Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

9292877466

COMBINED SCIENCE **0653/61**

Paper 6 Alternative to Practical **October/November 2023**

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 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 [ ].

This document has **16** pages. Any blank pages are indicated.

[Turn over

1 A student investigates the effect of an enzyme used in the large-scale production of apple juice from apples.

(a) Procedure

The student:

step 1 labels two test-tubes **E** and **W**

step 2 uses a spatula to add apple puree (crushed apple) to each test-tube

step 3 adds 10 cm^3 of the enzyme to the test-tube labelled **E**

step 4 adds 10 cm^3 of distilled water to the test-tube labelled **W**

step 5 stirs the contents of each test-tube using a clean glass rod

step 6 puts both test-tubes in a beaker containing 250 cm^3 of water at an initial temperature of 40 °C

step 7 waits for 10 minutes and then measures the final temperature of the water in the beaker.

(i) Fig. 1.1 shows the reading on the thermometer.

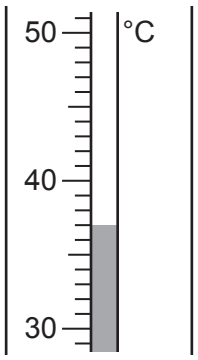


Fig. 1.1

Record the final temperature of the water.

final temperature of water = ... °C [1]

(ii) The student:

step 8 filters the contents of each test-tube as shown in Fig. 1.2

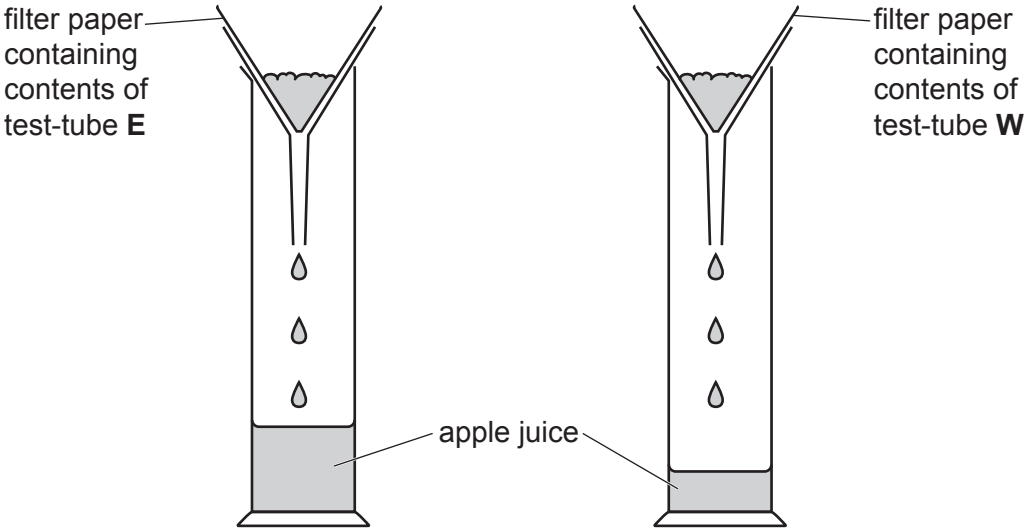


Fig. 1.2

step 9 collects the juice in a measuring cylinder for 5 minutes.

Fig. 1.3 shows the volume of juice collected in each measuring cylinder after 5 minutes.

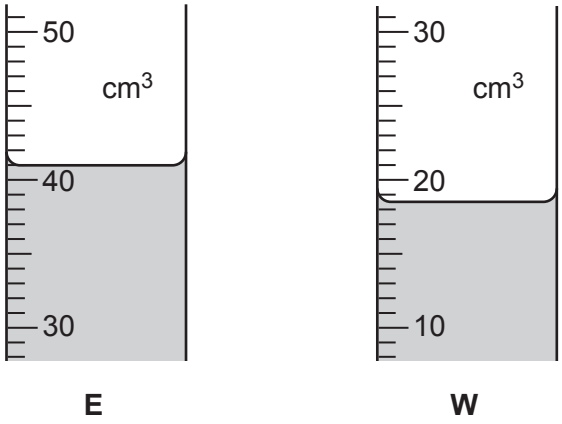


Fig. 1.3

Record in Table 1.1 the volume of apple juice collected from each test-tube to the nearest 0.5 cm^3.

Table 1.1

test-tube	volume of apple juice collected / cm^3
E	
W	

[2]

[Turn over

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

.....

