

Cambridge IGCSE™

CANDIDATE
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COMBINED SCIENCE

0653/63

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.

- 1 A student investigates the effect of light on a plant.

The student uses a plant with variegated leaves that are green and white.

Fig. 1.1 shows one of the leaves on the plant.

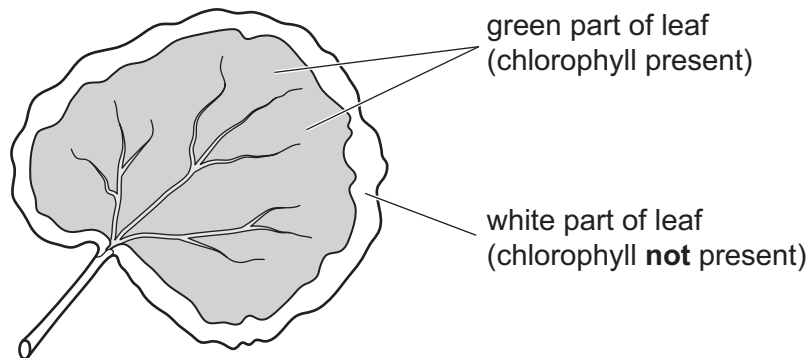


Fig. 1.1

(a) Procedure

The student:

- step 1** removes the starch from the leaves by placing the plant in a dark room for 2 days
- step 2** places a strip of black paper on the surface of one of the leaves of the plant, as shown in Fig. 1.2

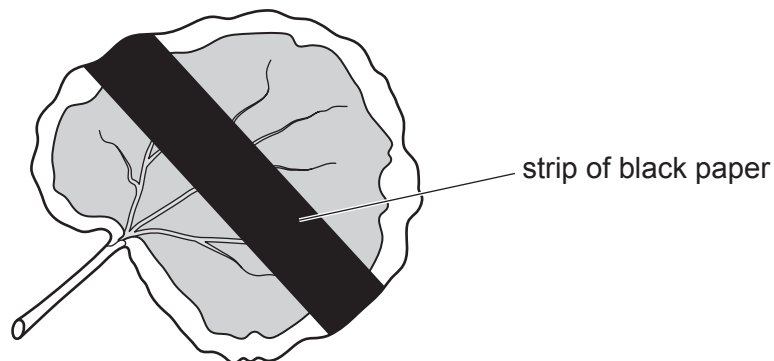


Fig. 1.2

- step 3** places the plant in bright light for 2 hours
- step 4** removes the strip of black paper
- step 5** removes the leaf from the plant
- step 6** places the leaf in boiling water for 5 minutes to remove the waxy cuticle
- step 7** places the leaf in hot ethanol for 5 minutes to remove the green colour (chlorophyll)
- step 8** places the leaf on a white tile and adds iodine solution.

Fig. 1.3 shows the leaf after iodine solution is added.

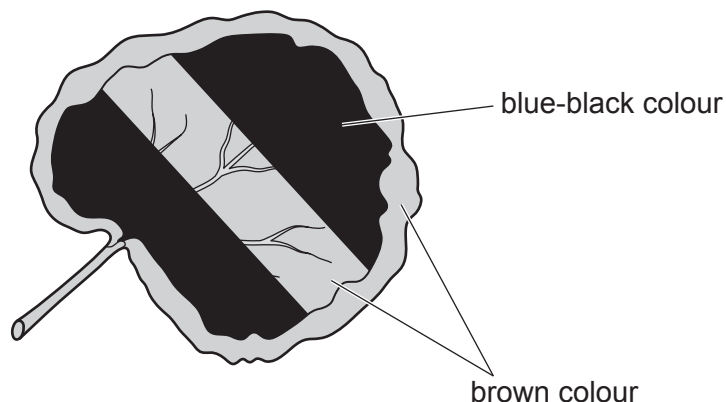


Fig. 1.3

- (i) A leaf produces starch as a result of photosynthesis.

Use Fig. 1.3 to determine which **two** factors are needed for photosynthesis.

Explain how the results in Fig. 1.3 provide evidence for your answers.

factor 1

explanation

.....

.....

factor 2

explanation

.....

