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Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

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COMBINED SCIENCE **0653/51**

Paper 5 Practical Test **October/November 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 an enzyme-controlled reaction.

Catalase is an enzyme found inside potato cells. It catalyses the breakdown of hydrogen peroxide, releasing oxygen gas.

When potato is mixed with aqueous hydrogen peroxide in a boiling tube, oxygen gas produces a foam.

The height of the foam is measured as shown in Fig. 1.1.

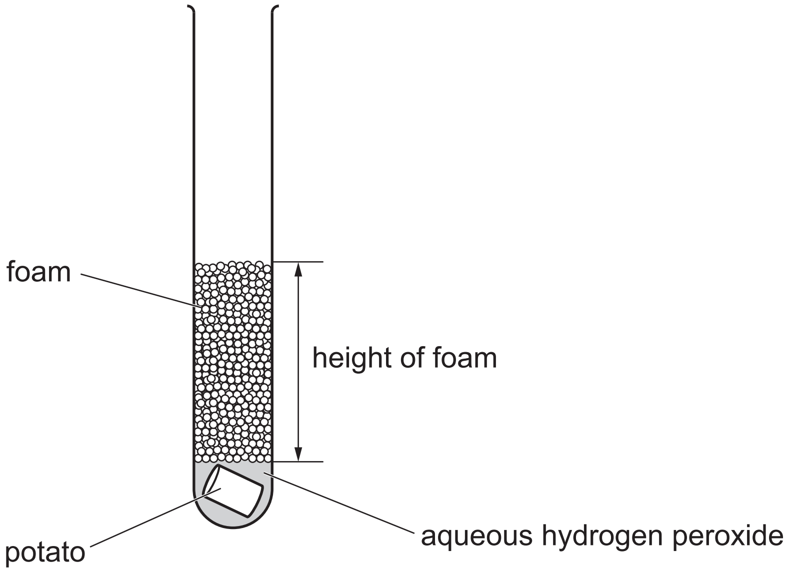

Fig. 1.1

You are provided with a supply of 6% aqueous hydrogen peroxide and five cylinders of potato.

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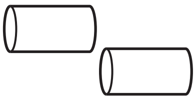
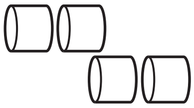
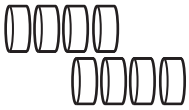
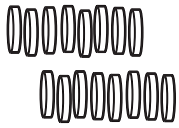
Procedure

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

step 2 Place all five cylinders of potato on the white tile and cut each cylinder to a length of 5 cm.

step 3 Further cut four of the 5 cm potato cylinders into approximately equal-sized pieces, as shown in Table 1.1.

Table 1.1

	boiling tube				
	A	**B**	**C**	**D**	**E**
how to cut potato					
number of pieces	1	2	4	8	16

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

step 5 Use a syringe to add 10 cm^3 of aqueous hydrogen peroxide to each boiling tube.

step 6 Start the stop-clock and leave the boiling tubes for 5 minutes.

step 7 After 5 minutes, measure the height of the foam in each boiling tube, as shown in Fig. 1.1.

(a) Record in Table 1.2 the heights of the foam in mm to the nearest mm.

Table 1.2

boiling tube	number of pieces of potato	height of foam / mm
A	1	
B	2	
C	4	
D	8	
E	16	

[4]

(b) **(i)** On the grid, plot the height of the foam (vertical axis) against the number of pieces of potato.

[3]

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

(c) Cutting the potato cylinder into pieces increases the surface area.

Describe the relationship between the surface area and the height of foam produced.

....

.... [1]

(d) Measuring the volume of oxygen produced is a more accurate method than measuring the height of the foam.

(i) Describe **one** practical difficulty in measuring the height of the foam in **step 7**.

....

.... [1]

(ii) Suggest **one other** reason why measuring the volume of oxygen produced is a more accurate method than measuring the height of the foam.

....

.... [1]

(iii) Complete Fig. 1.2 to show assembled apparatus suitable for collecting and measuring the volume of oxygen produced.

Label the apparatus.