..... [1]

(iv) Use your answer in **(a)(i)** to decide if temperature is a source of error in this 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 2**.

Suggest a suitable piece of apparatus to overcome this error.

error .....

apparatus .....
[1]

(vi) Suggest why it is important to use a clean glass rod in **step 5**.

.....

..... [1]

(b) Fig. 1.4 shows a section through an apple.

Fig. 1.4

In the box, make a large clear pencil drawing of the apple section shown in Fig. 1.4.

[3]

(c) Fig. 1.5 shows some cells in apple puree.

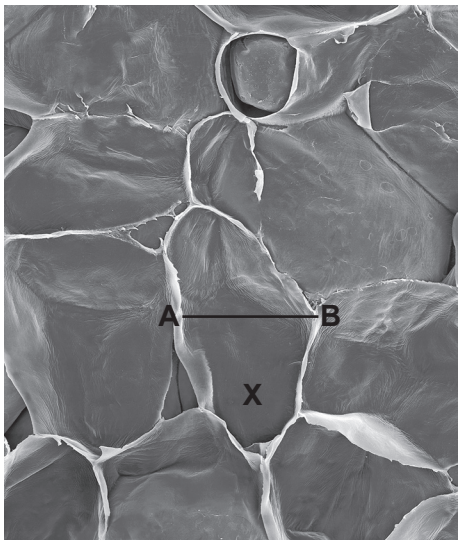


Fig. 1.5

(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. 1.5 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]

2 **(a)** When magnesium ribbon is added to dilute hydrochloric acid, the mixture fizzes and makes hydrogen gas. The magnesium ribbon stays on the surface of the acid during the reaction. The reaction is complete when all the magnesium ribbon disappears and the fizzing stops.

State the test used to confirm the presence of hydrogen gas and give the observation for a positive result.

test .....

observation .....
[1]

(b) A student investigates the rate of reaction between magnesium ribbon and dilute hydrochloric acid.

Procedure

The student:

step 1 adds 25 cm^3 of dilute hydrochloric acid to a glass beaker

step 2 puts a 5 mm length of magnesium ribbon into the dilute hydrochloric acid and immediately starts a stop-watch

step 3 uses 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 4 stops the stop-watch when all the magnesium ribbon has reacted

step 5 records in Table 2.1 the reaction time (the time it takes for all the magnesium ribbon to react) to the nearest second

step 6 repeats **step 1** to **step 5** four more times using 10 mm, 15 mm, 20 mm and 25 mm lengths of magnesium ribbon instead of 5 mm.

(i) In **step 1**, the student uses a measuring cylinder to measure 25 cm^3 of dilute hydrochloric acid.

Suggest **one** other piece of apparatus suitable for measuring 25 cm^3 accurately.

..... [1]

(ii) Explain the importance of **step 3** in the procedure.

.....

..... [1]

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

.....

..... [1]

[Turn over

(iv) Fig. 2.1 shows the stop-watch readings for 5 mm and 25 mm lengths of magnesium ribbon.

5 mm length 25 mm length

Fig. 2.1

Record in Table 2.1 the reaction times in Fig. 2.1 to the nearest second.

Table 2.1

length of magnesium ribbon / mm	reaction time / s	rate of reaction in mm / s
5		
10	31	0.32
15	29	0.52
20	30	0.67
25		

[2]

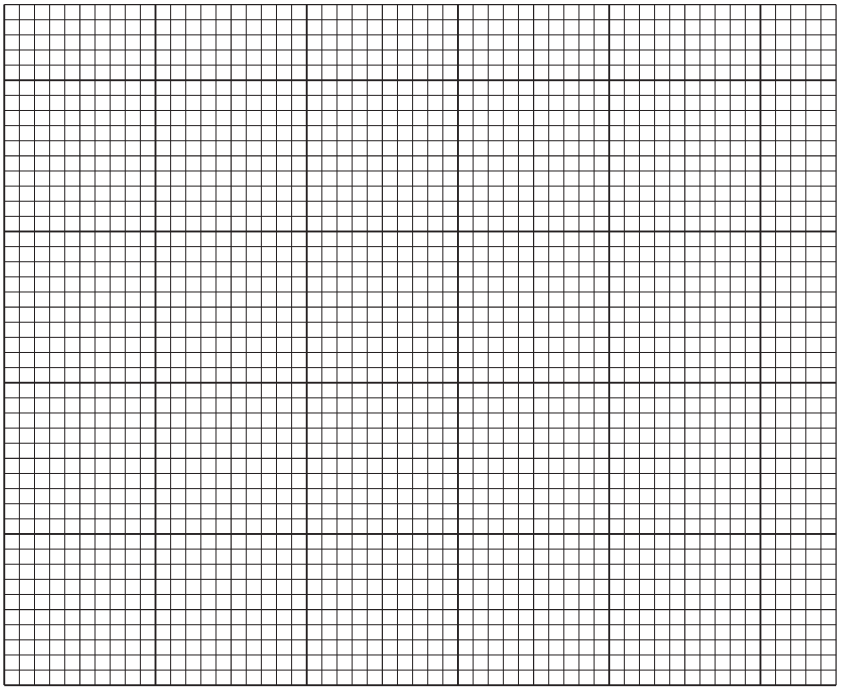
(v) Calculate the rate of reaction for the 5 mm and 25 mm lengths of magnesium ribbon.

