Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	
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3653281461

CO-ORDINATED SCIENCES **0654/62**

Paper 6 Alternative to Practical **October/November 2022**

1 hour 30 minutes

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 60.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **24** pages. Any blank pages are indicated.

DC (CE/SW) 301659/1

1 A student investigates respiration in small animals.

(a) The student sets up the airtight apparatus shown in Fig. 1.1.

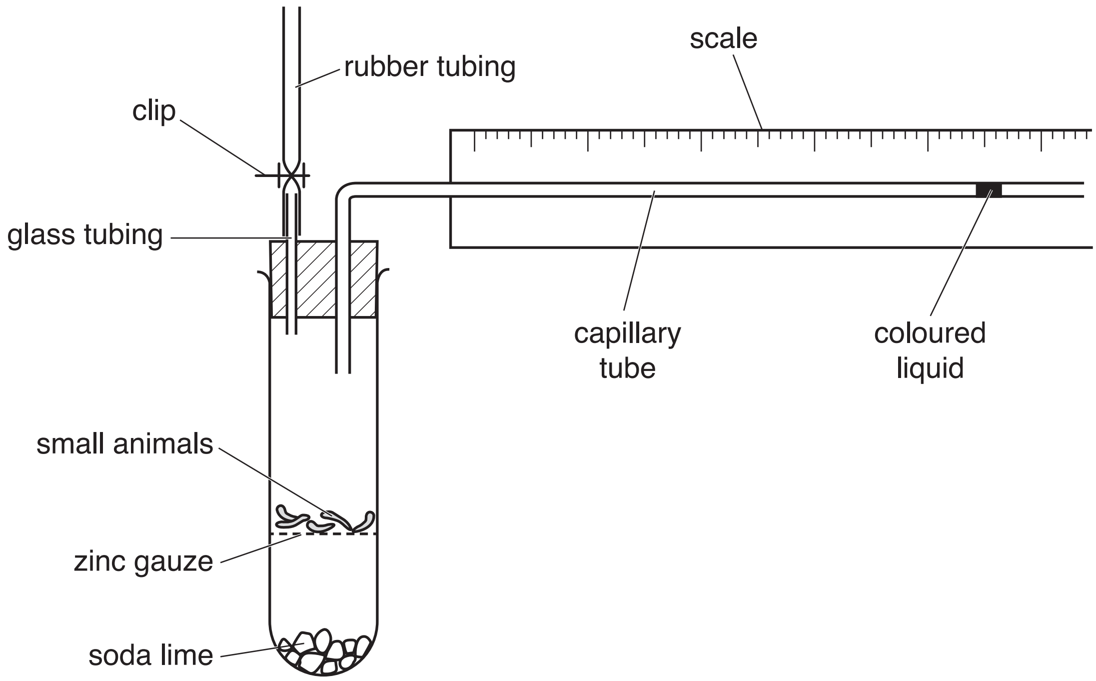

Fig. 1.1

The student records the position of the coloured liquid in the capillary tube every 2 minutes for 10 minutes.

Some of the student's results are shown in Table 1.1.

Table 1.1

time / minutes	position of coloured liquid / cm
0	5.0
2	5.9
4	
6	7.6
8	8.7
10	9.4

(i) Fig. 1.2 shows the start position for the coloured liquid in the capillary tube.

The student records the start position as 5.0.

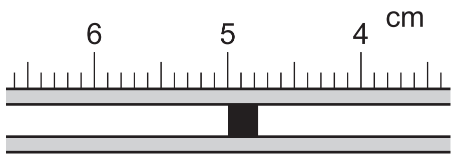

Fig. 1.2

State which part of the coloured liquid the student uses to measure the start position.

.... [1]

(ii) Fig. 1.3 shows the position of the coloured liquid after 4 minutes.

Record in Table 1.1 the position in centimetres to the nearest 0.1 cm.

