



CANDIDATE  
NAME

|  |
|--|
|  |
|--|

CENTRE  
NUMBER

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|--|--|--|--|--|

CANDIDATE  
NUMBER

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|--|--|--|--|

## 0653/61

October/November 2023

**1 hour**

No additional materials are needed.

- 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.

- 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.

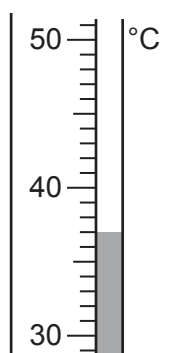
- 1 A student investigates the effect of an enzyme used in the large-scale production of apple juice from apples.

**(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  $10\text{ cm}^3$  of the enzyme to the test-tube labelled **E**
- step 4** adds  $10\text{ cm}^3$  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  $250\text{ cm}^3$  of water at an initial temperature of  $40^\circ\text{C}$
- 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.



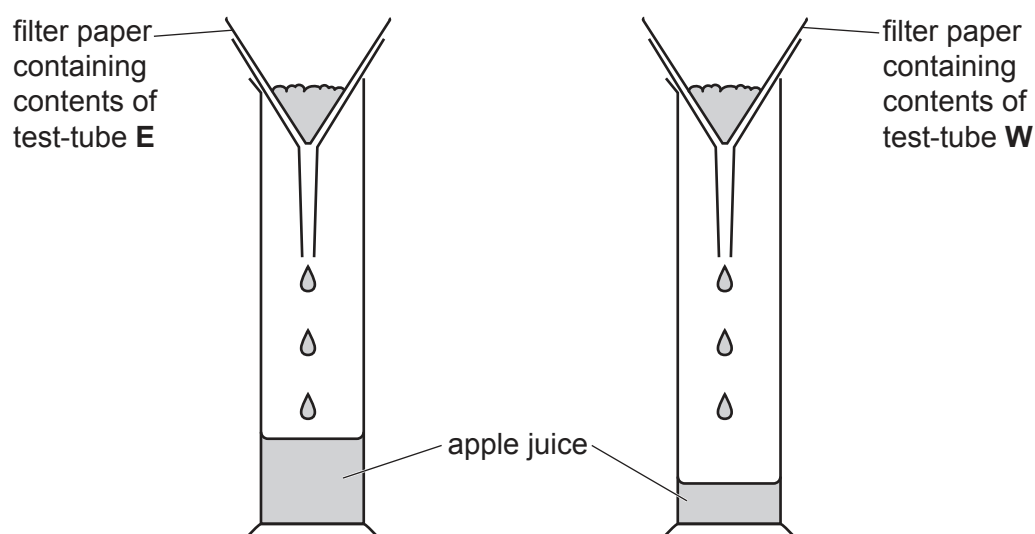
**Fig. 1.1**

Record the final temperature of the water.

final temperature of water = .....  $^\circ\text{C}$  [1]

(ii) The student:

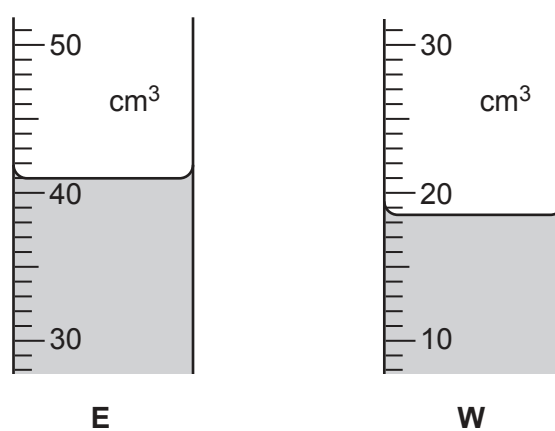
**step 8** filters the contents of each test-tube as shown in Fig. 1.2



**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  $0.5\text{ cm}^3$ .

**Table 1.1**

| test-tube | volume of apple juice collected<br>/ $\text{cm}^3$ |
|-----------|----------------------------------------------------|
| <b>E</b>  |                                                    |
| <b>W</b>  |                                                    |

[2]

- (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**.

