Cambridge IGCSE™

CANDIDATE NAME										
CENTRE NUMBER						CANDIDATE NUMBER				

0480700634

COMBINED SCIENCE **0653/51**

Paper 5 Practical Test **May/June 2024**

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.

DC (DE/SG) 329575/3

1 **(a)** You are going to investigate the effect of copper sulfate on the enzyme amylase.

Amylase speeds up the breakdown of starch into the sugar maltose. The word equation is shown.

$$\text{starch} \xrightarrow{\text{amylase}} \text{maltose}$$

The progress of this reaction can be followed by using iodine solution to test for the presence of starch.

Procedure

Step 1 Label four test-tubes, **S1**, **S2**, **A** and **C**.

Step 2 Use a clean syringe to add $2\,cm^3$ of **starch** to test-tube **S1** and $2\,cm^3$ of **starch** to test-tube **S2**.

Step 3 Use a clean syringe to add $2\,cm^3$ of **amylase** solution to test-tube **A** and $2\,cm^3$ of **amylase** solution to test-tube **C**.

Step 4 Use a clean syringe to add $1\,cm^3$ of **copper sulfate** to test-tube **C** only.

Step 5 Place all four test-tubes into a hot water-bath at approximately 50 °C.

(i) Record the temperature of the water-bath.

temperature = ... °C [1]

Step 6 Start the stop-clock and wait for 3 minutes.

While you are waiting continue with **step 7** and **step 8**.

Step 7 Label the wells on a spotting tile as shown in Fig. 1.1.

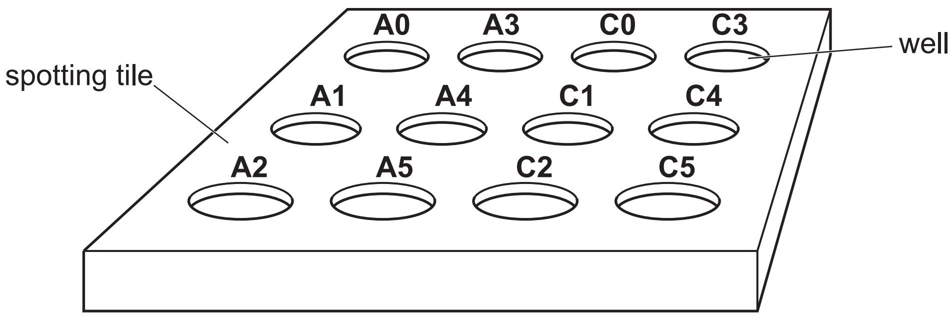


Fig. 1.1

Step 8 Add 2 drops of iodine solution to each well in the spotting tile.

Procedure continued

Step 9 After waiting for 3 minutes, stop and zero the stop-clock.

Step 10 Pour the contents of test-tube **S1** into test-tube **A**.

Step 11 Pour the contents of test-tube **S2** into test-tube **C**.

Step 12 Use a dropping pipette to put a drop of solution from test-tube **A** into well **A0**.

Step 13 Use another dropping pipette to put a drop of solution from test-tube **C** into well **C0**.

Step 14 Start the stop-clock.

Step 15 Repeat **step 12** and **step 13** for test-tubes **A** and **C** at one minute, using well **A1** and **C1**.

Step 16 Repeat **step 12** and **step 13** for test-tubes **A** and **C** at one minute intervals for a further 4 minutes, using wells **A2–A5** and **C2–C5**.

(ii) Record in Table 1.1, the colour of the iodine solution in each well for test-tubes **A** and **C**.

Table 1.1

time / minutes	colour in the well after adding solution from test-tube **A**		colour in the well after adding solution from test-tube **C**	
	well	colour	well	colour
0	**A0**		**C0**	
1	**A1**		**C1**	
2	**A2**		**C2**	
3	**A3**		**C3**	
4	**A4**		**C4**	
5	**A5**		**C5**	

[3]

(iii) Explain the results for test-tube **A**.

....

....

....

.... [2]

(iv) Describe the effect of copper sulfate on the reaction.

....

.... [1]

(v) Calculate the difference in volume of the solution in test-tube **A** and the solution in test-tube **C** at the end of **step 11**.

Use the information from **steps 2**, **3** and **4**.

volume of solution in test-tube **A** = ... cm^3

volume of solution in test-tube **C** = ... cm^3

difference in volume = ... cm^3
[1]

(vi) The difference in volume of solution that you calculated in **(a)(v)** identifies a limitation in this investigation.