Use the same part of the coloured liquid you identified in **(a)(i)**. [1]

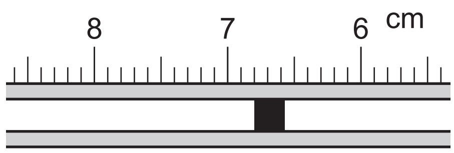

Fig. 1.3

(iii) State why it is important to measure the same part of the coloured liquid each time.

....

.... [1]

(b) **(i)** Calculate the total distance moved by the coloured liquid in the 10 minutes.

Use the data in Table 1.1 and the equation shown.

distance moved = position of coloured liquid after 10 minutes − position of coloured liquid at start

distance moved = ... cm [1]

(ii) Use your answer in **(b)(i)** to calculate the rate of movement of the coloured liquid.

Use the equation shown.

$$\text{rate of movement} = \frac{\text{your answer in } \mathbf{(b)(i)}}{10}$$

rate of movement = ... cm / min [1]

(c) The experiment is repeated with a smaller number of small animals.

Suggest how the results of this experiment are different from those in Table 1.1.

....

.... [1]

(d) During respiration, the small animals use up oxygen and give out carbon dioxide.
The soda lime absorbs the carbon dioxide.

Explain why the coloured liquid in the capillary tube moves towards the small animals.

....

.... [1]

(e) Suggest a reason why the student needs to open the clip at the end of the investigation.

.... [1]

[Total: 8]

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2 A student estimates the number of daisy plants in a garden.

(a) The student measures the length and width of the garden.

The length is 10 m and the width is 10 m.

(i) Suggest a piece of apparatus suitable for measuring the length and width of the garden.

.... [1]

(ii) Calculate the area of the garden.

Use the equation shown.

area of garden = length × width

area = ... m^2 [1]

(b) **Procedure**

The student:

- counts the number of daisy plants in a 1 m^2 area of the garden
- counts the number of plants in two other 1 m^2 areas of the garden
- records the numbers in Table 2.1.

Fig. 2.1 shows the daisy plants in the third 1 m^2 sample area of garden.

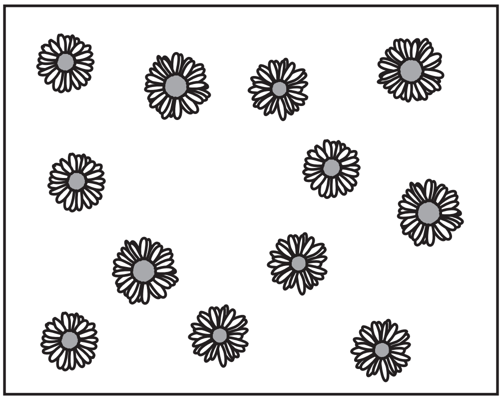

Fig. 2.1

(i) Record in Table 2.1 the number of daisy plants in sample 3.

Table 2.1

$1\,m^2$ sample	number of daisy plants
1	6
2	9
3	

[1]

(ii) Calculate the average number of daisy plants in $1\,m^2$ of the garden.

Use the equation shown.

$$\text{average} = \frac{\text{number in sample 1 + number in sample 2 + number in sample 3}}{3}$$

average = ... [1]

(c) Calculate the total number of daisy plants estimated to be in the whole garden.

number = ... [1]

[Total: 5]

3 Amylase is a digestive enzyme that breaks down starch into reducing sugar.

The presence of starch in a solution can be confirmed by adding iodine solution. If starch is present the iodine solution will turn from brown to blue-black.

Plan an investigation to find out if the time taken for starch to break down is affected by the concentration of amylase enzyme.

You are provided with:

- starch solution
- 10% amylase solution
- iodine solution.

You may also use any common laboratory apparatus.

Include in your plan:

- the apparatus needed
- a brief description of the method explaining any safety precautions
- the measurements you will make
- the variables you will control
- how you will process your results to draw a conclusion.

You may include a results table if you wish, you are not required to enter any readings in the table.

You may include a labelled diagram if you wish.

[7]

4 A student investigates the percentage yield for the decomposition of copper carbonate.

Percentage yield compares the mass of substance made in an experiment with the mass of substance that is expected to be made.

