CAMBRIDGE International Education

Cambridge IGCSE™

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

COMBINED SCIENCE **0653/52**

Paper 5 Practical Test **February/March 2026**

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. Do **not** use correction fluid or tape.
- 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.

© Cambridge University Press & Assessment 2026

1 **(a)** You are going to investigate diffusion in beetroot.

Beetroot cells contain a red colour that diffuses out of the cells when placed in water. The more diffusion, the darker the solution surrounding the beetroot.

You are going to find out if the surface area of the beetroot affects the rate of diffusion.

Procedure

step 1 Label four boiling tubes **A**, **B**, **C** and **D**.

step 2 Place four cylinders of beetroot onto a white tile and cut each to a length of 5 cm.

step 3 Cut the 5 cm cylinders of beetroot into pieces as shown in Figure 1.1.

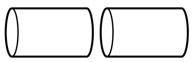
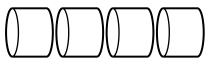
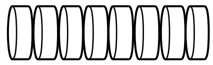
cylinder of beetroot	**A**	**B**	**C**	**D**
how to cut				
number of pieces	1	2	4	8

Figure 1.1

step 4 Put the pieces of beetroot into the boiling tubes labelled **A**, **B**, **C** and **D**.

step 5 Use a syringe to add 10 cm^3 of distilled water to each boiling tube.

step 6 Shake each boiling tube and leave them for 10 minutes.

Continue with the procedure while waiting.

step 7 Place the fifth piece of beetroot onto the white tile and cut it to a length of 5 cm.

(i) The diameter *d* of a cylinder of beetroot is shown in Figure 1.2.

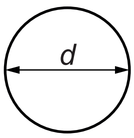


Figure 1.2

Measure the diameter *d* of **your** cylinder of beetroot.

d = ... mm [1]

DO NOT WRITE IN THIS MARGIN

(ii) Calculate the surface area of the cylinder of beetroot.

Use the equation shown.

$$\text{surface area} = 157d + 1.57d^2$$

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

surface area = ... mm^2 [2]

(iii) **Procedure continued**

step 8 Label four test-tubes **A**, **B**, **C** and **D**.

step 9 After the 10 minutes in **step 6**, pour the solution surrounding the beetroot piece from boiling tube **A** into test-tube **A**. Use the glass rod to keep the beetroot piece in the boiling tube.

step 10 Repeat **step 9** with the other boiling tubes and test-tubes.

step 11 Compare the intensity of the colour of the solution in each test-tube with the greyscale colour chart in Figure 1.3. Determine an intensity score for each solution.

darkest red — lightest red

colour:

intensity score: 5 4 3 2 1 0

Figure 1.3

Record in Table 1.1 the intensity score for each solution **A**, **B**, **C** and **D**.

Table 1.1

solution	number of pieces of beetroot	intensity score
A	1	
B	2	
C	4	
D	8	

[3]

(iv) State the relationship between the number of pieces of beetroot and the intensity score.

....

.... [1]

(v) Cutting the beetroot cylinders into pieces increases the surface area.

State how the surface area affects the rate of diffusion from beetroot cells.

....

.... [1]

(b) **(i)** Identify **one** hazard when doing this investigation and state a suitable safety precaution.

hazard ....

precaution ....
[2]

(ii) Suggest why the solutions are poured from the boiling tubes into test-tubes in **step 9** and **step 10**.

....

.... [1]

(iii) Identify **two** possible sources of error in the procedure.

1 ....

....

2 ....

....
[2]

[Total: 13]

© Cambridge University Press & Assessment 2026

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

2 You are going to investigate the effect of water on solid **G**.

(a) **(i)** **Procedure**

step 1 Assemble the apparatus shown in Figure 2.1.

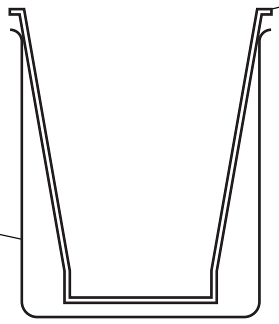


Figure 2.1

step 2 Measure 25 cm^3 of water into the polystyrene cup.

step 3 Measure the temperature of the water.

step 4 Record in Table 2.1 the temperature of the water to the nearest 0.5 °C.

step 5 Add all of the sample of **G** into the water. Stir the mixture of **G** and water and record any observations in **2(a)(iii)**.

step 6 Measure the maximum temperature reached by this mixture.

step 7 Record in Table 2.1 this temperature to the nearest 0.5 °C.

step 8 Do **not** throw away this mixture, it is needed for **2(c)**.

Table 2.1

	/°C
temperature of water	
maximum temperature of mixture of **G** and water	
temperature increase	

[2]

(ii) Calculate the temperature increase.

Record this value in Table 2.1. [1]

(iii) Describe the observations during **step 5**.

....

.... [1]

© Cambridge University Press & Assessment 2026

(iv) The experiment is done using a polystyrene cup inside a glass beaker instead of just in a glass beaker.

Suggest why.

....

.... [1]

(b) A student follows the procedure in **2(a)** seven times.

Each time the student adds a different mass of **G** to water.

Table 2.2 shows the results the student obtains.

Table 2.2

mass of G added to water /g	**temperature increase /°C**
0.0	0.0
0.5	4.5
1.0	9.0
1.5	13.5
2.0	14.0
2.5	22.5
3.0	27.0

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

(i) On the grid, plot temperature increase (vertical axis) against the mass of **G** added to water.