Suggest a change to the procedure that removes this limitation.

....

.... [1]

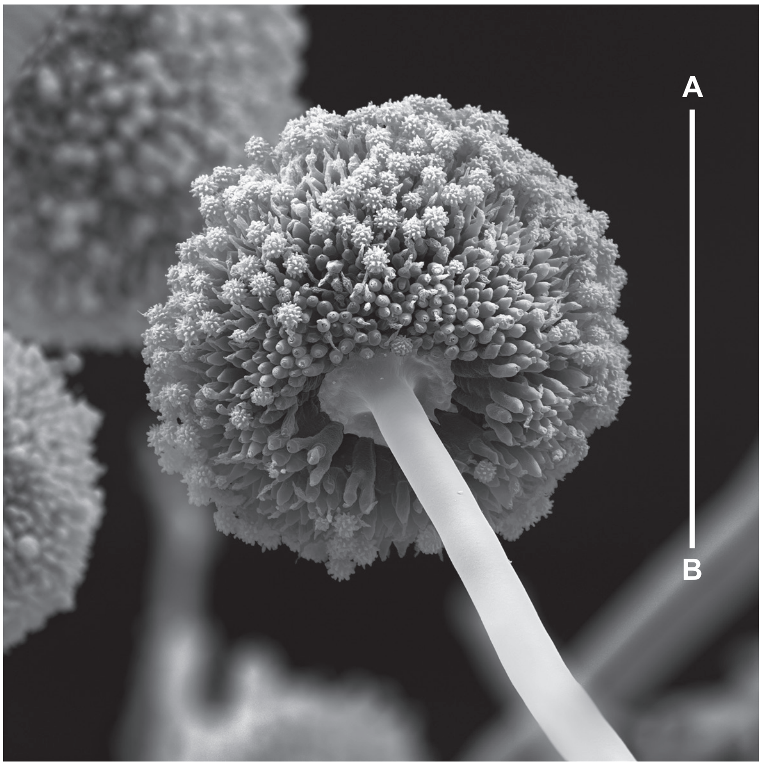
(vii) Explain why the test-tubes are left for 3 minutes in **step 6**.

....

.... [1]

(b) Amylase is extracted from the fungus *Aspergillus*.

Fig. 1.2 shows a photograph of the fruiting body of the fungus taken using a microscope.



magnification = ×920

Fig. 1.2

Line **AB** represents the diameter of the fruiting body.

(i) Measure the length of line **AB** on Fig. 1.2.

length of line **AB** = ... mm [1]

(ii) Calculate the actual diameter of the fruiting body.

Use the equation shown.

$$\text{actual diameter} = \frac{\text{length of line } \mathbf{AB}}{\text{magnification}}$$

Give your answer to **one** significant figure.

actual diameter = ... mm [2]

[Total: 13]

2 You are going to investigate the reaction of sodium hydrogencarbonate with dilute sulfuric acid.

This reaction produces carbon dioxide gas.

(a) Procedure

Step 1 Using a measuring cylinder, put 50 cm^3 of dilute sulfuric acid into a 250 cm^3 beaker.

Step 2 Add one spatula of sodium hydrogencarbonate to the acid.

Step 3 Immediately start a stop-watch.

Step 4 Stir the mixture until it stops fizzing.

Step 5 Stop the stop-watch.

Step 6 Record in Table 2.1 this reaction time to the nearest second.

Step 7 Rinse the beaker with distilled water.

Step 8 Repeat the procedure four more times using the number of spatulas of sodium hydrogencarbonate shown in Table 2.1.