When copper carbonate solid is heated strongly it forms copper oxide solid and gives off carbon dioxide gas.

copper carbonate $\longrightarrow$ copper oxide + carbon dioxide

(a) Procedure

The student:

step **1** uses a balance to find the mass of an empty evaporating basin and records this mass in Table 4.1

step **2** adds three spatula loads of copper carbonate to the evaporating basin

step **3** uses a balance to find the total mass of the evaporating basin and the copper carbonate and records this mass in Table 4.1

step **4** places the evaporating basin on top of a tripod and gauze

step **5** heats and stirs the copper carbonate for three minutes

step **6** uses a balance to find the total mass of the evaporating basin and copper oxide and records this mass in Table 4.1.

Table 4.1

mass of empty evaporating basin / g	23.46
total mass of evaporating basin and copper carbonate (before heating) / g	
total mass of evaporating basin and copper oxide (after heating) / g	

(i) Draw a labelled diagram of the assembled apparatus showing the heating of the copper carbonate.

[3]

(ii) Suggest why the copper carbonate is stirred while it is being heated in step **5**.

....

.... [1]

(iii) Fig. 4.1 shows the balance readings.

25.912	25.229
total mass of evaporating basin and copper carbonate (before heating)	total mass of evaporating basin and copper oxide (after heating)

Fig. 4.1

Record in Table 4.1 these masses to **two** decimal places. [2]

(iv) Explain why the mass of copper carbonate decreases when it is heated.

....

.... [1]

(v) Copper carbonate solid is green.

Copper oxide solid is black.

Suggest how the student can tell when all of the copper carbonate has turned into copper oxide.

....

.... [1]

(b) **(i)** Calculate the mass of copper carbonate in the evaporating basin.

Use the equation shown.

mass of copper carbonate	=	total mass of evaporating basin and copper carbonate (before heating)	–	mass of empty evaporating basin

mass of copper carbonate = ... g [1]

(ii) Calculate the expected mass of copper oxide.

Use the equation shown.

expected mass of copper oxide = 0.64 × your answer to **(b)(i)**

expected mass of copper oxide = ... g [1]

(iii) Calculate the actual mass of copper oxide made.

Use the equation shown.

mass of copper oxide made	=	total mass of evaporating basin and copper oxide (after heating)	–	mass of empty evaporating basin

actual mass of copper oxide made = ... g [1]

(iv) Calculate the percentage yield of copper oxide.

Use the equation shown.

$$\text{percentage yield of copper oxide} = \frac{\text{answer to } \textbf{(b)(iii)}}{\text{answer to } \textbf{(b)(ii)}} \times 100$$

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

percentage yield of copper oxide = ... % [2]

(c) Suggest why the percentage yield is not 100%.

....

.... [1]

(d) Suggest what you can do to have more confidence in your value of the percentage yield.

....

.... [1]

[Total: 15]

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5 A student does some tests on solutions **R**, **S** and **T**.

The student's results are shown in Table 5.1.

Table 5.1

test	observations		
	R	**S**	**T**
add a few drops of aqueous sodium hydroxide add excess aqueous sodium hydroxide	white precipitate white precipitate	white precipitate white precipitate	white precipitate white precipitate
add a few drops of aqueous ammonia add excess aqueous ammonia	white precipitate colourless solution	white precipitate colourless solution	white precipitate white precipitate
add methyl orange	orange	orange	orange
add dilute nitric acid and barium nitrate solution	colourless solution	white precipitate	colourless solution
add dilute nitric acid and aqueous silver nitrate	white precipitate	cream precipitate	colourless solution
flame test colour	blue	blue	red

(a) Use the results in Table 5.1 to describe a test to identify a sample of solution **R**. Include the observations in your answer.

Explain why this test is used to identify **R** but not **S** and **T**.

test ....

observation ....

explanation ....

....
[2]

(b) Use the results in Table 5.1 to describe a test to identify a sample of solution **S**.
Include the observations in your answer.