.....

[4]

- (ii) Suggest why the green colour (chlorophyll) is removed in **step 7**.

.....

..... [1]

- (b) The student does a test to determine whether the leaf contains reducing sugar.

State the test the student uses. Include the observation for a positive result.

test

observation

[2]

[Total: 7]

- 2 Urease is an enzyme that breaks down urea in solution to form aqueous ammonia.

Urea in solution is almost neutral. The aqueous ammonia formed increases the pH of the solution.

Plan an investigation to determine the relationship between the concentration of urease and the pH of the solution formed.

You are provided with:

- urea solution
- 10% urease solution
- universal indicator solution and a pH colour chart.

You may use any common laboratory apparatus in your plan.

In your plan, include:

- the apparatus you will use
- a brief description of the method, explaining 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 results table if you wish (you do not need to include any results in the table).

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- 3 A student investigates a white solid, **H**.

(a) **Procedure**

The student:

- dissolves some solid **H** in distilled water
- adds universal indicator to the solution
- compares the colour obtained with a pH colour chart.

The universal indicator turns a blue-green colour.

Fig. 3.1 shows a pH colour chart.

colour of universal indicator	red	orange	yellow	green	dark green	blue	purple
pH	1	4	6	7	8	10	14

Fig. 3.1

- (i) Use Fig. 3.1 to estimate the pH of the solution of **H**. [1]
- (ii) Suggest why this pH colour chart **cannot** give an exact value for the pH of the solution of **H**.

.....

..... [1]

(b) Procedure

The student:

- puts some dilute sulfuric acid into a test-tube
- adds some solid **H** to the dilute sulfuric acid
- tests the gas produced with limewater.

(i) The limewater turns milky.

State the name of the gas produced.

..... [1]

(ii) Tick (✓) the name of the anion (negative ion) present in **H**.

carbonate

☐

chloride

☐

nitrate

☐

sulfate

☐

[1]

(c) Procedure

The student:

- puts some aqueous sodium hydroxide into a test-tube
- adds some solid **H** to the aqueous sodium hydroxide
- warms the mixture
- tests the gas produced with damp red litmus paper.

(i) The damp red litmus paper turns blue.

State the name of the gas produced.

..... [1]

(ii) Tick (✓) the name of the cation (positive ion) present in **H**.

ammonium

☐

calcium

☐

copper

☐

zinc

☐

[1]

(d) Procedure

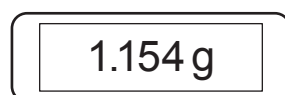
The student:

- step 1** puts 25.0 cm^3 of dilute sulfuric acid into a beaker
- step 2** uses a balance to find the mass of a sample of solid **H**
- step 3** adds the sample of solid **H** to the dilute sulfuric acid
- step 4** immediately starts a stop-watch
- step 5** stops the stop-watch when the mixture no longer fizzes.

- (i) State the name of a piece of apparatus suitable to measure 25.0 cm^3 of dilute sulfuric acid.

..... [1]

- (ii) Fig. 3.2 shows the reading on the balance in **step 2**.



mass of solid **H**

Fig. 3.2

Record the mass of solid **H** to **two** decimal places.

mass of solid **H** =g [1]

- (iii) Fig. 3.3 shows the reading on the stop-watch at **step 5**.



Fig. 3.3

Record this reaction time to the nearest second.

reaction time = s [1]

- (iv) Calculate the rate of reaction between solid **H** and dilute sulfuric acid.

Use the equation shown.

$$\text{rate of reaction} = \frac{\text{mass of solid H}}{\text{reaction time}}$$

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

rate of reaction = g/s [2]

- (v) Suggest **one** reason why it is difficult to measure the reaction time accurately using this procedure.

.....

..... [1]

- (vi) Suggest **one** improvement to the procedure that improves confidence in the rate of reaction calculated.

Explain your answer.

improvement

explanation

.....

[1]

[Total: 13]

- 4 A student investigates the magnification of a thin converging lens.

The student uses the apparatus shown in Fig. 4.1.

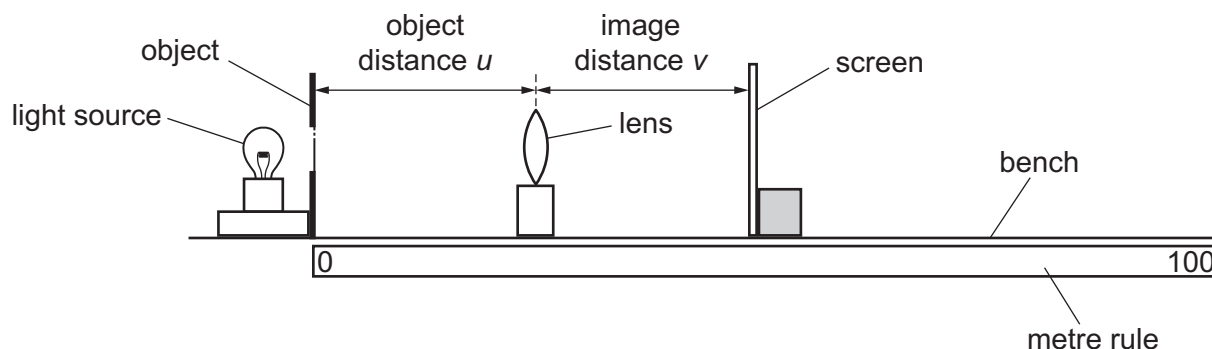


Fig. 4.1

Procedure

The student:

- records height h_o of the object
- places the object at the 0 cm mark on the metre rule
- places the lens at object distance u from the object
- changes image distance v so that a **sharp** image of the object is seen on the screen
- records height h_i of the image on the screen.

- (a) Fig. 4.2 shows the position of the lens on the metre rule.

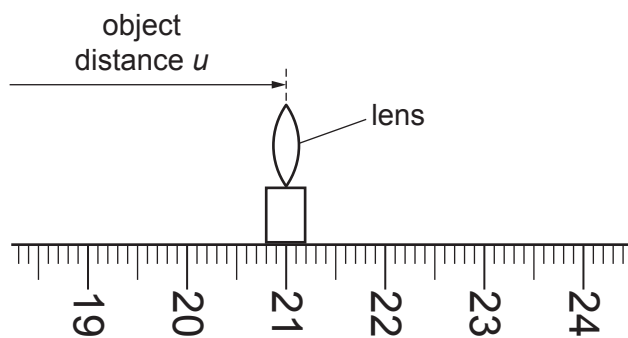


Fig. 4.2

Record object distance u .

$u = \dots\dots\dots$ cm [1]

- (b) (i) The student uses a triangular hole in a piece of cardboard as an object.

Fig. 4.3 shows the object, drawn to actual size.

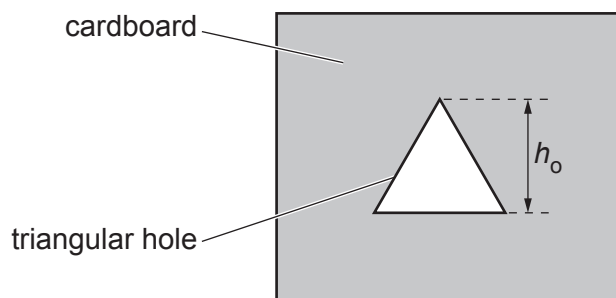


Fig. 4.3 (drawn to scale)

Use a ruler to measure h_o to the nearest 0.1 cm.

$$h_o = \dots\dots\dots \text{ cm [1]}$$

- (ii) Fig. 4.4 shows the outline of the image on the screen.

The image is inverted (upside-down).

The image is **not** actual size.

