacts more with the polar paper (stationary phase) and travels less with the solvent.

(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]

Use a different solvent by further varying the ratio of propan-2-ol, or //
Change stationary phase e.g. TLC paper