



CANDIDATE  
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## 0653/52

May/June 2023

**1 hour 15 minutes**

You must answer on the question paper.

**You will need:** The materials and apparatus listed in the confidential 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.

- 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 **12** pages. Any blank pages are indicated.

- 1 You are going to investigate okra, a fruit which contains many seeds.

You are provided with a section of okra on a white tile.

- (a) In the box provided, draw a large, clear pencil drawing of the cut surface of the okra.

A large, empty rectangular box with a thin black border, intended for a pencil drawing of the cut surface of an okra.

[3]

- (b) (i) Measure the diameter of the section of okra on the white tile.

diameter of okra on white tile = ..... mm [1]

- (ii) Suggest why it is difficult to measure the diameter of the okra accurately.

.....  
 ..... [1]

- (iii) Measure the diameter of your drawing in (a).  
 Draw a line on your drawing to show where you have measured.

diameter of your drawing = ..... mm [1]

- (iv) Calculate the magnification of your drawing.

Use the equation shown.

$$\text{magnification} = \frac{\text{diameter of your drawing}}{\text{diameter of okra on white tile}}$$

magnification = ..... [1]

[Total: 7]

**2** The enzyme amylase breaks down starch to form a reducing sugar.

Plan an investigation to determine the relationship between temperature and the time taken to completely break down starch by amylase. Iodine is a brown solution that turns blue/black in the presence of starch.

You are provided with:

- 1% amylase solution
- 1% starch solution
- iodine solution

You may also use any other common laboratory apparatus.

**You are not required to do this investigation.**

In your plan include:

- the additional apparatus needed
- a brief description of the method and an explanation of any safety precautions you will take
- what you will measure
- which variables you will keep constant
- how you will process your results to draw a conclusion.

You may include a labelled diagram if you wish.

You may include a table that can be used to record the results if you wish.

You do **not** need to include any results in your results table.



3 You are going to investigate a white solid **H**.

(a) (i) **Procedure**

- Measure the mass of the clean dry test-tube labelled **H**.
- Record this mass in Table 3.1.
- Place two spatula loads of solid **H** into the test-tube.
- Measure the mass of the test-tube and solid **H**.
- Record this mass in Table 3.1.
- Using the test-tube holder, heat solid **H** safely for one minute using a blue Bunsen burner flame.
- Observe solid **H** during heating.
- Lay the test-tube on the laboratory mat and allow the test-tube to cool down.

**Table 3.1**

|                                             | mass<br>/g |
|---------------------------------------------|------------|
| empty test-tube                             |            |
| test-tube and solid <b>H</b> before heating |            |
| test-tube and the solid after heating       |            |

[2]

(ii) Describe your observation of solid **H** during heating.

..... [1]

**While you are waiting for the test-tube to cool down do part (b).**

(iii) When the test-tube is cool, measure the mass of the test-tube and the solid after heating.

Record this mass in Table 3.1. [1]

(iv) Describe your observation of the solid after cooling.

..... [1]

(v) Calculate the mass of solid **H** in the test-tube before heating.

Use the equation shown.

|                                          |   |                                                        |   |                         |
|------------------------------------------|---|--------------------------------------------------------|---|-------------------------|
| mass of solid <b>H</b><br>before heating | = | mass of test-tube and<br>solid <b>H</b> before heating | – | mass of empty test-tube |
|------------------------------------------|---|--------------------------------------------------------|---|-------------------------|

mass of solid **H** before heating = ..... g [1]

- (vi) Calculate the mass of the solid in the test-tube after heating.

Use the equation shown.

|                                    |   |                                                  |   |                         |
|------------------------------------|---|--------------------------------------------------|---|-------------------------|
| mass of the solid<br>after heating | = | mass of test-tube and<br>the solid after heating | – | mass of empty test-tube |
|------------------------------------|---|--------------------------------------------------|---|-------------------------|

mass of the solid after heating = ..... g [1]

- (vii) There is a loss in mass when solid **H** is heated.

Suggest **one** reason for this loss in mass.

..... [1]

- (viii) Calculate the percentage loss in mass.

Use the equation shown.

$$\text{percentage loss in mass} = \frac{\text{mass of solid H before heating} - \text{mass of the solid after heating}}{\text{mass of solid H before heating}} \times 100$$

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

percentage loss in mass = ..... [2]

- (ix) Explain why it is a good idea to heat solid **H** for at least five minutes rather than one minute.

.....  
 ..... [1]

- (x) State **one** reason why the test-tube must be heated with a blue Bunsen burner flame rather than a yellow Bunsen burner flame.

..... [1]

- (b) Put about 3 cm depth of dilute hydrochloric acid in a clean test-tube.

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

Describe **one** observation.

..... [1]

**Go back to (a)(iii) to finish question (a).**

[Total: 13]

- 4 You are going to measure the focal length  $F$  of a convex lens.

Arrange the equipment as shown in Fig. 4.1.

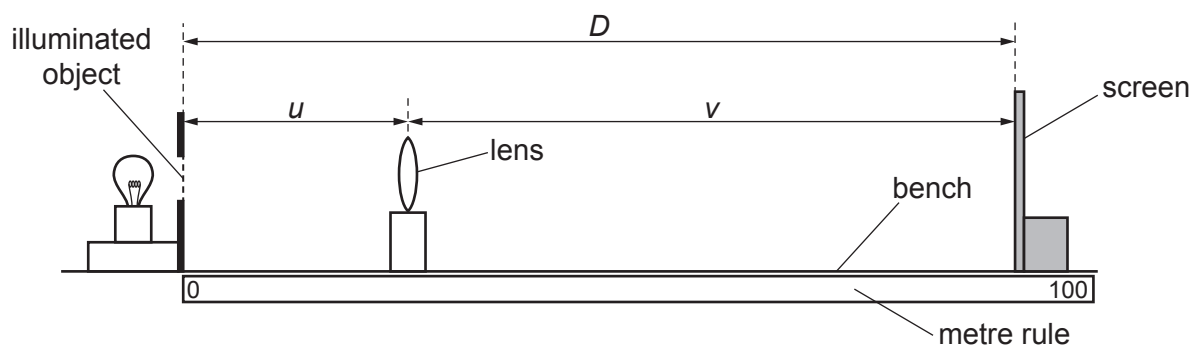


Fig. 4.1

(a) Procedure

- Switch on the lamp.
- Place the illuminated object (a triangle) at the 0 cm mark on the metre rule.
- Place the lens at a distance  $u = 10.0$  cm from the illuminated object.
- Place the screen at a distance  $D = 95.0$  cm from the illuminated object.

An out of focus, fuzzy image appears on the screen.

- Move the lens slowly towards the screen until the image formed is in focus, and as sharp as possible.

- (i) Measure the distances  $u$  and  $v$  to the nearest 0.1 cm.

Record  $u$  and  $v$  in the first row of Table 4.1.

Table 4.1

| $D$<br>/ cm | $u$<br>/ cm | $v$<br>/ cm | $uv$<br>/ ..... |
|-------------|-------------|-------------|-----------------|
| 95.0        |             |             |                 |
| 85.0        |             |             |                 |
| 75.0        |             |             |                 |
| 70.0        |             |             |                 |
| 65.0        |             |             |                 |

[1]

- (ii) Repeat the measurements for the four other values of  $D$  shown in Table 4.1.

Record the distances  $u$  and  $v$  in Table 4.1 against the correct values of  $D$ .

[2]

- (iii) Calculate the product  $uv$  and record it for each value of  $D$  in the final column of Table 4.1. Use the equation shown.

$$uv = u \times v$$

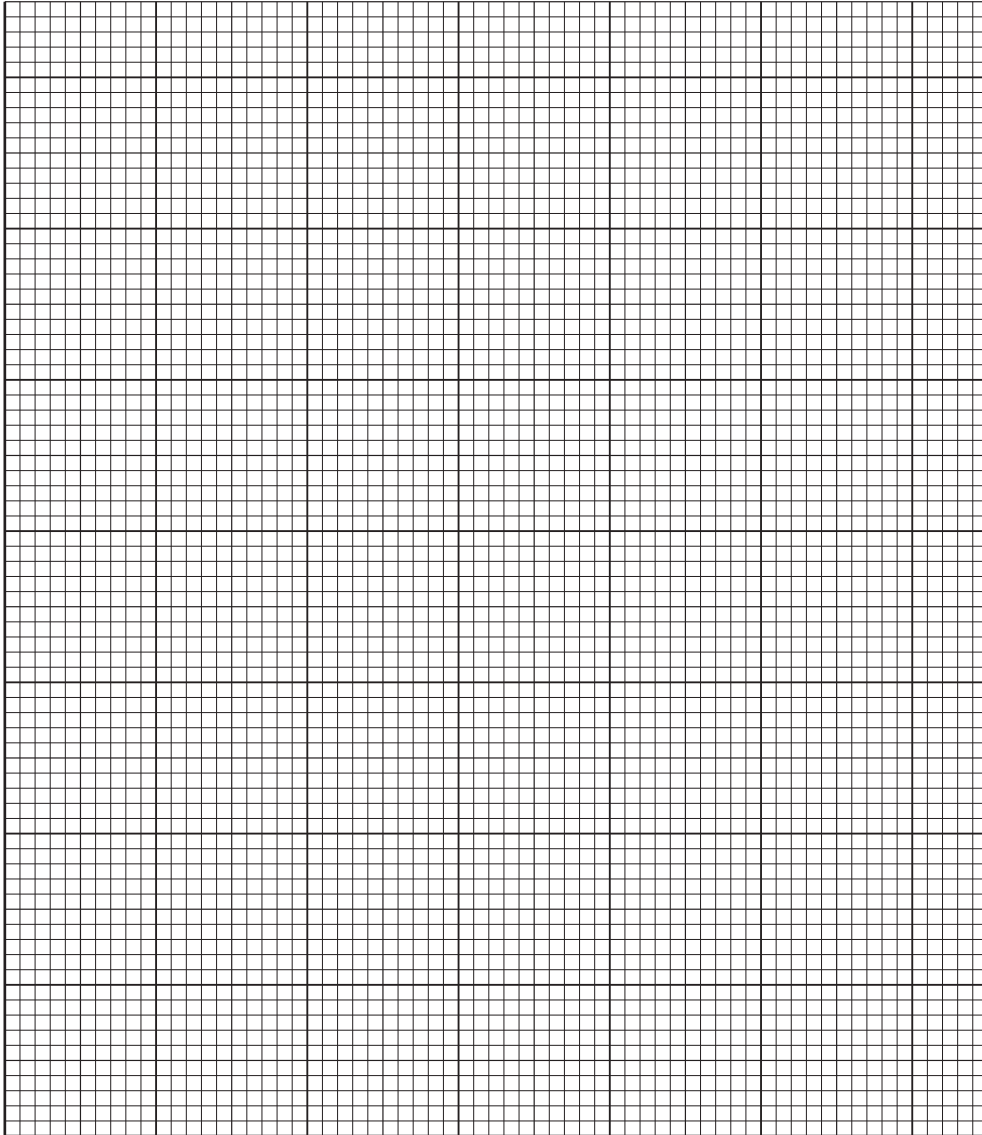
[1]

- (iv) Add the unit to the column heading for  $uv$  in Table 4.1.

[1]

- (b) (i) On the grid, plot a graph of  $uv$  (vertical axis) against  $D$ .

You do **not** need to start your graph from the origin (0, 0).



[3]

- (ii) Draw the best-fit straight line.

[1]

- (c) The focal length  $F$  of the lens is equal to the gradient of your line.

Calculate the gradient of your line.

Indicate on your graph the values you choose to calculate the gradient.

$$F = \dots\dots\dots [2]$$

- (d) (i)  $F$  can also be calculated without plotting a graph, by using the results for one value of  $D$ .

Suggest why plotting a graph and calculating a gradient to find the value of  $F$  gives a more accurate answer than calculating  $F$  for one value of  $D$ .

.....  
 ..... [1]

- (ii) State **one** precaution that you take when doing the experiment to make your readings as accurate as possible.

.....  
 ..... [1]

[Total: 13]



## NOTES FOR USE IN QUALITATIVE ANALYSIS

## Tests for anions

| anion                                           | test                                                              | test result                            |
|-------------------------------------------------|-------------------------------------------------------------------|----------------------------------------|
| carbonate ( $\text{CO}_3^{2-}$ )                | add dilute acid                                                   | effervescence, carbon dioxide produced |
| chloride ( $\text{Cl}^-$ )<br>[in solution]     | acidify with dilute nitric acid, then add aqueous silver nitrate  | white ppt.                             |
| nitrate ( $\text{NO}_3^-$ )<br>[in solution]    | add aqueous sodium hydroxide, then aluminium foil; warm carefully | ammonia produced                       |
| sulfate ( $\text{SO}_4^{2-}$ )<br>[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 ( $\text{NH}_4^+$ )    | ammonia produced on warming                                 | —                                                               |
| calcium ( $\text{Ca}^{2+}$ )    | white ppt., insoluble in excess                             | no ppt. or very slight white ppt.                               |
| copper(II) ( $\text{Cu}^{2+}$ ) | light blue ppt., insoluble in excess                        | light blue ppt., soluble in excess, giving a dark blue solution |
| iron(II) ( $\text{Fe}^{2+}$ )   | green ppt., insoluble in excess                             | green ppt., insoluble in excess                                 |
| iron(III) ( $\text{Fe}^{3+}$ )  | red-brown ppt., insoluble in excess                         | red-brown ppt., insoluble in excess                             |
| zinc ( $\text{Zn}^{2+}$ )       | 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 ( $\text{NH}_3$ )        | turns damp red litmus paper blue |
| carbon dioxide ( $\text{CO}_2$ ) | turns limewater milky            |
| chlorine ( $\text{Cl}_2$ )       | bleaches damp litmus paper       |
| hydrogen ( $\text{H}_2$ )        | 'pops' with a lighted splint     |
| oxygen ( $\text{O}_2$ )          | relights a glowing splint        |

## Flame tests for metal ions

| metal ion                       | flame colour |
|---------------------------------|--------------|
| lithium ( $\text{Li}^+$ )       | red          |
| sodium ( $\text{Na}^+$ )        | yellow       |
| potassium ( $\text{K}^+$ )      | lilac        |
| copper(II) ( $\text{Cu}^{2+}$ ) | blue-green   |

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