Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

COMBINED SCIENCE **0653/51**

Paper 5 Practical Test **October/November 2023**

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 (LK/SW) 319389/2

1 You are going to investigate the effect of an enzyme used in the large-scale production of apple juice from apples.

(a) You are provided with a beaker containing 50 cm^3 of apple puree and a beaker containing an enzyme solution.

Procedure

step 1 Use the beaker labelled **water-bath** and the hot and cold water provided to set up a water-bath at approximately 40 °C.

step 2 Label two boiling tubes (large test-tubes) **E** and **W**.

step 3 Use the spatula to half-fill both boiling tubes with apple puree.

step 4 Use a clean syringe to add 10 cm^3 of enzyme solution to the boiling tube labelled **E**.

step 5 Use a clean syringe to add 10 cm^3 of distilled water to the boiling tube labelled **W**.

step 6 Stir the contents of each boiling tube using a clean glass rod.

step 7 Place both boiling tubes into the water-bath.

step 8 Start the stop-clock and wait for 10 minutes.

Continue with **1(b)** and **1(c)** while you are waiting.

step 9 After 10 minutes, measure the temperature of the water in the water-bath.

(i) Record the temperature of the water.

temperature of water = ... °C [1]

(ii) **step 10** Place a filter funnel into the top of each measuring cylinder.

step 11 Place a folded filter paper into each filter funnel.

step 12 Pour the contents of boiling tube **E** into one filter paper and the contents of boiling tube **W** into the other filter paper, as shown in Fig. 1.1.

Leave for 2 minutes.

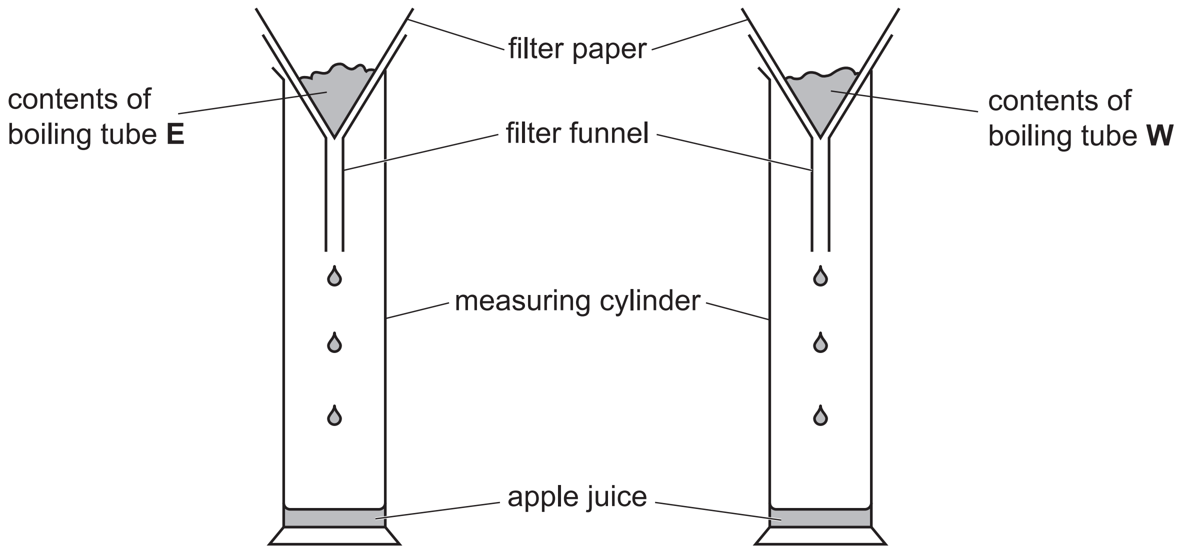

Fig. 1.1

step 13 After 2 minutes, measure the volume of apple juice in each measuring cylinder.

Record in Table 1.1 the volume of apple juice collected after 2 minutes.

Table 1.1

boiling tube	volume of apple juice after 2 minutes / cm^3
E	
W	

[3]

(iii) Use your results to suggest why this enzyme is used in the large-scale production of apple juice.

....

.... [1]

(iv) Use your measurement in **1(a)(i)** to decide if temperature is a source of error in your investigation.

Tick the appropriate box and explain your decision.