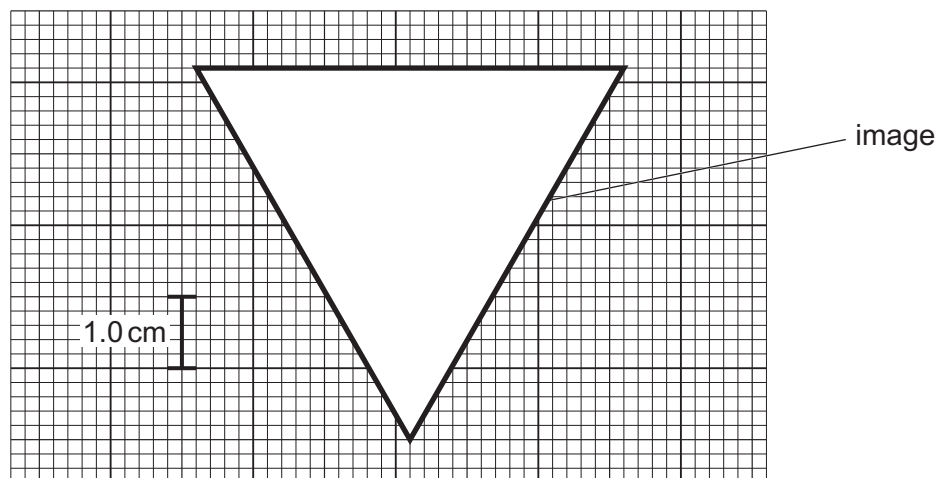


Fig. 4.4 (not to scale)

Use the scale on the screen to determine height h_i of the image.

$$h_i = \dots\dots\dots \text{ cm [1]}$$

(c) The student repeats the procedure for values of $u = 25.0, 30.0, 35.0, 40.0$ and 45.0 cm.

Table 4.1 shows the results.

Table 4.1

object distance u /cm	image height h_i /cm	magnification M
25.0	2.5	1.7
30.0	1.7	1.1
35.0	1.2	0.8
40.0	0.9	0.6
45.0	0.8	

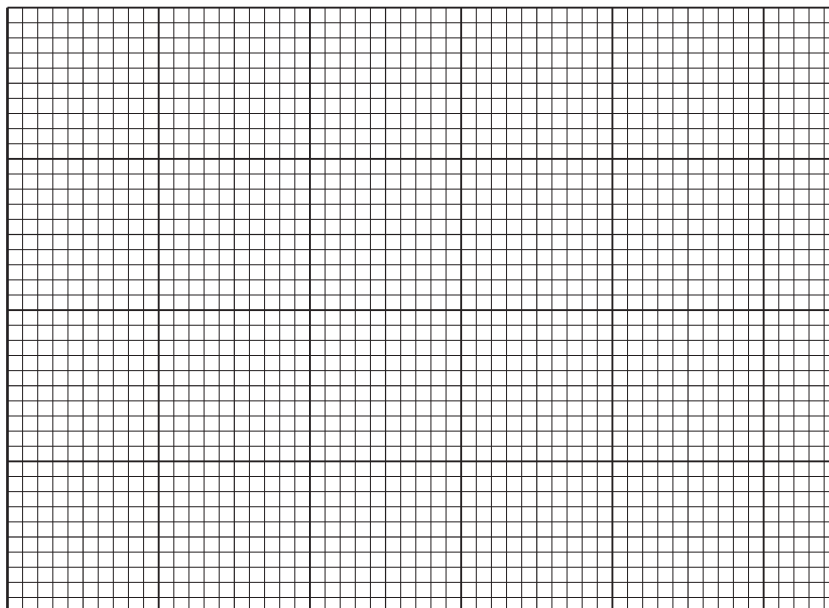
(i) Complete Table 4.1 by calculating the magnification M at $u = 45.0$ cm.

Use the equation shown and your value of h_o from (b)(i).

$$M = \frac{h_i}{h_o}$$

[1]

- (ii) Use the data in Table 4.1 to plot a graph of magnification M (vertical axis) against object distance u .



[3]

- (iii) Draw the curve of best fit.

[1]

- (iv) Use your graph to determine the value of u when $M = 1.0$.

$u = \dots\dots\dots$ cm [1]

- (v) Calculate the focal length f of the lens.

Use your value from (c)(iv) and the equation shown.

$$f = \frac{u}{2}$$

$f = \dots\dots\dots$ cm [1]

- (d) (i) State **two** precautions the student must take to obtain a **sharp** image on the screen.

1

.....

2

.....

[2]

- (ii) Describe how the student avoids a parallax error (line-of-sight error) when measuring object distance u .

.....

..... [1]

[Total: 13]