Explain why this test is used to identify **S** but not **R** and **T**.

test ....

observation ....

explanation ....

.... [2]

(c) In a flame test, the solution is soaked into a wooden splint and the splint is placed into the top of a blue Bunsen burner flame.

R and **S** give the **same** flame colour.

Suggest one **other** reason why a flame test is **not** used to identify solutions **R** and **S**.
Use the results in Table 5.1.

....

.... [1]

[Total: 5]

6 A student investigates the magnification of an image formed by a converging lens.

(a) The student sets up the apparatus shown in Fig. 6.1.

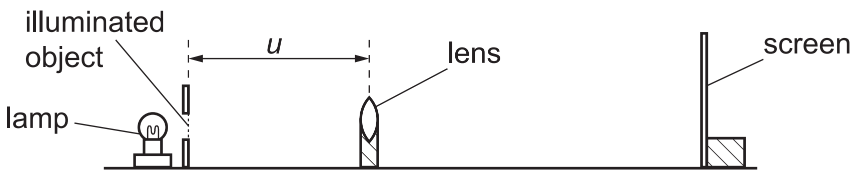


Fig. 6.1

The object, a triangular hole in a piece of card, is shown in Fig. 6.2.

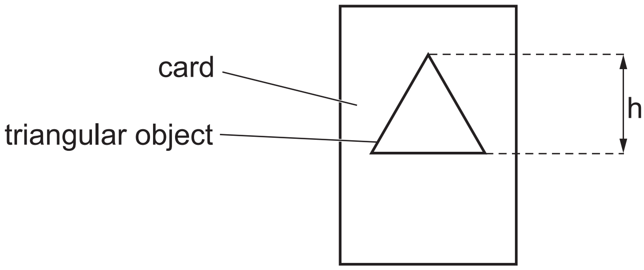


Fig. 6.2

(i) The triangular object in Fig. 6.2 is shown full size.

Measure the height *h* in centimetres to the nearest 0.1 cm.

h = ... cm [1]

(ii) Procedure

The student:

- places the lens a distance u = 20.0 cm in front of the object
- moves the screen until a sharp image of the object is seen on the screen
- measures the height h_1 of the image on the screen.

Fig. 6.3 shows the image full size.

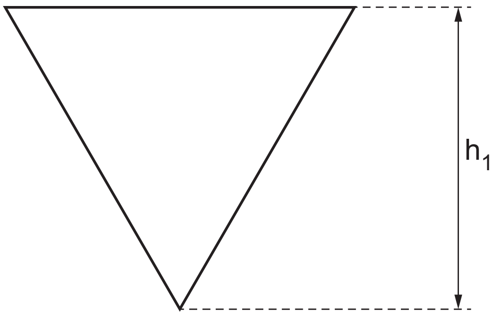


Fig. 6.3

Measure the height h_1 of the image in centimetres to the nearest 0.1 cm.

Record your value in Table 6.1.

Table 6.1

object distance u / cm	height of image h_1 / cm	magnification m
20.0		
30.0	1.3	1.0
40.0	0.78	0.60
50.0	0.56	0.43
60.0	0.43	0.33

[1]

(iii) State **one** difference between the object and its image.

....

.... [1]

(b) The student measures the height h_1 of the image for object distances u = 30.0 cm, 40.0 cm, 50.0 cm and 60.0 cm.

The student's results are shown in Table 6.1.

