Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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0542879087

CO-ORDINATED SCIENCES **0654/52**

Paper 5 Practical Test **October/November 2025**

2 hours

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 60.
- 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	
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3	
4	
5	
6	
Total	

This document has **20** pages. Any blank pages are indicated.

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1 You are going to test potato and milk for their nutrient content.

(a) Read through the procedure in **(a)(ii)**.

(i) Draw a table to record your results from **(a)(ii)**.

[2]

(ii) **Procedure**

step 1 Cut the cube of potato into two pieces.
step 2 Place one piece of potato into each of two test-tubes.
step 3 Add about 2 cm depth of biuret solution to one of these test-tubes.
step 4 Add a few drops of iodine solution to the other test-tube.
step 5 Add about 2 cm depth of milk to each of two clean test-tubes.
step 6 Repeat steps 3 and 4 with the milk instead of the potato pieces.

Record in your results table in **(a)(i)** the final colours observed in each test-tube. [4]

(iii) Use your results to state the nutrients that the potato and milk contain.

potato contains .....

milk contains .....

[2]

(b) A student tests 10 cm^3 of two fruit juices, **A** and **B**, with Benedict's solution.

Both juices produce a precipitate.

(i) State the name of the nutrient identified by Benedict's solution.

..... [1]

(ii) Suggest a suitable temperature the student uses for the test.

temperature = ... °C [1]

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(iii) Method 1

The precipitates produced in the tests in **(b)** are filtered, dried and weighed.

The greater the mass of precipitate, the more nutrient the fruit juice contains.

The student repeats the experiment two more times.

Table 1.1 shows the masses the student obtains.

Table 1.1

fruit juice	mass of precipitate / g			
	trial 1	trial 2	trial 3	average
A	0.55	0.59	0.58	
B	0.81	0.86	0.87	

Calculate the average mass for each juice.

Record in Table 1.1 your values to **two** significant figures.

[2]

(iv) Method 2

The student repeats the tests in **(b)** using the same volumes of fruit juice and Benedict's solution.

The student observes and records the colour of the solution formed.

The student repeats the experiment two more times.

Benedict's solution gives a range of colours to indicate how much of the nutrient is present.

Explain why **method 1** allows the student to have more confidence in determining how much of the nutrient is present in each fruit juice.

.....

.....

..... [1]

(v) Suggest why the Benedict's solution needs to be in excess in **method 1**.

.....

..... [1]

[Total: 14]

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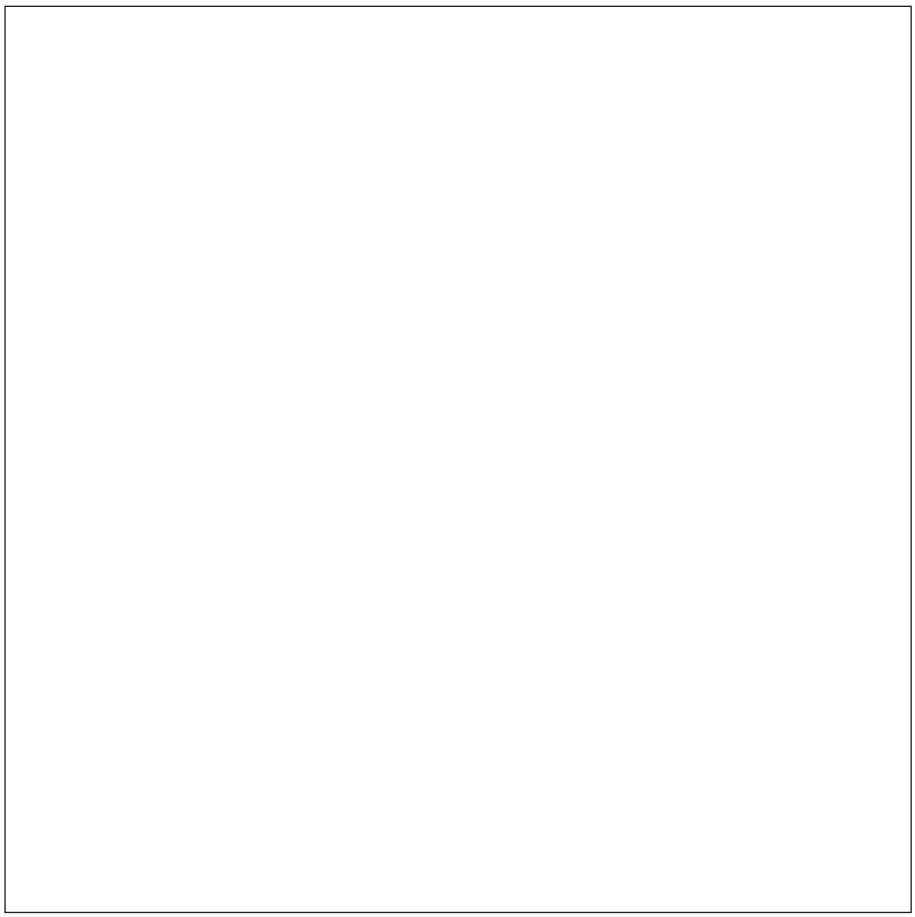
2 You are provided with a leaf.