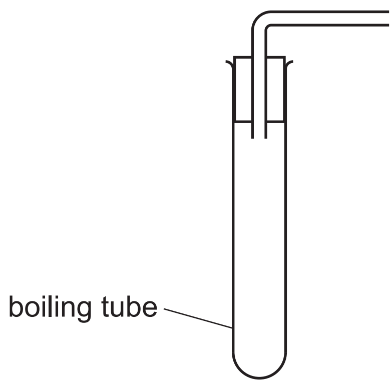


Fig. 1.2

[2]

[Total: 13]

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2 You are going to investigate the chemical reaction between aqueous barium nitrate and **aqueous H**.

(a) Procedure

step 1 Measure 25.0 cm^3 of **aqueous H** using a measuring cylinder.

step 2 Pour this volume of **aqueous H** into a conical flask.

step 3 You have one test-tube with a thread attached. Half-fill this test-tube with aqueous barium nitrate. Use a paper towel to wipe off any aqueous barium nitrate on the outside of this test-tube.

step 4 Assemble the apparatus shown in Fig. 2.1 so that the thread is held between the stopper and the conical flask.

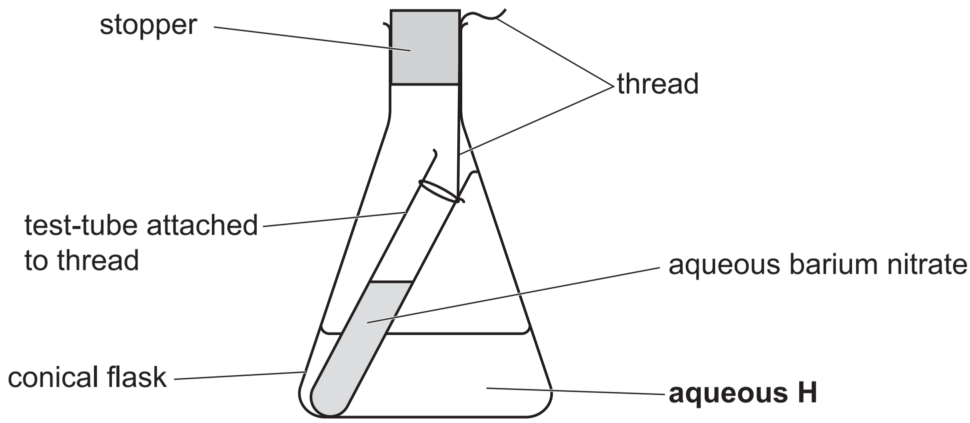


Fig. 2.1

step 5 Use a balance to measure the mass of the assembled apparatus shown in Fig. 2.1.

step 6 Record this mass in Table 2.1.

step 7 **Make sure the stopper fits tightly in the flask so that no liquid can escape.** Slowly turn the flask upside down to mix the chemicals. Return the flask to an upright position.

step 8 Record in Table 2.1 your observations of the mixture in the flask.

step 9 Use the same balance to measure the mass of the apparatus after mixing.

step 10 Record this mass in Table 2.1.

Table 2.1

mass of apparatus at **step 5** / g	
observations at **step 8**	
mass of apparatus after mixing at **step 9** / g	

[3]

(b) A teacher states:

"In a chemical reaction, no mass is gained or lost."

Explain whether your results in Table 2.1 support this statement.

....

.... [1]

(c) Identify **one** ion present in **aqueous H**.

Explain your answer.

ion ....

explanation ....

....

[1]

(d) Suggest why this procedure is **not** used to investigate the reaction between aqueous sodium carbonate and dilute hydrochloric acid.

Explain your answer.

....

....

.... [2]

[Total: 7]

3 Solid citric acid is added to aqueous sodium hydrogencarbonate. There is a reaction and the temperature of the aqueous sodium hydrogencarbonate decreases.

Plan an investigation to determine the relationship between the mass of citric acid added to the aqueous sodium hydrogencarbonate and the decrease in temperature.

You are provided with:

- solid citric acid
- aqueous sodium hydrogencarbonate.

You may use any common laboratory apparatus in your plan.

You are not required to do this investigation.

In your plan, include:

- the apparatus you will use
- a brief description of the method
- what you will measure
- which variables you will control
- how you will process your results to form a conclusion.

You may include a results table (you are **not** required to enter any data into the table).

[7]

4 You are going to use **two** methods to determine the resistance R of resistor **W**.

(a) Method 1

The circuit in Fig. 4.1 is assembled for you.

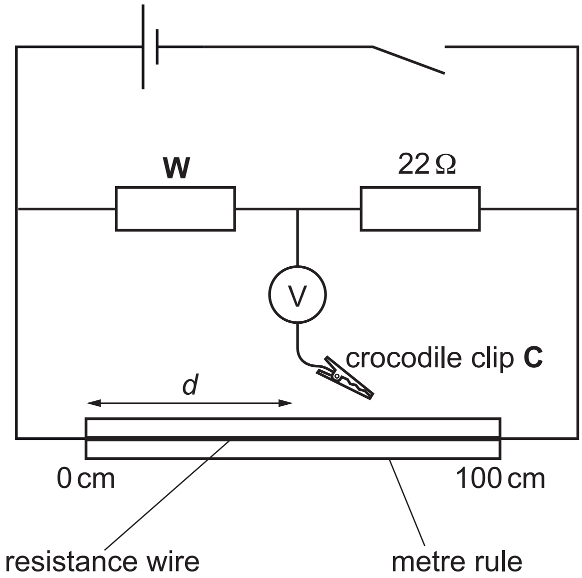


Fig. 4.1

(i) Procedure

- Connect crocodile clip **C** to the wire so that $d = 50\,\text{cm}$.
- Close the switch.

Record the voltmeter reading V_1.

V_1 = ... V

- Move **C** along the wire towards the zero end of the metre rule until the voltmeter reading is zero. This position of **C** on the metre rule is d_0.

Record d_0 in cm to the nearest 0.1 cm.

d_0 = ... cm

- Open the switch.

[2]

(ii) One difficulty in measuring d_0 is that the end of the crocodile clip is wide.

Suggest a change to the apparatus that overcomes this difficulty.

....

.... [1]

(iii) Describe **one other** difficulty in determining d_0.

....

.... [1]

(iv) Calculate the resistance R of resistor **W**.

Use your answer in **(a)(i)** and the equation shown.

$$R = 22 \times \left(\frac{d_0}{100 - d_0} \right)$$

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

R = ... Ω [2]

(b) Method 2

Assemble the circuit shown in Fig. 4.2.

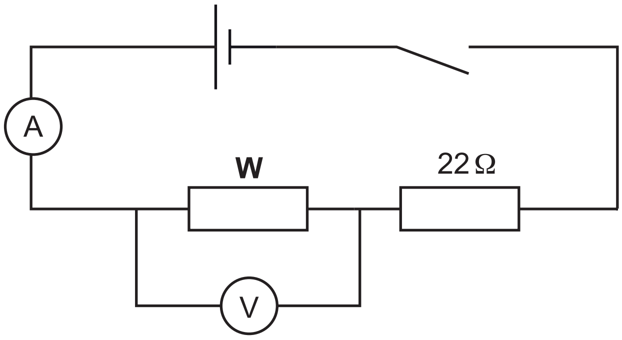


Fig. 4.2

(i) Procedure

- Close the switch.

Record the reading on the ammeter, I.

I = ... A

Record the reading on the voltmeter, V_2.

V_2 = ... V

- Open the switch.

[2]

(ii) Calculate the resistance R of resistor **W**.

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

$$R = \frac{V_2}{I}$$

R = ... Ω [1]

(c) Two values are considered equal within the limits of experimental error if the difference between them is less than 10%.

Explain whether your values of *R* in **(a)(iv)** and **(b)(ii)** are equal within the limits of experimental error.

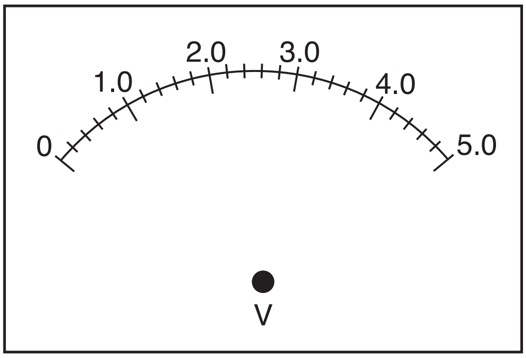
Justify your answer with a calculation.

....

.... [2]

(d) Fig. 4.3 shows a voltage reading on a digital voltmeter and an analogue voltmeter without a pointer arrow.

digital voltmeter



analogue voltmeter

Fig. 4.3

(i) Draw a pointer arrow on the analogue voltmeter in Fig. 4.3 to show the same voltage reading as the digital voltmeter. [1]

(ii) Suggest **one** advantage of taking readings from the digital voltmeter.

....

.... [1]

[Total: 13]

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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