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Cambridge Assessment International Education

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CANDIDATE NAME				
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COMBINED SCIENCE **0653/52**

Paper 5 Practical Test **May/June 2025**

1 hour 15 minutes

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].
- Notes for use in qualitative analysis are provided in the question paper.

For Examiner's Use	
1	
2	
3	
4	
Total	

This document has **16** pages. Any blank pages are indicated.

1 You are going to investigate a root vegetable.

You are provided with a section of carrot root on a white tile.

(a) In the box, make a large pencil drawing of the cut surface of the carrot root.

[3]

(b) Fig. 1.1 shows a magnified photograph of a section of a lotus root.

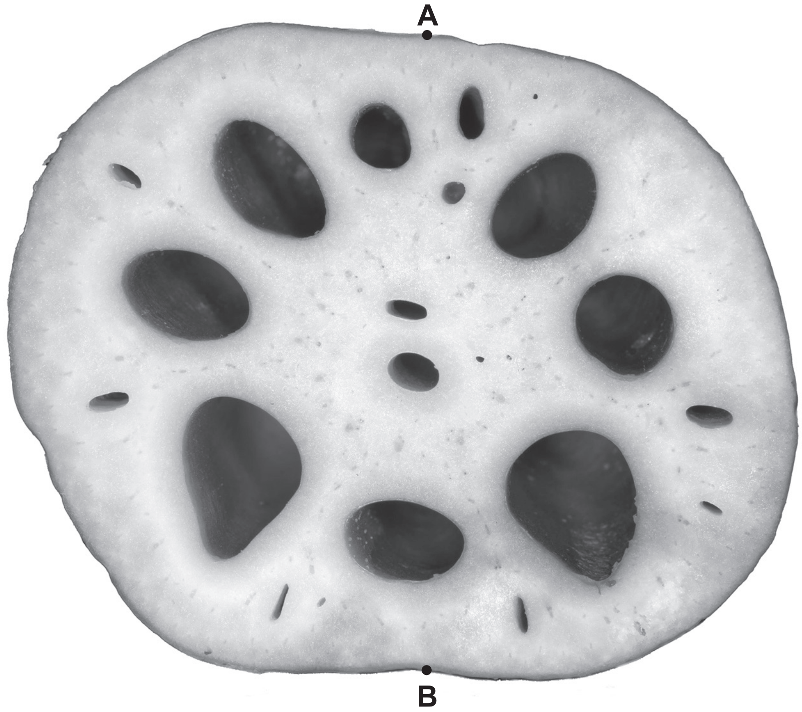


Fig. 1.1

(i) The distance **AB** represents the diameter of the lotus root section.

Measure the distance **AB** on Fig. 1.1.

Record your answer to the nearest mm.

distance **AB** = ... mm [1]

(ii) The actual diameter of the lotus root section is 75 mm.

Calculate the magnification of the photograph in Fig. 1.1.

Use the equation shown.

$$\text{magnification} = \frac{\text{length of line } \mathbf{AB}}{\text{actual diameter of lotus root section}}$$

Give your answer to **two** significant figures.

magnification = ... [2]

(iii) Distance **AB** shows the smallest diameter of the lotus root section.

Describe how to determine the **average** diameter of the lotus root section.

....

.... [1]

(c) You are going to compare the carrot root with the lotus root.

(i) Describe **one** way that the section of carrot root on your white tile is **similar** to the section of lotus root in Fig. 1.1.

....

.... [1]

(ii) Describe **two** differences between the section of carrot root on your white tile and the section of lotus root in Fig. 1.1.

difference 1 ....

....

....

difference 2 ....

....

....

[2]

(d) You are going to test the carrot root and a piece of potato for the presence of starch.

Procedure

- Place the piece of carrot root and the piece of potato onto the white tile.
- Add a few drops of iodine solution to the surface of each piece.

(i) Complete Table 1.1.

Table 1.1

	colour with iodine solution	conclusion
carrot		
potato		

[2]

(ii) Suggest why it is difficult to determine the presence of reducing sugars in a sample of carrot root using Benedict's solution.

....

.... [1]

[Total: 13]

2 You are going to investigate the reaction between aluminium and aqueous copper(II) chloride.

Aqueous copper(II) chloride is a blue solution.

(a) (i) Procedure

- Assemble the apparatus shown in Fig. 2.1.