(a) In the box make a large, detailed pencil drawing of the leaf.



[3]

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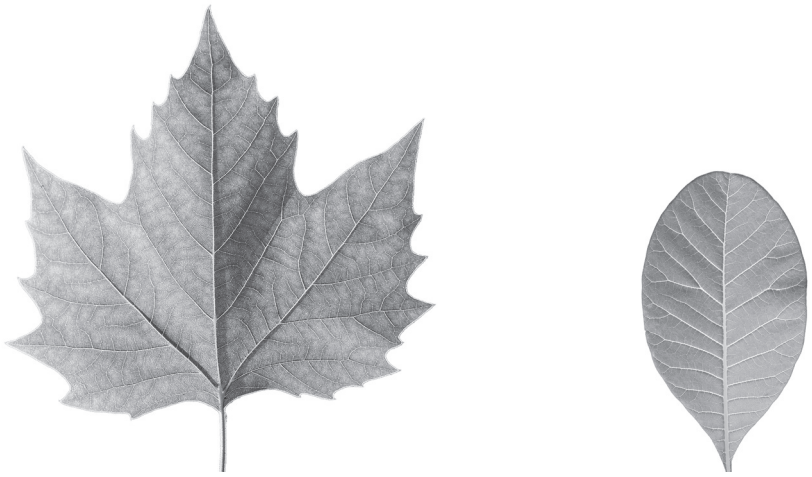
(b) Fig. 2.1 shows photographs of leaves, **C** and **D**, from two different trees. The photographs are at the same magnification.



leaf **C** leaf **D**

Fig. 2.1

State **one** similarity and **two** differences between leaf **C** and leaf **D** visible in Fig. 2.1.

similarity .....

.....

difference 1 .....

.....

difference 2 .....

.....

[3]

[Total: 6]

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3 You are going to investigate the effect of concentration on the rate of a reaction.

Copper carbonate reacts with dilute hydrochloric acid forming carbon dioxide gas.

Copper carbonate does not dissolve in or react with water.

An aqueous solution is made less concentrated by adding water to it.

(a) Procedure

- Use a measuring cylinder to add 5 cm^3 of dilute hydrochloric acid to a conical flask.
- Use a clean measuring cylinder to add 20 cm^3 of water to the conical flask.
- Add 2 spatula loads of copper carbonate to the conical flask.
- Swirl the flask and immediately start a stop-watch.
- Stop the stop-watch when the reaction finishes.
- Record in Table 3.1 the time taken to the nearest second for the reaction to finish. This is the reaction time.

Repeat the procedure using the volumes shown in Table 3.1.

Table 3.1

volume of dilute hydrochloric acid / cm^3	volume of water / cm^3	reaction time / s
5	20	
10	15	
15	10	
20	5	
25	0	

[4]

(b) (i) Explain how you know when the reaction has finished.