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]

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



[3]

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

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

.....

..... [1]

(c) The student repeats the procedure in **(b)** 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]

[Turn over

3 A student investigates the reflection of light by a plane mirror.

(a) Fig. 3.1 on page 11 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]

(b) Procedure

The student:

- puts the mirror along line **XZ** with the reflecting face of the mirror facing the letter **N** on Fig. 3.1
- places two pins, P_1 and P_2, on line **AY** at least 5 cm apart.

(i) On Fig. 3.1, mark with crosses suitable positions for pins P_1 and P_2.

Label the crosses P_1 and P_2. [1]

(ii) Procedure

The student:

- looks into the mirror from the position of the eye shown in Fig. 3.1
- views the **images** of pins P_1 and P_2 in the mirror
- places two pins, P_3 and P_4, to the right 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.

The position of pin P_3 is already shown on Fig. 3.1.

Mark with a cross a suitable position for pin P_4.

Label the cross P_4. [1]

(c) 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 = ... ° [2]

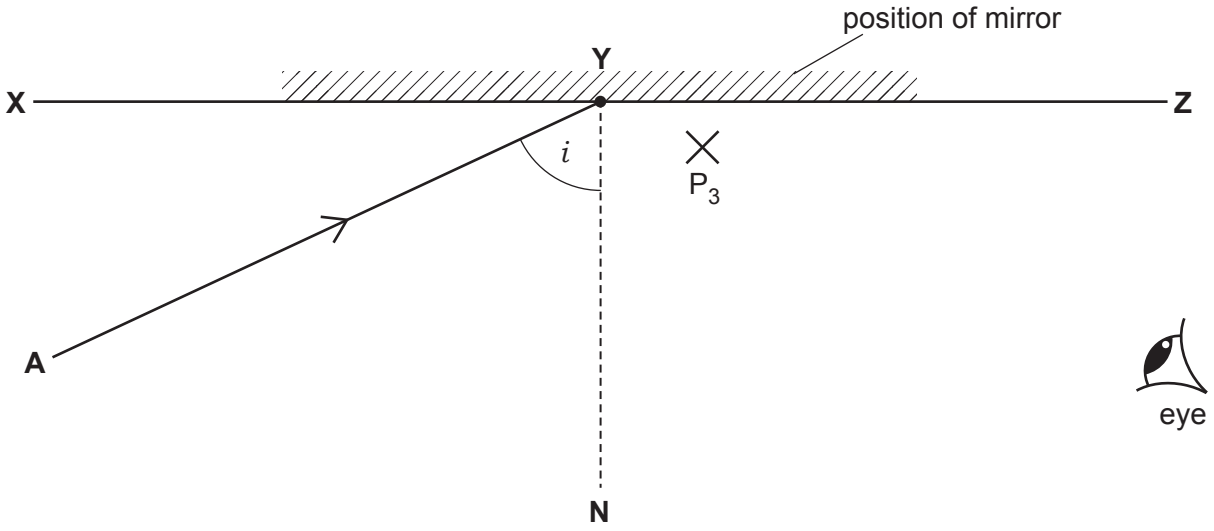


Fig. 3.1

(d) Procedure

The student:

- repeats the experiment for i = 30°, 45° and 60°
- takes three readings of θ for each value of i
- records the results in Table 3.1.

Table 3.1

i / °	θ / °		
	reading 1	reading 2	reading 3
30	61	59	29
45	46	47	45
60	31	28	30

The student notices that there is an anomalous reading in Table 3.1.

(i) Circle the anomalous reading. [1]

(ii) Suggest what the student does to improve the data.

.....

..... [1]

[Total: 7]

[Turn over

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.

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]

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