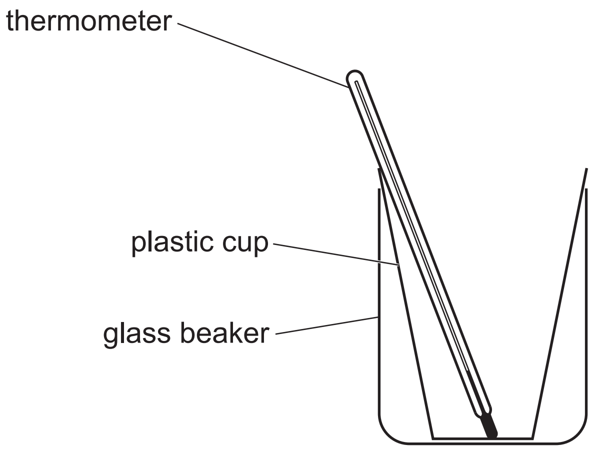


Fig. 2.1

- Measure 25 cm^3 of aqueous copper(II) chloride using a measuring cylinder.
- Pour the aqueous copper(II) chloride into the plastic cup.
- Record in Table 2.1 the initial temperature of the aqueous copper(II) chloride to the nearest 0.5 °C.
- Add all of the aluminium to the aqueous copper(II) chloride in the plastic cup.
- Stir the mixture with the thermometer.
- Record in Table 2.1 the highest temperature reached by the reaction mixture to the nearest 0.5 °C.
- Do **not** throw away the mixture in the plastic cup.

Table 2.1

initial temperature of aqueous copper(II) chloride / °C	
highest temperature reached by the reaction mixture / °C	
temperature change / °C	

[2]

(ii) Calculate the temperature change.

Record this value in Table 2.1. [1]

(b) **(i)** Describe the appearance of the mixture in the plastic cup at the end of the experiment.

....

.... [1]

(ii) The aluminium is in excess in this experiment.

Explain how your observations in **(b)(i)** show that aluminium is in excess.

....

.... [1]

(c) There is an error in the experiment that causes a smaller temperature change than expected.

Identify this error.

Suggest **one** improvement to the experiment to minimise this error.

error ....

improvement ....

....

[2]

(d) A student repeats the procedure using six different concentrations of aqueous copper(II) chloride.

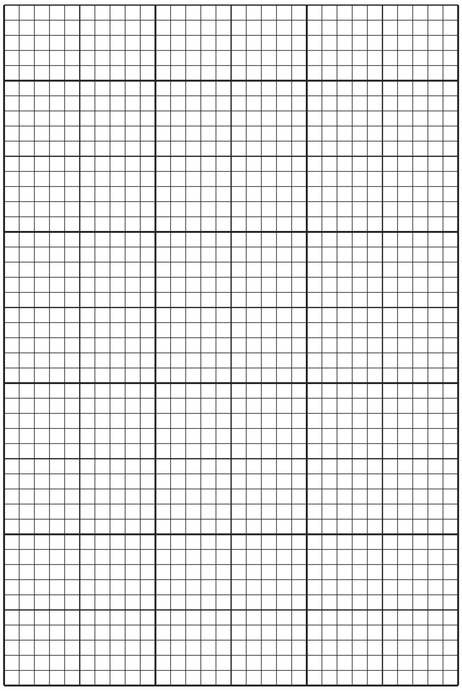
The unit of concentration is M.

Table 2.2 shows the results the student obtains.

Table 2.2

concentration of aqueous copper(II) chloride / M	temperature change / °C
0.00	0
0.10	7.5
0.20	16.0
0.30	23.5
0.40	32.5
0.50	39.5

(i) On the grid, plot temperature change (vertical axis) against the concentration of aqueous copper(II) chloride.



[3]

(ii) Draw the line of best fit. [1]

(e) Estimate using the graph, the concentration of the aqueous copper(II) chloride you used in the procedure in **(a)(i)**.

Use the temperature change you calculated in **(a)(ii)** to help you.

Show your working on the graph.

concentration = ... M [2]

[Total: 13]

3 You are going to investigate the behaviour of resistors in a series circuit.

(a) The circuit shown in Fig. 3.1 has been set up for you.

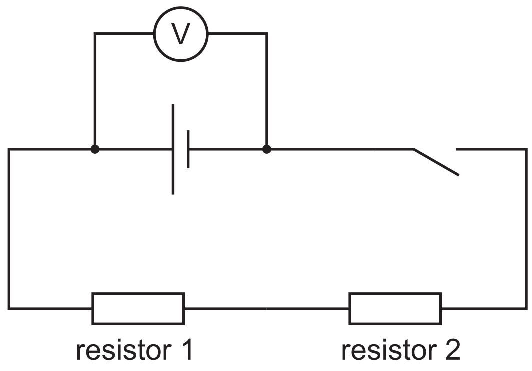


Fig. 3.1

Procedure

- Close the switch.
- Measure and record the reading on the voltmeter V_0 across the power supply.
- Open the switch.

V_0 = ... V [1]

(b) Procedure

- Disconnect the voltmeter.
- Connect the voltmeter across resistor 1 as shown in Fig. 3.2.