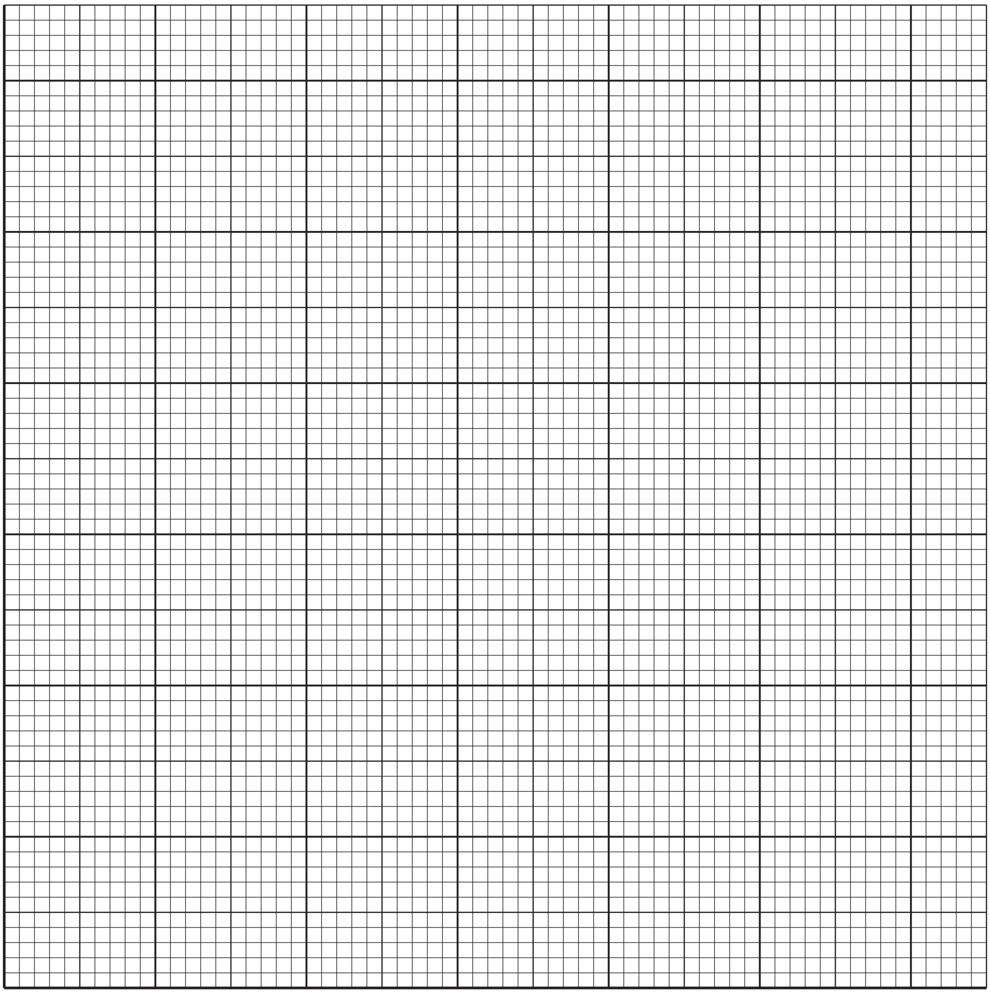
Table 2.1

number of spatulas of sodium hydrogencarbonate	reaction time / s
1	
2	
3	
4	
5	

[4]

(b) **(i)** On the grid, plot reaction time (vertical axis) against the number of spatulas of sodium hydrogencarbonate.

The *x*-axis must include 6 spatulas of sodium hydrogencarbonate. You should also extend your *y*-axis.



[3]

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

(iii) Describe the relationship between the number of spatulas of sodium hydrogencarbonate and the reaction time.

....

.... [1]

(iv) Use your graph to predict the reaction time for 6 spatulas of sodium hydrogencarbonate.

Show your working on the graph.

reaction time = ... s [2]

(c) **(i)** State why it is difficult to measure the reaction time accurately.

....

.... [1]

(ii) Suggest a change to **step 2** to improve the procedure.

....

.... [1]

[Total: 13]

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3 You are going to determine the density of a wooden block.

(a) Fig. 3.1 shows a wooden block.

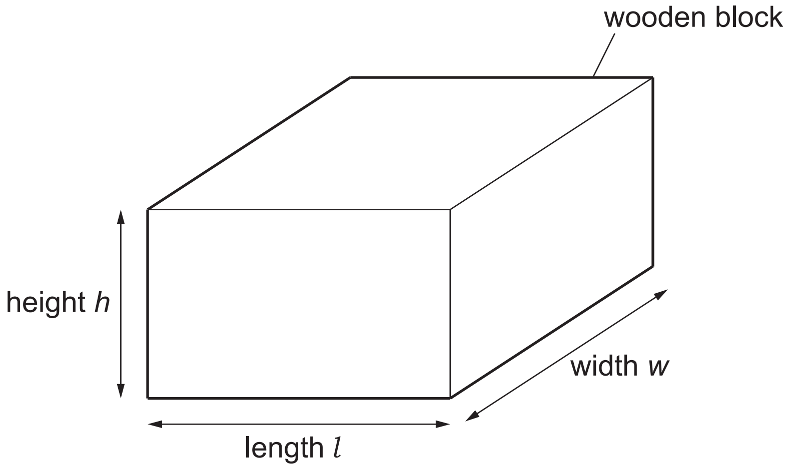

Fig. 3.1

(i) Measure the height h, width w and length l of your wooden block.