☐ temperature is a source of error

☐ temperature is **not** a source of error

explanation ....

....

.... [1]

(v) Identify **one** source of error in **step 3**.

Suggest a suitable piece of apparatus to overcome this error.

error ....

apparatus .... [1]

(b) You are provided with a section through an apple.

In the box, make a large clear pencil drawing of the cut surface of the apple.

[3]

(c) Fig. 1.2 shows some cells in apple puree.

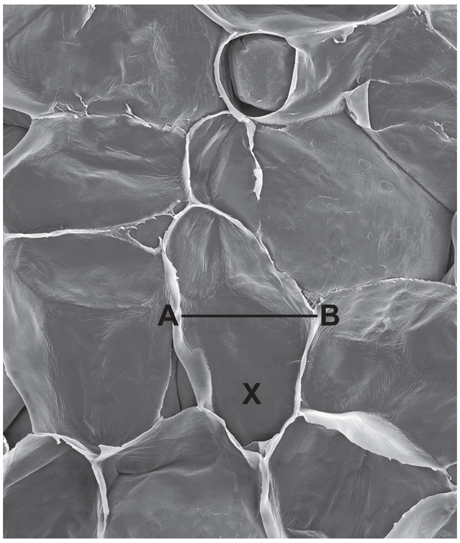

Fig. 1.2

(i) Line **AB** represents the width of the apple cell labelled **X**.

Measure the length of line **AB**.

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

(ii) The cells in Fig. 1.2 are magnified ×160.

Calculate the actual width of the apple cell labelled **X**.

Use the equation shown.

$$\text{actual width of cell } \mathbf{X} = \frac{\text{length of line } \mathbf{AB}}{\text{magnification}}$$

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

actual width of cell **X** = ... mm [2]

[Total: 13]

Check that you have completed 1(a).

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2 You are going to investigate the rate of reaction between magnesium and dilute hydrochloric acid.

(a) (i) **Procedure**

step 1 Use a measuring cylinder to measure 25.0 cm^3 of dilute hydrochloric acid.

step 2 Add the dilute hydrochloric acid to a 100 cm^3 glass beaker.

step 3 Cut a 5 mm length of magnesium ribbon.

step 4 Put the magnesium ribbon into the dilute hydrochloric acid in the beaker and immediately start a stop-watch.

step 5 Use a glass rod to keep the magnesium ribbon under the surface of the dilute hydrochloric acid but **not** touching the bottom of the beaker.

step 6 Stop the stop-watch when all the magnesium ribbon has reacted and disappeared.

step 7 Record in Table 2.1 the reaction time (the time it takes for all the magnesium to react) to the nearest second.

step 8 Empty, rinse and dry the beaker.

Table 2.1

length of magnesium ribbon / mm	reaction time / s	rate of reaction in mm / s
5		
10		
15		
20		
25		

[1]

(ii) Repeat the procedure four more times using 10 mm, 15 mm, 20 mm and 25 mm lengths of magnesium ribbon instead of 5 mm.

Record in Table 2.1 the reaction times to the nearest second. [3]

(iii) Calculate the rate of reaction for each length of magnesium ribbon.

Use the equation shown.

$$\text{rate of reaction} = \frac{\text{length of magnesium ribbon}}{\text{reaction time}}$$

Record your values in Table 2.1. [1]

(b) **(i)** On the grid, plot a graph of the rate of reaction (vertical axis) against the length of magnesium ribbon.

[3]

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

(iii) Describe the relationship between the rate of reaction and the length of magnesium ribbon.

....

.... [1]

(c) Explain the importance of **step 5** in the procedure.

....

.... [1]

(d) Suggest **one** source of uncertainty in the measurement of the reaction time.

....

.... [1]

(e) A student repeats the procedure in **(a)** using a 100 mm length of magnesium ribbon.

The student concludes that the magnesium ribbon is in excess.

Suggest an observation the student makes to reach this conclusion.

....

.... [1]

[Total: 13]

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3 You are going to investigate the reflection of light by a plane mirror.

(a) Fig. 3.1 shows a horizontal line **XZ**.

Line **NY** is the normal to line **XZ** at point **Y**.

Line **AY** meets line **XZ** at point **Y**.