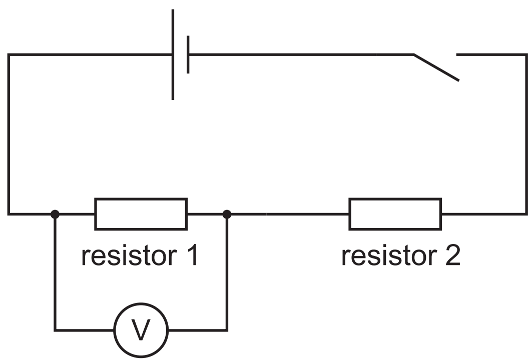


Fig. 3.2

- Close the switch.
- Measure and record the reading on the voltmeter V_1 across resistor 1.
- Open the switch.

V_1 = ... V [1]

(c) **Procedure**

- Disconnect the voltmeter.
- Connect the voltmeter across resistor 2.
- Close the switch.
- Measure and record the reading on the voltmeter V_2 across resistor 2.
- Open the switch.

V_2 = ... V [1]

(d) Suggest why the switch is opened after each reading.

....

.... [1]

(e) A student suggests that $V_1 + V_2 = V_0$.

State if your values of V_0, V_1 and V_2 support the student's suggestion.

Justify your answer with a calculation.

....

.... [1]

(f) Another student wants to measure the current in the circuit in Fig. 3.2.

Complete the circuit diagram in Fig. 3.3 to show how to measure the current in the circuit.

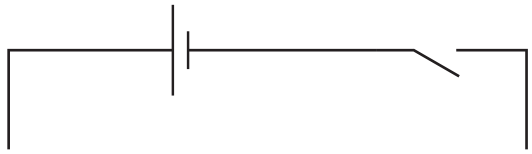


Fig. 3.3

[2]

[Total: 7]

4 Fig. 4.1 shows a metal rod placed in a box of sand.

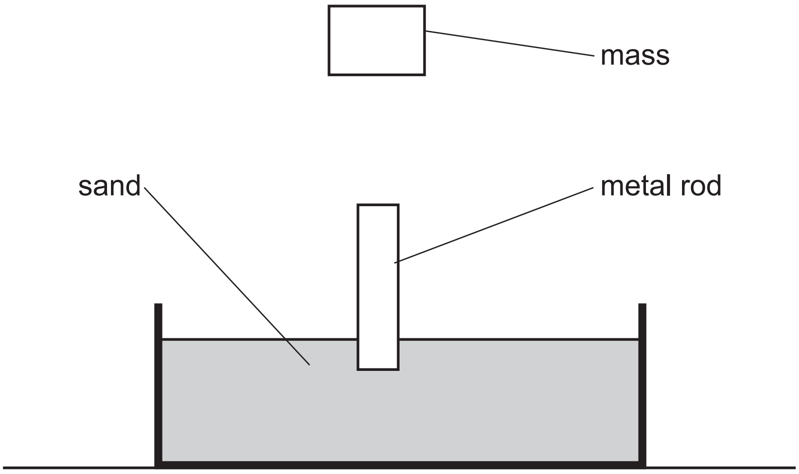


Fig. 4.1

When a mass is dropped onto the rod, the rod moves further into the sand.

A student predicts that the distance the rod moves into the sand is proportional to the mass dropped onto the rod.

Plan an investigation to test the student's prediction.

You are provided with:

- the apparatus in Fig. 4.1
- a number of different masses.

You are not required to do this investigation.

In your plan, include:

- any additional apparatus you will use
- a brief description of the method
- the variables you will control and the measurements you will take
- a table to record the results (you are **not** required to enter any readings in the table)
- how you will process your results to form a conclusion about the prediction.

[7]

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NOTES FOR USE IN QUALITATIVE ANALYSIS

Tests for anions

anion	*test*	*test result*
carbonate, CO_3^{2-}	add dilute acid, then test for carbon dioxide gas	effervescence, carbon dioxide produced
chloride, Cl^- [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
bromide, Br^- [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream ppt.
iodide, I^- [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	yellow ppt.
sulfate, SO_4^{2-} [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.

Tests for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
ammonium, NH_4^+	ammonia produced on warming	–
calcium, Ca^{2+}	white ppt., insoluble in excess	no ppt. or very slight white ppt.
copper(II), Cu^{2+}	light blue ppt., insoluble in excess	light blue ppt., soluble in excess, giving a dark blue solution
iron(II), Fe^{2+}	green ppt., insoluble in excess, ppt. turns brown near surface on standing	green ppt., insoluble in excess, ppt. turns brown near surface on standing
iron(III), Fe^{3+}	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc, Zn^{2+}	white ppt., soluble in excess, giving a colourless solution	white ppt., soluble in excess, giving a colourless solution

Tests for gases

gas	*test and test result*
ammonia, NH_3	turns damp red litmus paper blue
carbon dioxide, CO_2	turns limewater milky
chlorine, Cl_2	bleaches damp litmus paper
hydrogen, H_2	'pops' with a lighted splint
oxygen, O_2	relights a glowing splint

Flame tests for metal ions

metal ion	*flame colour*
lithium, Li^+	red
sodium, Na^+	yellow
potassium, K^+	lilac
copper(II), Cu^{2+}	blue-green