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CAMBRIDGE
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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6700579529

COMBINED SCIENCE **0653/51**

Paper 5 Practical Test **May/June 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	
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Total	

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1 **(a)** You are going to investigate 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).

You will compare the rate of reaction with different concentrations of aqueous hydrogen peroxide by measuring the temperature.

(i) Procedure

step 1 Label three test-tubes **A**, **B** and **C**.

step 2 Cover the outside of each test-tube with a piece of foil. Make sure that the label on each test-tube remains visible.

step 3 Add distilled water and aqueous hydrogen peroxide to each test-tube as shown in Table 1.1.

Table 1.1

test-tube	volume of aqueous hydrogen peroxide / cm^3	volume of distilled water / cm^3
A	10	0
B	5	5
C	0	10

step 4 Place a thermometer into test-tube **A** and stir. Measure the temperature of the solution to the nearest 0.5 °C. Record this value in Table 1.2 as 'initial temperature'.

step 5 Stir the yeast suspension.

step 6 Add 1 cm^3 of yeast suspension (catalase enzyme) to test-tube **A**.

step 7 Stir the mixture and measure the highest temperature reached. Record this value in Table 1.2.

step 8 Remove the thermometer from the test-tube and wash the thermometer with distilled water.

step 9 Repeat **step 4** to **step 8** using test-tube **B** and then test-tube **C**.

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Table 1.2

test-tube	initial temperature /°C	highest temperature /°C	change in temperature /°C
A			
B			
C			

[4]

(ii) Complete Table 1.2 by calculating the change in temperature for each test-tube **A**, **B** and **C**. [1]

(iii) Identify the independent variable in this investigation.

..... [1]

(iv) Suggest why:

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

.....

.....

- the yeast suspension is stirred in **step 5**.

.....

.....

[2]

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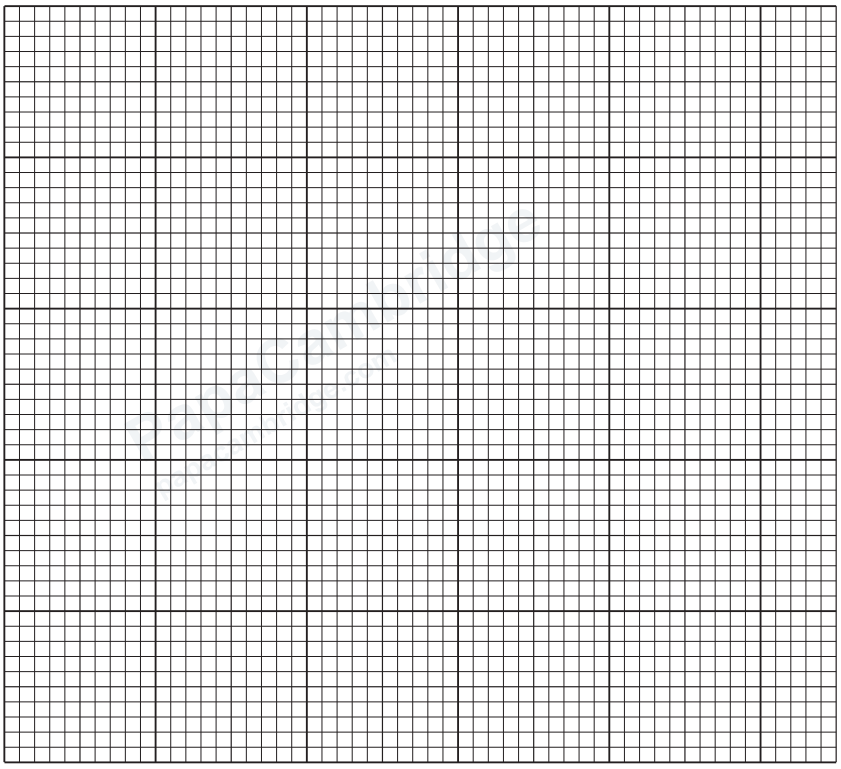
(b) A student repeats the investigation using different percentage concentrations of hydrogen peroxide.

The results are shown in Table 1.3.

Table 1.3

percentage concentration of hydrogen peroxide	change in temperature / °C
0	0.0
1	2.5
2	4.0
3	6.0
4	7.5
5	9.0

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



[3]

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

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

.....