The angle of incidence i is the angle between line **AY** and the normal, as shown in Fig. 3.1.

Measure the angle of incidence i in Fig. 3.1.

i = ...° [1]

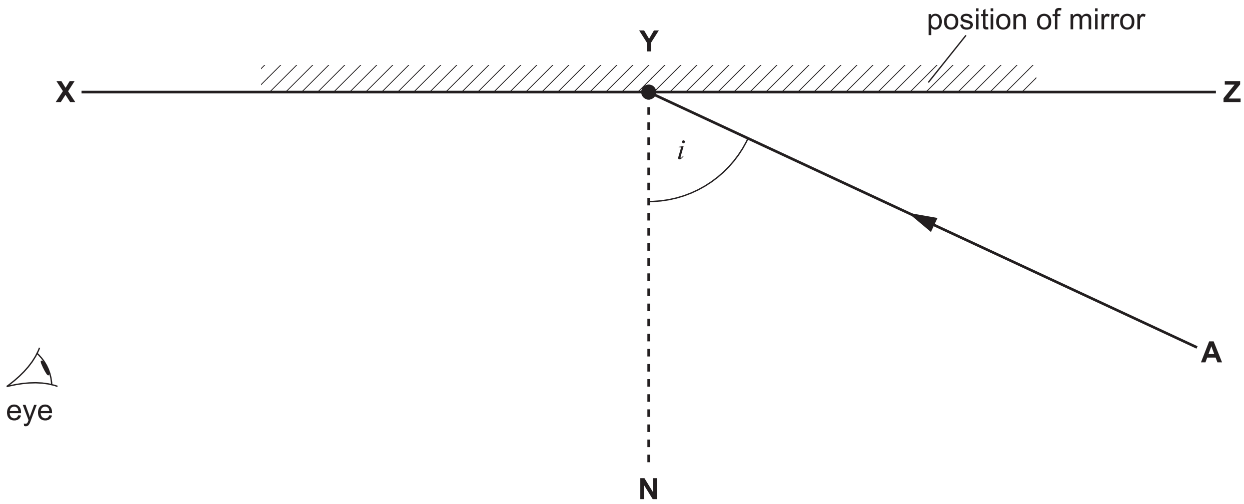

Fig. 3.1

(b) **Procedure**

- Place the pinboard under page 12 of the question paper (single page only) so that Fig. 3.1 is over the pinboard and facing upwards.
- Put the mirror along line **XZ** with the reflecting face of the mirror facing letter **N** on Fig. 3.1.
- Centre the mirror at **Y**.
- Place two pins, P_1 and P_2, on line **AY** at least 5 cm apart. Make sure to push the pins through page 12 of the question paper and into the pinboard underneath so that the pins stand vertical.

(i) Label the positions of pins P_1 and P_2 on Fig. 3.1. [1]

(ii) **Procedure**

- Look into the mirror from the position of the eye shown in Fig. 3.1.
- View the **images** of pins P_1 and P_2 in the mirror.
- Place two pins, P_3 and P_4, to the **left** of the normal, so that pins P_3 and P_4 and the images of pins P_1 and P_2 all appear lined up, one behind the other.

Label the positions of pins P_3 and P_4 on Fig. 3.1. [1]

(c) **Procedure**

- Remove the mirror, the pins and the pinboard.
- Draw a straight line through the positions of pins P_3 and P_4.
- Continue the line until it meets line **XZ**.

Label the angle θ between line P_3P_4 and line **XZ**.

Measure angle θ.

θ = ... ° [3]

(d) Describe **one** practical difficulty in doing the procedure in **(b)(ii)**.

....

.... [1]

[Total: 7]

4 Plan an investigation to determine the relationship between the temperature of apple juice and the time it takes for ice cubes to melt when added to it.

You are provided with:

- ice cubes of different shapes and sizes
- a supply of apple juice
- beakers.

You may use any other common laboratory apparatus.

You are not required to do this investigation.

In your plan, include:

- any other apparatus you will need
- a brief description of the method, including what you will measure and how you will make sure your measurements are accurate
- the variables you will control
- a results table to record your measurements (you are not required to enter any readings in the table)
- how you will process your results to draw a conclusion.

You may include a labelled diagram if you wish.

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.... [7]

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 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