Record each measurement to the nearest 0.1 cm.

h = ... cm

w = ... cm

l = ... cm
[1]

(ii) Calculate the volume V_{block} of the wooden block.

Use the equation shown.

$$V_{block} = h \times w \times l$$

V_{block} = ... cm^3 [1]

(b) You are provided with two identical beakers labelled **A** and **B**, each containing 100 cm^3 of water.
You are also provided with a measuring cylinder containing water.

(i) Record the initial volume of water V_1 in the measuring cylinder.

V_1 = ... cm^3 [1]

Procedure

- Carefully place the wooden block in beaker **A**.
  The water level in beaker **A** rises as the wooden block displaces water and the block floats.
- Place beaker **B** next to beaker **A**.
- Slowly pour water from the measuring cylinder into beaker **B** until the water level in beaker **B** is the same as the level in beaker **A**.
- Remove the wooden block from beaker **A**.

(ii) Record the final volume of water V_2 in the measuring cylinder.

V_2 = ...cm^3 [1]

(iii) The mass M of the wooden block is equal to the mass of water displaced by the block when it is placed in beaker **A**.

1.0 cm^3 of water has a mass of 1.0 g.

Calculate the mass M.

Use the equation shown.

$$M = (V_1 - V_2) \times 1.0$$

M = ... g [1]

(c) Calculate the density ρ of the wooden block.

Use your answers to **(a)(ii)** and **(b)(iii)** and the equation shown.

$$\rho = \frac{M}{V_{block}}$$

ρ = ...g / cm^3 [1]

(d) Another student repeats the experiment and makes an error when reading V_2. Their value of V_2 is too small.

State the effect this has on the calculated density ρ of the wooden block.

Give a reason for your answer.

effect ....

reason ....

....
[1]

[Total: 7]

4 A thermistor is a type of variable resistor.

A thermistor is used to measure changes in the temperature of water in a beaker. The resistance of the thermistor changes as the water temperature changes.

The resistance *R* of the thermistor at temperature *T* is calculated using the equation:

$$R_T = \frac{V}{I}$$

where *V* is the potential difference across the thermistor
and *I* is the current through the thermistor.

Plan an investigation to find the relationship between the temperature of the water and the resistance of the thermistor.

You are provided with:

- a supply of hot and cold water
- extra connecting wires (or leads)
- the assembled apparatus shown in Fig. 4.1.

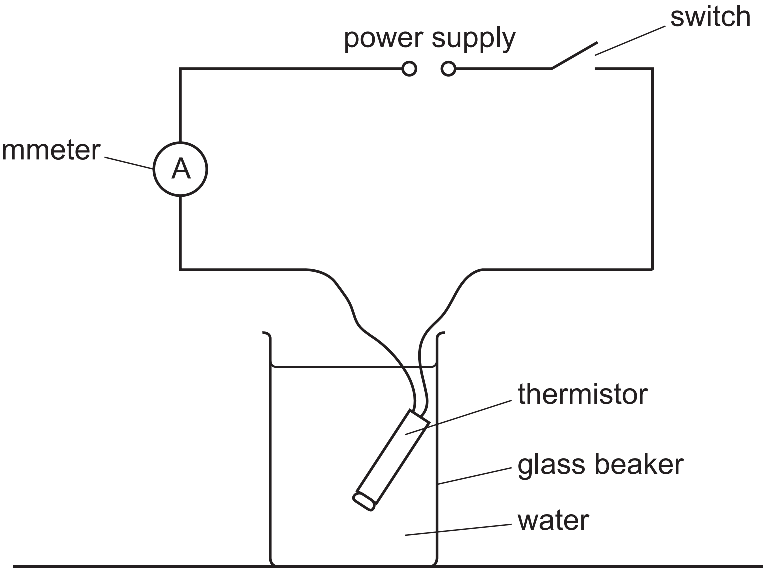

Fig. 4.1

You may use any common laboratory apparatus in your plan.

You are not required to do this investigation.

In your plan, include:

- a brief description of how you will use the assembled apparatus shown in Fig. 4.1
- any other apparatus needed
- what you will measure and how you will make sure your measurements are accurate
- a results table to record your measurements (you do **not** need to enter any readings in the table)
- how you will process your results to draw a conclusion.

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.... [7]

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NOTES FOR USE IN QUALITATIVE ANALYSIS

Tests for anions

anion	test	test result
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify, 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	green ppt., insoluble in excess
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 results
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