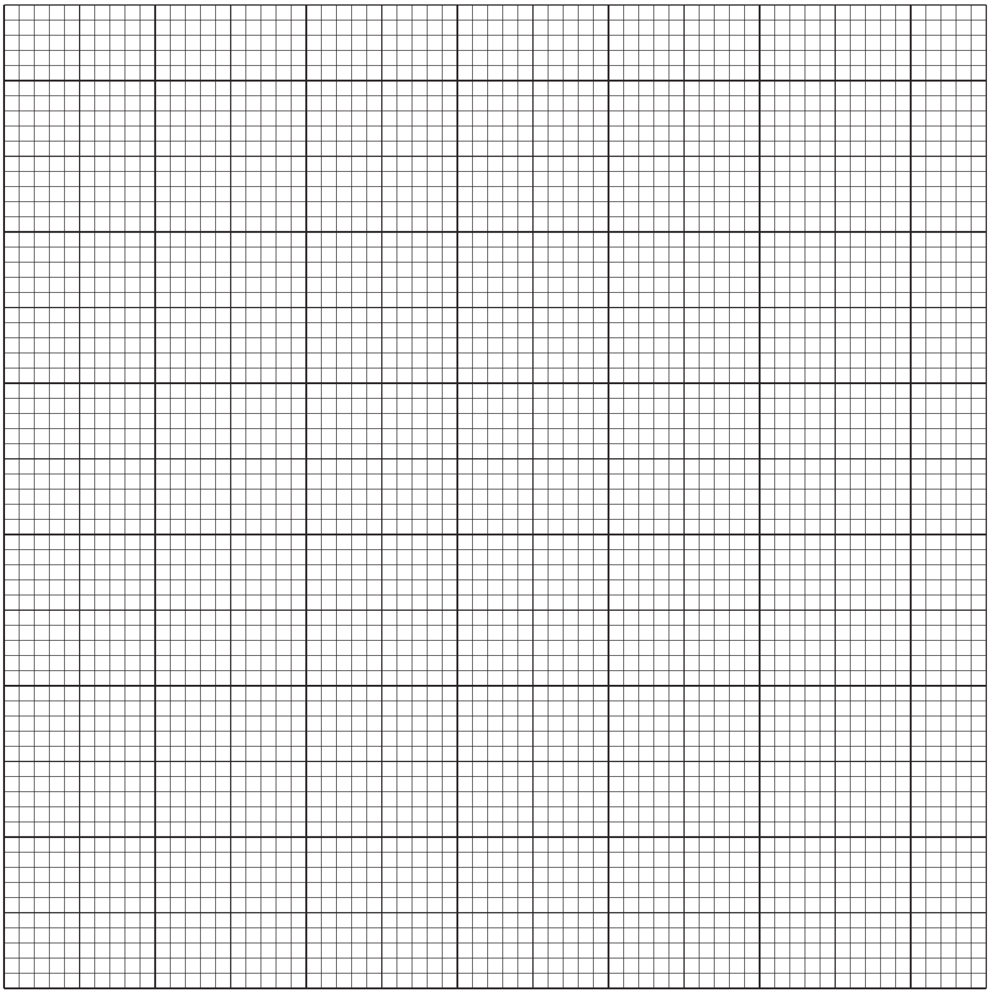
Calculate the magnification m of the image when the object distance u = 20.0 cm.

Use your value of h from **(a)(i)**, h_1 from Table 6.1 and the equation shown.

$$m = \frac{h_1}{h}$$

Record your value of m in Table 6.1. [1]

(c) **(i)** On the grid, plot a graph of m (vertical axis) against u.



[3]

(ii) Draw the best-fit curve. [1]

(d) **(i)** Use your graph to determine the value of the object distance u when m = 0.5.

u = ... cm [1]

(ii) Use the values of m and u from part **(d)(i)** to calculate a value for the focal length f of the lens.

Use the equation shown.

$$f = \frac{m \times u}{(m + 1)}$$

f = ... cm [1]

(e) State **one** difficulty the student has when measuring the height of the image on the screen.

....

.... [1]

[Total: 11]

7 A student investigates how the resistance of a wire changes as its length l changes.

(a) The student sets up the circuit shown in Fig. 7.1.