.....

..... [1]

(ii) Suggest why this experiment is **not** done using 0 cm^3 of dilute hydrochloric acid, 25 cm^3 of water and 2 spatula loads of copper carbonate.

.....

..... [1]

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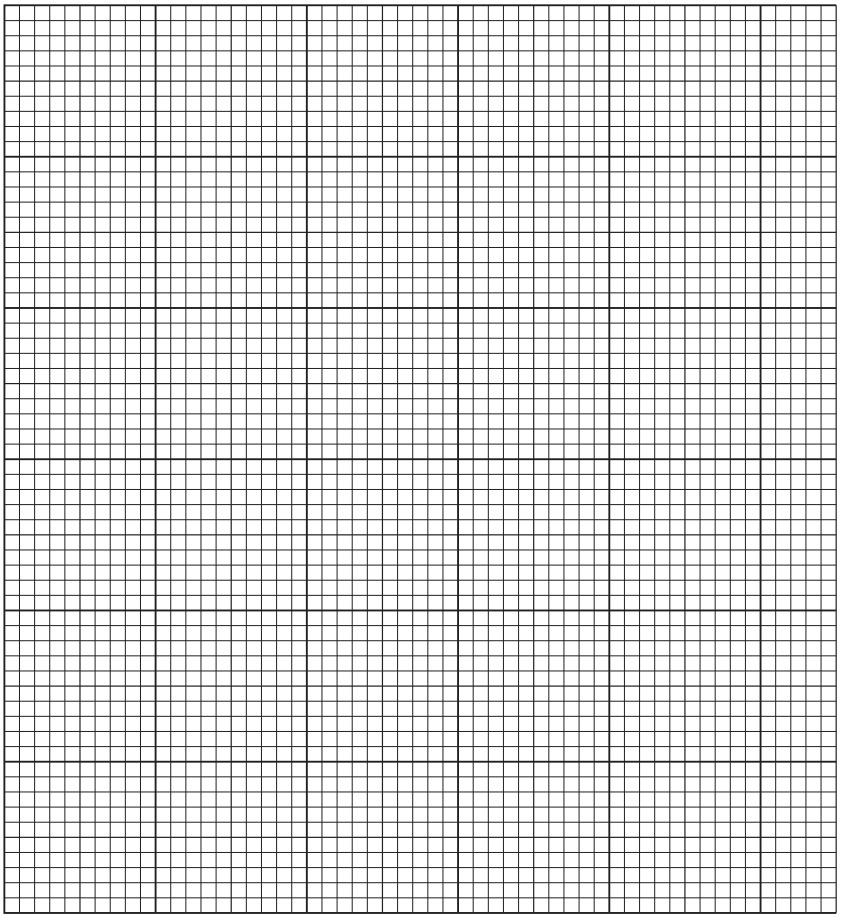
(c) The volume of dilute hydrochloric acid is used to represent the concentration of the dilute hydrochloric acid.

(i) On the grid, plot reaction time (vertical axis) against volume of dilute hydrochloric acid.



[3]

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

(iii) State the relationship between the concentration of dilute hydrochloric acid and the rate of the reaction.

.....

..... [1]

(iv) Use your graph to predict the reaction time when 12 cm^3 of dilute hydrochloric acid are used.

reaction time = ... s [1]

(d) (i) Increasing the temperature of a reaction increases the rate of a reaction.

On the grid in **(c)(i)**, draw a line to show the expected results when the investigation is done at a higher temperature. Label this line **H**. [1]

(ii) When the temperature increases the particles move faster.

A reaction happens when the particles collide.

Suggest why the reaction happens faster when the temperature is increased.

.....

..... [1]

(e) It is possible to collect and measure the volume of carbon dioxide gas given off in the reaction.

Name the **one** piece of apparatus used to collect and measure the volume of carbon dioxide gas.

..... [1]

[Total: 15]

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4 You are going to identify some ions.

You are given two solutions, aqueous **X** and aqueous **Y**.

Only **one** of these solutions contains the sulfate ion.