[3]

(ii) One of the results is anomalous.

Circle this anomalous result on the grid. [1]

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

(iv) Explain how the graph shows that the temperature increase is proportional to the mass of **G** added to water.

....

....

.... [1]

(c) The solution at the end of **step 8** is aqueous copper sulfate.

Procedure

- Pour 1 cm depth of the solution at the end of **step 8** into a test-tube.
- Add 1 cm depth of dilute nitric acid and 1 cm depth of aqueous barium nitrate to the test-tube.

(i) Explain why it is difficult to determine the actual colour of the precipitate that forms.

....

.... [1]

(ii) Suggest how the procedure is changed to confirm the actual colour of the precipitate.

....

.... [1]

[Total: 13]

DO NOT WRITE IN THIS MARGIN

Turn over

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

3 You are going to determine the density of a metal object.

(a) Use a balance to find the mass m of the metal object.

Record m to the nearest 0.1 g.

m = ... g [1]

(b) Procedure

- Place the small container in the large container, as shown in Figure 3.1.

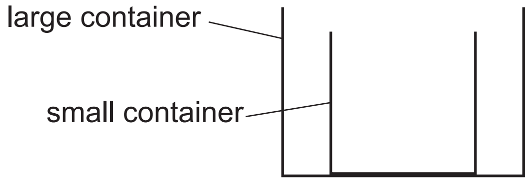


Figure 3.1

- Pour water into the **small** container until it is about to overflow.
- Carefully place the metal object into the water in the small container, as shown in Figure 3.2.

  The water spills over into the large container.

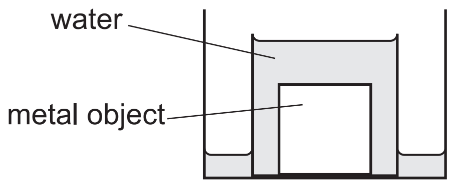


Figure 3.2

- Carefully remove the small container and its contents from the large container. Place the small container on a paper towel.
- Carefully pour the water from the **large** container into the measuring cylinder.
- Record the volume of water V to the nearest cm^3.

V = ... cm^3 [1]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

(c) Calculate the density of the metal object.

Use your answers in **3(a)** and **3(b)** and the equation shown.

$$\text{density} = \frac{m}{V}$$

density = ... g / cm^3 [1]

(d) A student calculates the density of the metal object as 8.0 g / cm^3.

Two values are considered equal, within the limits of experimental error, if they are within 10% of each other.

Explain if your value of density in **3(c)** is equal to the student's value within the limits of experimental error.

Justify your answer with a calculation.

....

.... [2]

(e) Suggest **one** source of error in your results.

....

.... [1]

(f) Another student cools the metal object in a freezer. The object contracts due to the lower temperature.

The student repeats the procedure in **3(a)** and **3(b)** with the colder metal object.

State the effect cooling has on the calculated density of the metal object.

Explain your answer.

effect ....

explanation ....

....

[1]

[Total: 7]

DO NOT WRITE IN THIS MARGIN

4 A ray of light enters a triangular glass prism with an angle of incidence *i*.

The ray of light is refracted as shown in Figure 4.1.

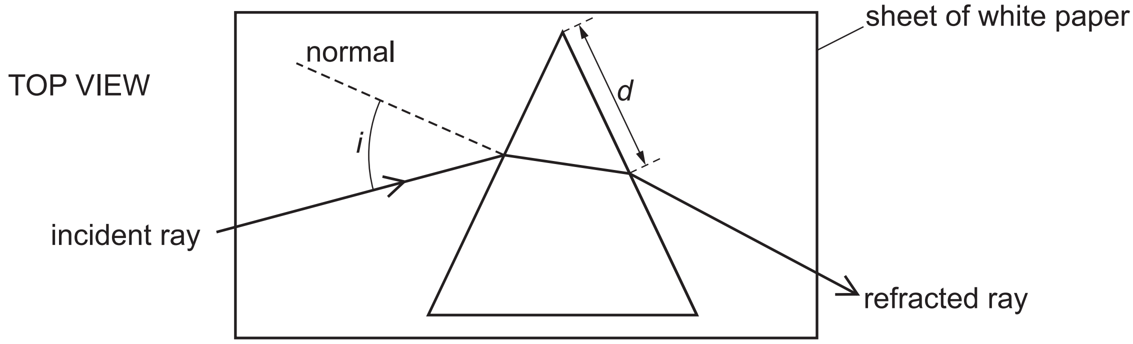


Figure 4.1

The distance *d* is the distance between the top of the prism and the point at which the refracted ray leaves the prism.

A student states that the distance *d* depends on angle *i*.

Plan an investigation to determine the relationship between *d* and *i*.

You are **not** required to do this investigation.

You are provided with:

- a triangular glass prism
- a sheet of paper.

You may use any common laboratory apparatus in your plan.

In your plan, include:

- any additional apparatus you will use
- a brief description of the method
- what you will measure
- a table to record your results (you do **not** need to enter any readings in the table)
- how you will process your results to reach a conclusion.

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

[7]

DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

BLANK PAGE

DO NOT WRITE IN THIS MARGIN

BLANK PAGE

DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

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

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (Cambridge University Press & Assessment) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in our Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge International Education is the name of our awarding body and a part of Cambridge University Press & Assessment, which is a department of the University of Cambridge.

© Cambridge University Press & Assessment 2026

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN