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CAMBRIDGE
International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0330300088

COMBINED SCIENCE **0653/61**

Paper 6 Alternative to Practical **May/June 2026**

1 hour

You must answer on the question paper.

No additional materials are needed.

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.

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

DC (PQ/TC) 358290/2

[Turn over

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1 A student investigates the relationship between substrate concentration and the rate of an enzyme-controlled reaction.

Catalase is an enzyme found in yeast cells. It catalyses the breakdown of the substrate hydrogen peroxide, releasing thermal energy (heat).

The student compares the rate of reaction with different concentrations of aqueous hydrogen peroxide by measuring the temperature.

(a) Procedure

The student:

step 1 labels six test-tubes **A**, **B**, **C**, **D**, **E** and **F**

step 2 covers the outside of each test-tube with foil

step 3 adds 10 cm^3 of a different concentration of aqueous hydrogen peroxide to each test-tube as shown in Table 1.1

step 4 places a thermometer into test-tube **A** and records in Table 1.1 the initial temperature

step 5 adds 1 cm^3 of yeast suspension (catalase enzyme) to test-tube **A**

step 6 stirs the mixture and records in Table 1.1 the highest temperature reached in test-tube **A**

step 7 removes the thermometer from the test-tube and washes it with distilled water

step 8 repeats **step 4** to **step 7** using test-tubes **B**, **C**, **D**, **E** and **F**.

Figure 1.1 shows the highest reading on the thermometer for test-tube **A** and test-tube **B**.

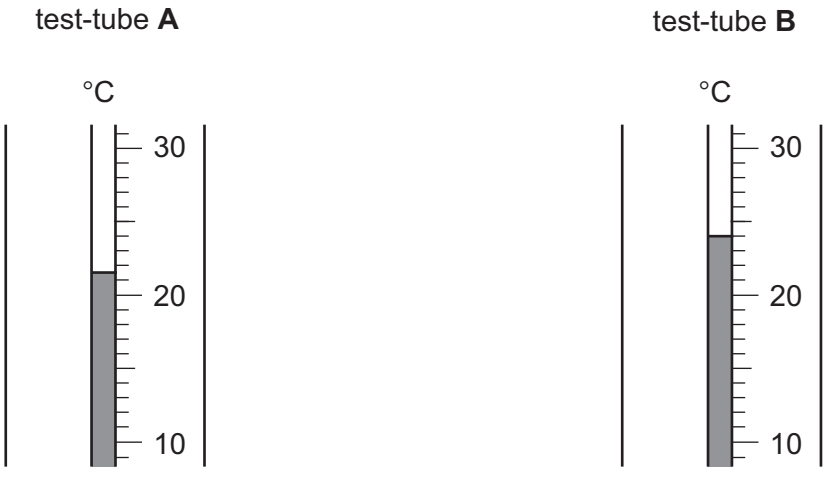


Figure 1.1

(i) Record in Table 1.1 the temperature readings shown in Figure 1.1 to the nearest 0.5 °C.

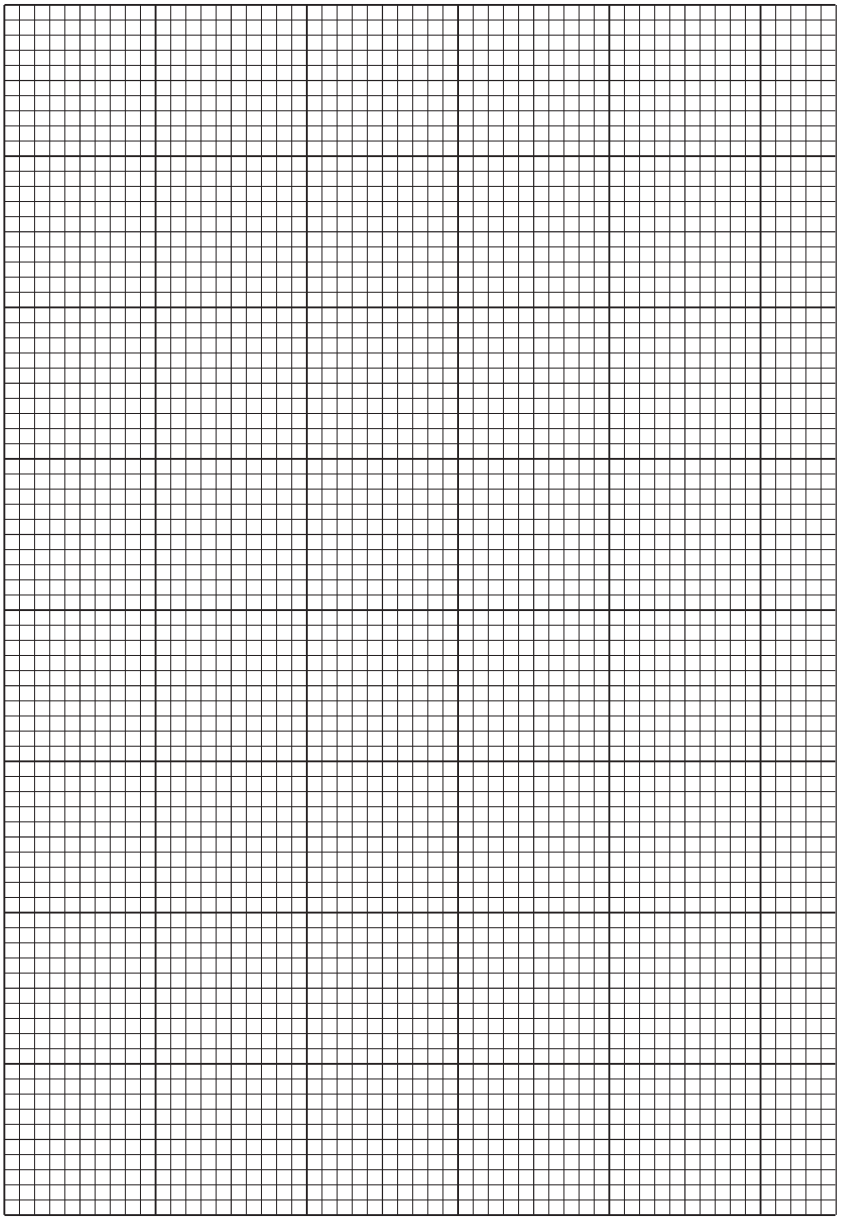
Table 1.1

test-tube	percentage concentration of hydrogen peroxide	initial temperature /°C	highest temperature /°C	change in temperature /°C
A	0	21.5		
B	1	20.5		
C	2	21.0	28.0	7.0
D	3	21.5	30.0	8.5
E	4	21.0	33.5	12.5
F	5	21.0	36.0	15.0

[2]

(ii) Complete Table 1.1 by calculating the change in temperature for test-tube **A** and test-tube **B**. [1]

(iii) On the grid, plot a graph of change in temperature (vertical axis) against percentage concentration of hydrogen peroxide.



[3]

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

(v) State the relationship between the percentage concentration of hydrogen peroxide and the rate of reaction.

.....

..... [1]

(vi) Identify the independent variable in this investigation.

..... [1]

(vii) Suggest why:

- the test-tubes are covered in foil in **step 2**

.....

.....

- the thermometer is washed in **step 7**.

.....

.....

[2]

(b) Catalase enzyme is a protein.

Name a reagent used to test for protein and state the colour formed for a positive result.

reagent .....

colour .....

[2]

[Total: 13]

Turn over

2 A student prepares a sample of aqueous copper sulfate by reacting excess copper carbonate with dilute sulfuric acid.

Copper carbonate is a green solid.

Aqueous copper sulfate is a blue solution.

Procedure

The student:

step 1 pours 10 cm^3 of dilute sulfuric acid into a beaker

step 2 adds one spatula load of solid copper carbonate into the dilute sulfuric acid

step 3 uses a glass rod to stir the mixture

step 4 repeats **step 2** and **step 3** until excess copper carbonate is added

step 5 filters the reaction mixture into a conical flask.

(a) Describe one observation for the reaction that happens in **step 2**.

..... [1]

(b) Explain the importance of adding excess copper carbonate in **step 4**.

.....

..... [1]

(c) Draw a labelled diagram to show the assembled apparatus used to filter the reaction mixture.

[2]

(d) Describe the appearance of the filtrate in the conical flask and the residue on the filter paper.

filtrate .....

residue .....

[1]

(e) Procedure

The student :

- does a flame test by placing a wooden splint into the filtrate
- leaves the splint in the filtrate for 2 minutes
- places the splint into the edge of a blue Bunsen burner flame.

(i) State the colour the student observes in the flame test.

..... [1]

(ii) A blue Bunsen burner flame is hotter than a yellow Bunsen burner flame.

State one **other** reason for using a blue Bunsen burner flame in the flame test.

.....

..... [1]

[Total: 7]

3 When a liquid detergent is shaken with water in a measuring cylinder it makes a layer of bubbles called foam.

A student thinks that dissolving salt in the water will change the volume of foam the detergent makes.

Plan an investigation to determine the relationship between the mass of salt dissolved in water and the volume of foam made when the detergent is shaken with the water.

You are provided with:

- a liquid detergent
- solid salt
- a 100 cm^3 measuring cylinder fitted with a stopper.

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
- 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).

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.....

.....

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.....

.....

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.....

.....

..... [7]

4 A student investigates a circuit with a resistance wire **E** taped to a metre ruler.

(a) Figure 4.1 shows a diagram of the circuit the student assembles.

The teacher asks the student to include a resistor in the circuit to prevent the circuit overheating.

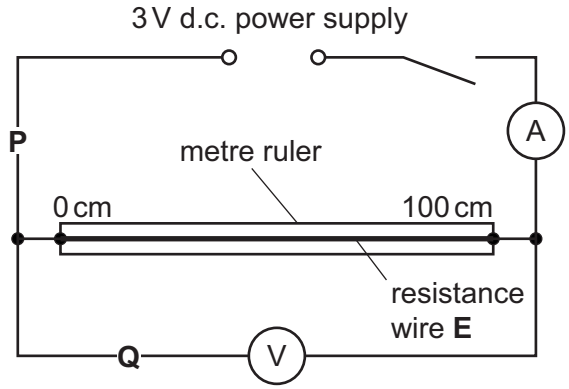

Figure 4.1

On Figure 4.1, circle the position **P** or **Q** of the resistor.

Draw in the box the electrical symbol for a resistor.

[1]

(b) (i) The student closes the switch.

Figure 4.2 shows the voltmeter reading V_1 and the ammeter reading I_1.

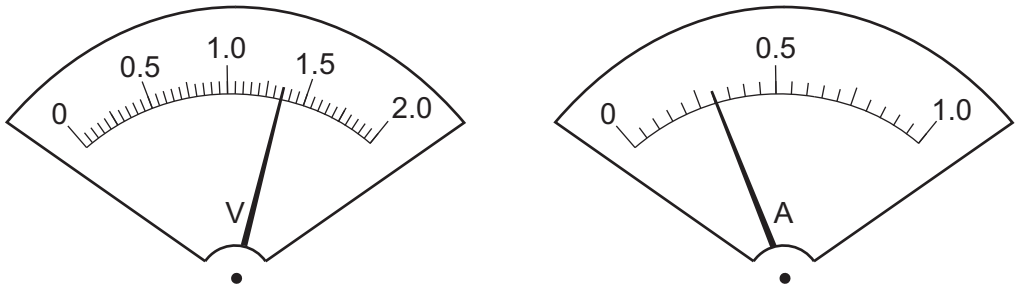

Figure 4.2

Record the voltmeter reading V_1 and the ammeter reading I_1.

V_1 = ... V

I_1 = ... A
[2]

(ii) The student opens the switch.

Calculate the resistance R_1 of the wire.

Use your answers in **4(b)(i)** and the equation shown.

$$R_1 = \frac{V_1}{I_1}$$

R_1 = ... Ω [1]

(c) A second resistance wire **F** is connected to the taped resistance wire **E** using crocodile clips as shown in Figure 4.3.

The distance between the crocodile clips needs to be 50.0 cm.

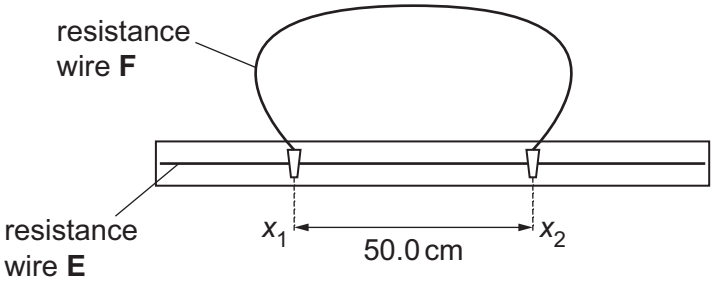

Figure 4.3

The student connects the crocodile clips.

Figure 4.4 shows the position of one crocodile clip as viewed from above.