(a) Procedure

- Put approximately 2 cm depth of aqueous **X** into a test-tube.
- Put approximately 2 cm depth of aqueous **Y** into a test-tube.
- Add a wooden splint to each test-tube and leave the splints soaking for use in **(c)**.

- Put approximately 2 cm depth of aqueous **X** into a clean test-tube.
- Put approximately 2 cm depth of aqueous **Y** into a clean test-tube.
- Add a few drops of aqueous barium nitrate to these two test-tubes.
- Record in Table 4.1 your observations.

Table 4.1

solution	observations with aqueous barium nitrate
X	
Y	

[1]

(b) Suggest an improvement to the test which will identify the solution that contains the sulfate ion.

Explain your answer.

(You do **not** need to do this improved experiment.)

improvement .....

.....

explanation .....

.....

[2]

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(c) Aqueous **X** and aqueous **Y** each contain the same cation.

Procedure

- Use the wooden splint that has been soaking in aqueous **X**.
- Put the splint into the top of a blue Bunsen burner flame.
- Observe the first colour seen and record this in Table 4.2.
- If you do not see a colour repeat the test.

Repeat the procedure with the splint from aqueous **Y**.

Table 4.2

solution	colour of flame
X	
Y	

Identify the cation present in aqueous **X** and aqueous **Y**.

..... [2]

[Total: 5]

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5 You are going to calculate the focal length *f* of a converging lens.

The apparatus shown in Fig. 5.1 has been assembled for you.

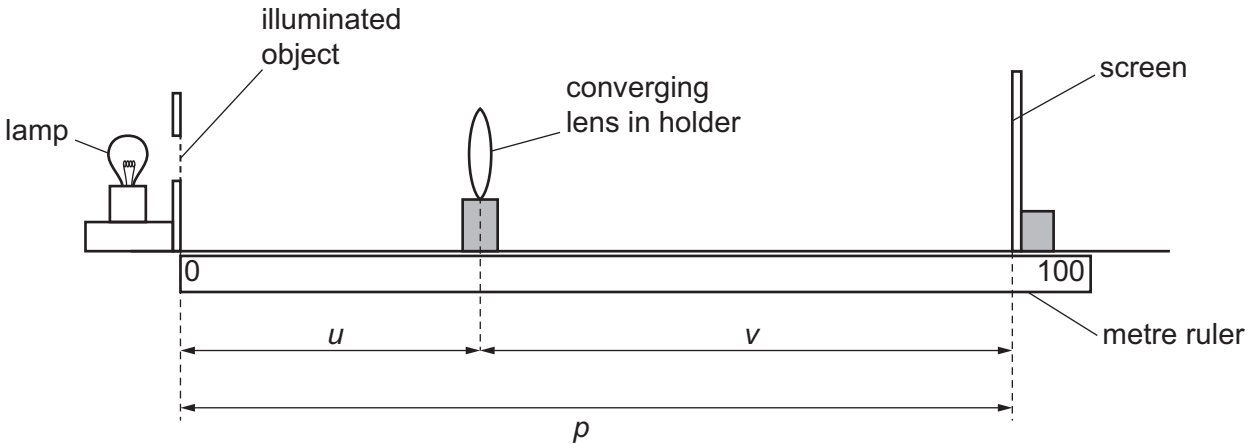

Fig. 5.1

(a) (i) Procedure

- Place the lens at a distance u = 30.0 cm from the illuminated object.
- Switch on the lamp.
- Move the **screen** backwards and forwards until there is a focused, sharp image on the screen.
- Record the distance p of the screen from the illuminated object in cm to the nearest 0.1 cm.

p = ... cm

Calculate the distance v between the centre of the lens and the screen.

Use the equation shown.

$$v = p - 30.0$$

Record in Table 5.1 this distance v in cm to the nearest 0.1 cm.

[2]

Table 5.1

u/cm	v/cm	$u \times v$	$u + v$/cm	f/cm
30.0				
50.0				

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(ii) Repeat the procedure in **(a)(i)** using a distance u = 50.0 cm between the illuminated object and the lens.

p = ... cm

Calculate the distance v between the centre of the lens and the screen.