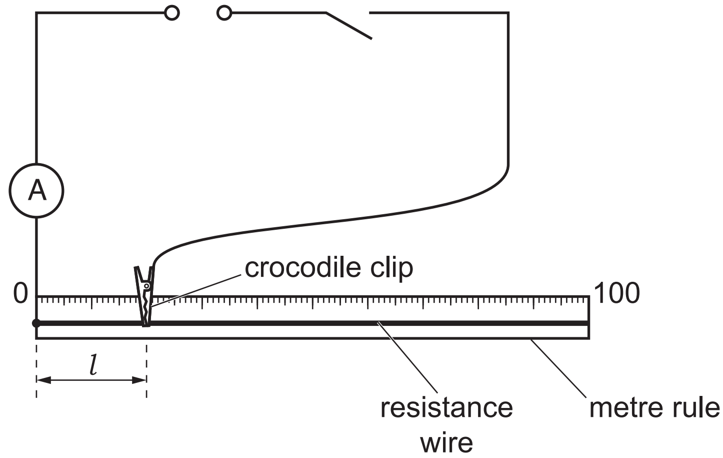


Fig. 7.1

Procedure

The student:

- connects a voltmeter to measure the potential difference V across a length l = 20.0 cm of the resistance wire
- measures the potential difference V
- measures the current I in the circuit.

(i) Draw on Fig. 7.1 a voltmeter connected to measure the potential difference V across the length of wire l. [1]

(ii) The values of V and I are shown on the meters in Fig. 7.2.

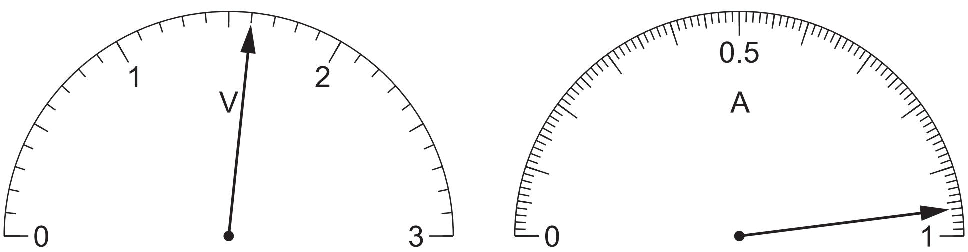


Fig. 7.2

Record in Table 7.1 the values of the potential difference and the current.

Table 7.1

length l/cm	potential difference V/V	current I/A	resistance R/Ω
20.0			
30.0	1.7	0.65	2.6
40.0	1.5	0.47	3.2
80.0	1.7	0.26	6.5

[2]

The student repeats the procedure for lengths of wire l = 30.0 cm, l = 40.0 cm and l = 80.0 cm and records the readings in Table 7.1.

(b) Calculate the resistance R of the 20.0 cm length of wire.

Use the equation shown.

$$R = \frac{V}{I}$$

Record your value in Table 7.1. [1]

(c) Use the results in Table 7.1 to estimate the resistance of a 60.0 cm length of the resistance wire. Show your working.

resistance = ... Ω [1]

(d) The teacher suggests that the resistance of the wire is directly proportional to its length.

Show how the results in Table 7.1 agree or disagree with the teacher's suggestion, allowing for experimental error.

....

.... [1]

(e) Suggest one reason why different students doing this experiment with similar apparatus, may **not** obtain identical results.

....

.... [1]

(f) A variable resistor is added to the circuit in Fig. 7.3 to prevent the resistance wire XY getting too hot.

Complete the circuit diagram to include a variable resistor. Use the correct symbol for the variable resistor.

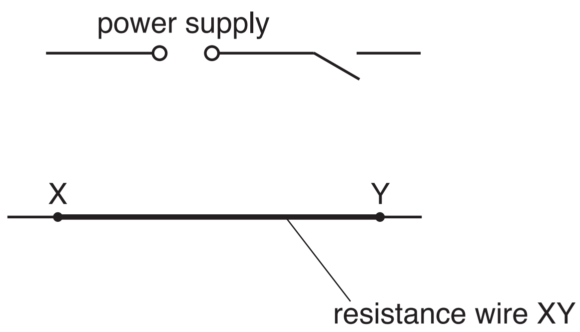


Fig. 7.3

[2]

[Total: 9]

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