..... [1]

[Total: 13]

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2 You are going to prepare a sample of an aqueous salt.

Procedure

step 1 Measure 10 cm^3 of dilute sulfuric acid.

step 2 Pour the dilute sulfuric acid into a beaker.

step 3 Add one spatula load of solid **H**.

step 4 Use a glass rod to stir the mixture.

step 5 Repeat **step 3** and **step 4** until no further reaction is seen and unreacted solid remains in the beaker.

step 6 Filter the reaction mixture into a conical flask.

(a) In **step 3** the mixture fizzes.

The gas given off turns limewater milky.

Identify the anion (negative ion) present in solid **H**.

..... [1]

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

[2]

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

filtrate .....

residue .....

[2]

(d) Procedure

- Place the wooden splint into the filtrate.
- Leave the splint to soak in the filtrate for about 1 minute.
- Do a flame test by placing the splint into the edge of a blue Bunsen burner flame.

(i) State the colour you observe in the flame test.

Identify the cation (positive ion) present in the filtrate.

colour .....

cation .....

[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]

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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.

You are not required to do this investigation.

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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4 You are going to investigate the resistance of two resistance wires.

A circuit has been assembled for you with a resistance wire taped to a metre ruler.

Figure 4.1 shows a diagram of this circuit. The resistor is missing from the diagram.

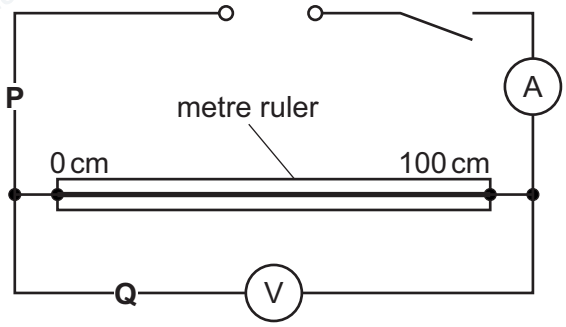


Figure 4.1

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

Draw in the box the electrical symbol for a resistor.

[1]

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(b) (i) Close the switch.

Record the voltmeter reading V_1.

V_1 = ... V [1]

(ii) Record the ammeter reading I_1.

I_1 = ...A [1]

(iii) Open the switch.

Calculate the resistance R_1 of the wire.

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

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

R_1 = ... Ω [1]

(c) (i) Take the resistance wire from the tray and connect it to the resistance wire on the ruler as shown in Figure 4.2.

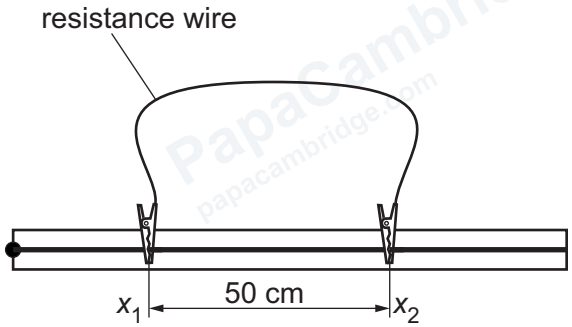


Figure 4.2

The two crocodile clips must be 50.0 cm apart.

The readings on the metre ruler where the crocodile clips are placed are x_1 and x_2.

Record the values of x_1 and x_2.

x_1 = ... cm

x_2 = ... cm [1]

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(ii) One difficulty in measuring x_1 and x_2 is that the end of the crocodile clip is wide.

Suggest a change to the apparatus that overcomes this difficulty.

.....

..... [1]

(iii) Close the switch.

Record the voltmeter reading V_2.

V_2 = ... V

Record the ammeter reading I_2.

I_2 = ... A

Open the switch.

[1]

(iv) Suggest **one** reason why it is important to open the switch after taking readings.

.....

..... [1]

(v) Calculate R_2.

Use your values in **4(c)(iii)** and the equation shown.

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

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

R_2 = ... Ω [1]

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(d) **(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)(iii)** 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(c)(v)** and **4(d)(i)** are considered equal within the limits of experimental error.

Justify your answer with a calculation.

.....

..... [2]

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

State **one** difficulty in taking readings from the voltmeter or ammeter 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

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