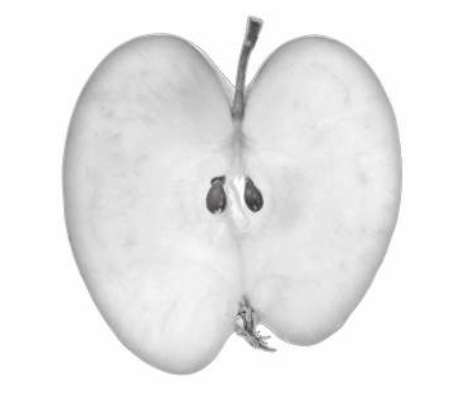
Suggest a suitable piece of apparatus to overcome this error.

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.

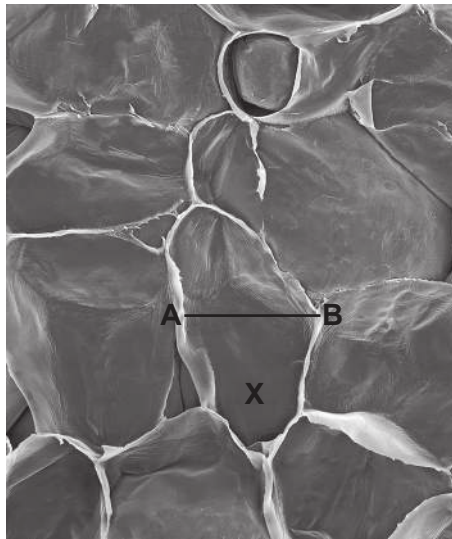


**Fig. 1.4**

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  $\times 160$ .

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

Use the equation shown.

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

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  $25\text{ cm}^3$  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  $25\text{ cm}^3$  of dilute hydrochloric acid.

Suggest **one** other piece of apparatus suitable for measuring  $25\text{ cm}^3$  accurately.

..... [1]

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

.....

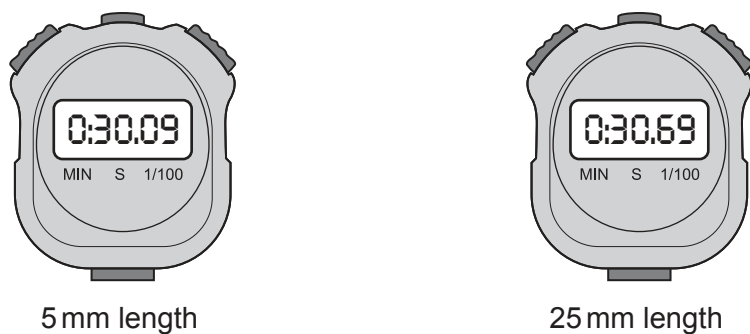
..... [1]

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

.....

..... [1]

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



**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<br>/mm | reaction time<br>/s | rate of reaction in<br>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.

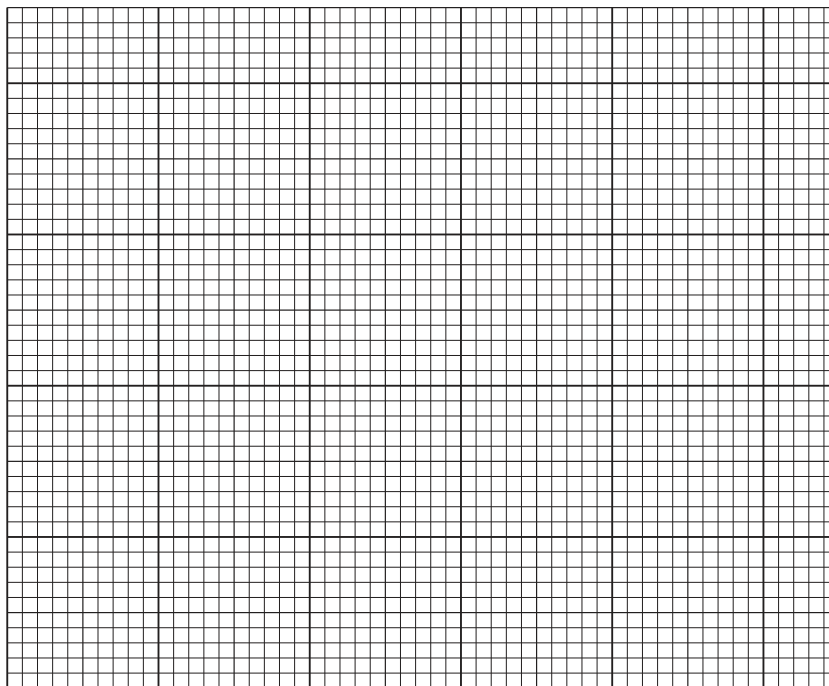
$$\text{rate of reaction} = \frac{\text{length of magnesium ribbon}}{\text{reaction time}}$$

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]

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.

$i = \dots\dots\dots^\circ$  [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  $\theta$  between line  $P_3P_4$  and line **XZ**.

Measure angle  $\theta$ .

$\theta = \dots\dots\dots^\circ$  [2]

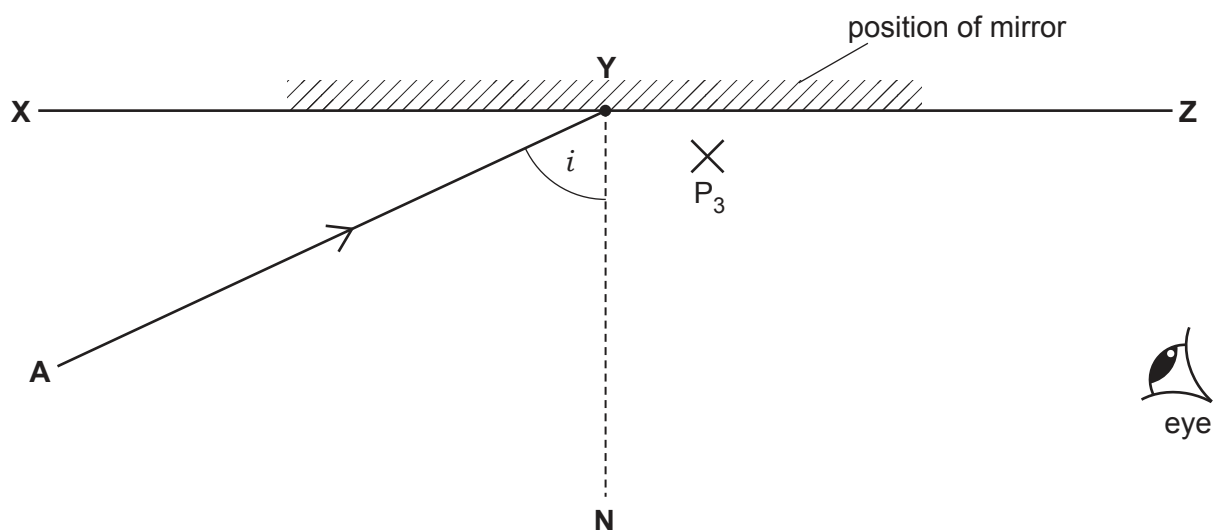


Fig. 3.1

**(d) Procedure**

The student:

- repeats the experiment for  $i = 30^\circ$ ,  $45^\circ$  and  $60^\circ$
- takes three readings of  $\theta$  for each value of  $i$
- records the results in Table 3.1.

**Table 3.1**

| $i / ^\circ$ | $\theta / ^\circ$ |           |           |
|--------------|-------------------|-----------|-----------|
|              | 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]

- 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.







**BLANK PAGE**

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cambridgeinternational.org](http://www.cambridgeinternational.org) after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.