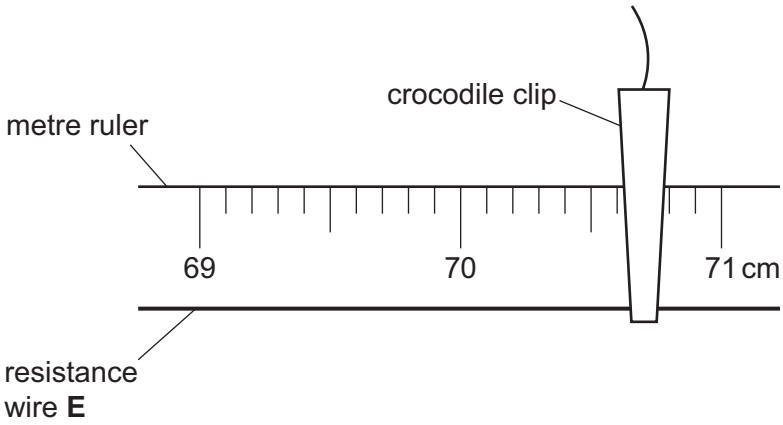

Figure 4.4

(i) Record to the nearest 0.1 cm, the position x_2 of the centre of the crocodile clip in Figure 4.4.

x_2 = ... cm [1]

(ii) Suggest **one** difficulty in determining position x_2.

.....

..... [1]

(iii) Figure 4.5 shows the position x_1 of the other crocodile clip as viewed from above.

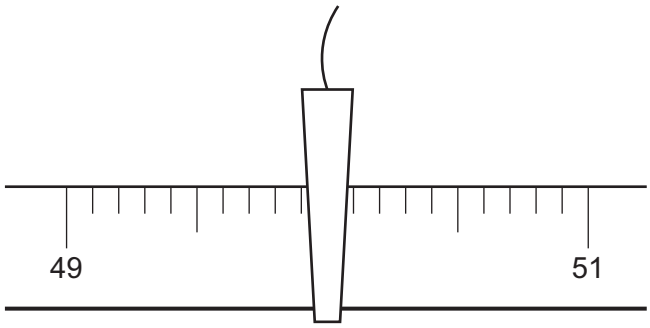

Figure 4.5

Describe the error that the student has made.

.....

..... [1]

(d) (i) The teacher corrects the student's error.

The student closes the switch.

The new voltmeter reading V_2 and the new ammeter reading I_2 are shown in Figure 4.6.

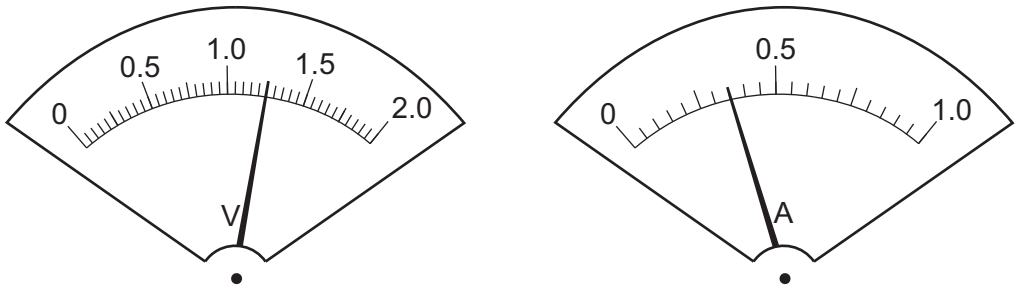

Figure 4.6

Record the new voltmeter reading V_2 and the new ammeter reading I_2.

V_2 = ... V

I_2 = ... A
[1]

(ii) The student opens the switch.

Calculate the resistance R_2 using your answers in **4(d)(i)** and the equation shown.

$$R_2 = \frac{V_2}{I_2}$$

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

R_2 = ... Ω [1]

(e) (i) The actual value of R_2 is calculated using the equation shown.

$$R_2 = \frac{5 \times R_1}{6}$$

Calculate the actual value of R_2.

Use your answer in **4(b)(ii)** and the equation shown.

actual value of R_2 = ... Ω [1]

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

Explain if the values of R_2 in **4(d)(ii)** and **4(e)(i)** are considered equal within the limits of experimental error.

Justify your answer with a calculation.

.....

..... [2]

(f) A 3 V power supply is used in this experiment.

State **one** difficulty in taking readings from the voltmeter or ammeter in Figure 4.6 if a 12 V power supply is used instead of a 3 V power supply.

.....

.....

[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