Use the equation shown.

$$v = p - 50.0$$

Record in Table 5.1 this distance v in cm to the nearest 0.1 cm.

[1]

(iii) Repeat the procedure in **(a)(i)** using a distance u = 40.0 cm between the illuminated object and the lens.

p = ... cm

Calculate the distance v between the centre of the lens and the screen.

Use the equation shown.

$$v = p - 40.0$$

Record this distance in cm to the nearest 0.1 cm.

v = ... cm [1]

(iv) Describe the relationship between u and v.

Use the values of u and your values of v from Table 5.1 and **(a)(iii)**.

.....

..... [1]

(v) State **one** difficulty you have when following the procedure.

Describe how this difficulty is overcome.

difficulty .....

.....

how to overcome .....

.....

[1]

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(b) (i) Calculate $u \times v$ for both values of u given in Table 5.1.

Record these values in Table 5.1.

[1]

(ii) State the unit for $u \times v$.

..... [1]

(iii) Calculate $u + v$ for both values of u given in Table 5.1.

Record these values in Table 5.1.

[1]

(iv) Calculate f for both values of u given in Table 5.1.

Use the equation shown.

$$f = \frac{u \times v}{u + v}$$

Record these values in Table 5.1.

[2]

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(c) Two students do another experiment to determine the focal length *f* of a different lens.

The lens has a focal length *f* of 10.6 cm.

The students each determine a value for *f* and repeat the experiment three more times.

Their values for *f* are shown in Table 5.2.

Table 5.2

	f / cm			
	trial 1	trial 2	trial 3	trial 4
student **A**	10.7	10.2	12.3	10.1
student **B**	10.6	10.4	10.6	10.5

The results for student **B** are more accurate than the results for student **A**.

Use the data in Table 5.2 to explain why the results for student **B** are more accurate.

.....

..... [1]

(d) The students use an identical ruler to measure the height of an image on a screen.

The students each take a single measurement of the height.

The students record their results in mm as shown.

student **A**, height of image = 21.2 mm

student **B**, height of image = 21 mm

The result from student **A** is **not** correct.

Explain why.

.....

..... [1]

[Total: 13]

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6 A student investigates the time taken for one swing of a pendulum (period).

Plan an experiment to determine the relationship between the time for one swing of a pendulum (period) and the length of the string, l.

You are provided with the assembled apparatus shown in Fig. 6.1.

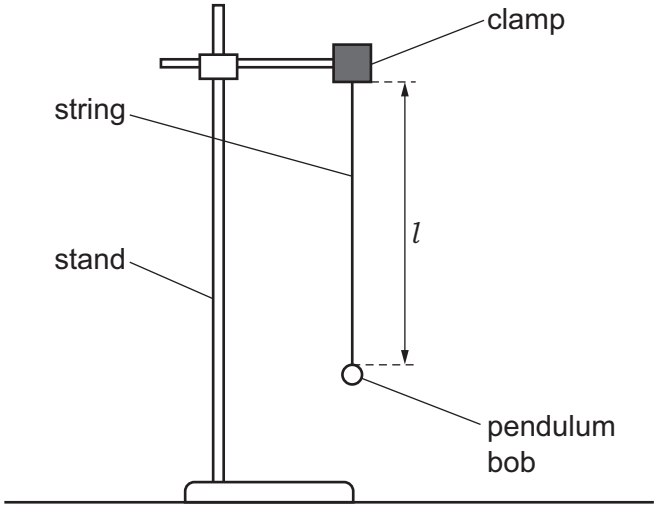

Fig. 6.1

You may use any common laboratory apparatus in your plan.

You are not required to do this investigation.

In your plan, include:

- any additional apparatus
- what you will measure including how you make sure your results are accurate
- the variables you will control
- a results table to record your measurements (you are **not** required to enter any readings into the table)
- how you will process your results to form a conclusion.

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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.
nitrate, NO_3^- [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
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

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