Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

0251053605

COMBINED SCIENCE **0653/63**

Paper 6 Alternative to Practical **May/June 2024**

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.

DC (PB/JG) 330922/2

[Turn over

1 A student investigates the growth of plants.

Procedure

The student:

Step 1 measures the mass of three potted plants **A**, **B** and **C**

Step 2 gives each plant 50 cm^3 of different concentrations of plant nutrients as shown in Table 1.1

Step 3 puts the plants near a window for 2 weeks giving each plant an equal volume of water each day

Step 4 measures the final mass of each potted plant.

Fig. 1.1 shows the plants after 2 weeks.

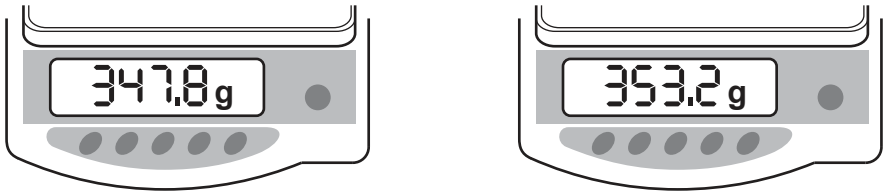
plant **A** plant **B** plant **C**

Fig. 1.1

Table 1.1

plant	percentage concentration of nutrients given	mass at start / g	final mass / g	change in mass / g
A	0	330	339	9
B	5	334		
C	10	328		

(a) Fig. 1.2 shows the readings of final mass for plant **B** and plant **C**.



plant **B** plant **C**

Fig. 1.2

(i) Record in Table 1.1 the final mass of plants **B** and **C** to the nearest whole number. [2]

(ii) Calculate the change in mass for plants **B** and **C**.

Record your values in Table 1.1.

[1]

(iii) State the dependent variable in this investigation.

..... [1]

(iv) State a conclusion about the growth of the plants.

.....

..... [1]

(b) (i) The student repeats the procedure three times and calculates an average value for the change in mass.

State one **other** reason for repeating the procedure three times.

.....

..... [1]

(ii) In another investigation, the height of the plants is measured.

Suggest why it is better to measure the mass of the plants rather than the height.

.....

..... [1]

[Total: 7]

2 When seeds germinate, they use oxygen gas for aerobic respiration.

glucose + oxygen → carbon dioxide + water

When placed in a test-tube as shown in Fig. 2.1, the seeds use up oxygen and the drop of liquid in the capillary tube moves towards the test-tube.

The greater the rate of respiration the faster the drop of liquid moves.

Plan an investigation to determine the relationship between temperature and the rate of respiration of germinating seeds.

You are provided with:

- the apparatus shown in Fig. 2.1
- 100 germinating seeds.

You may use any other common laboratory apparatus.

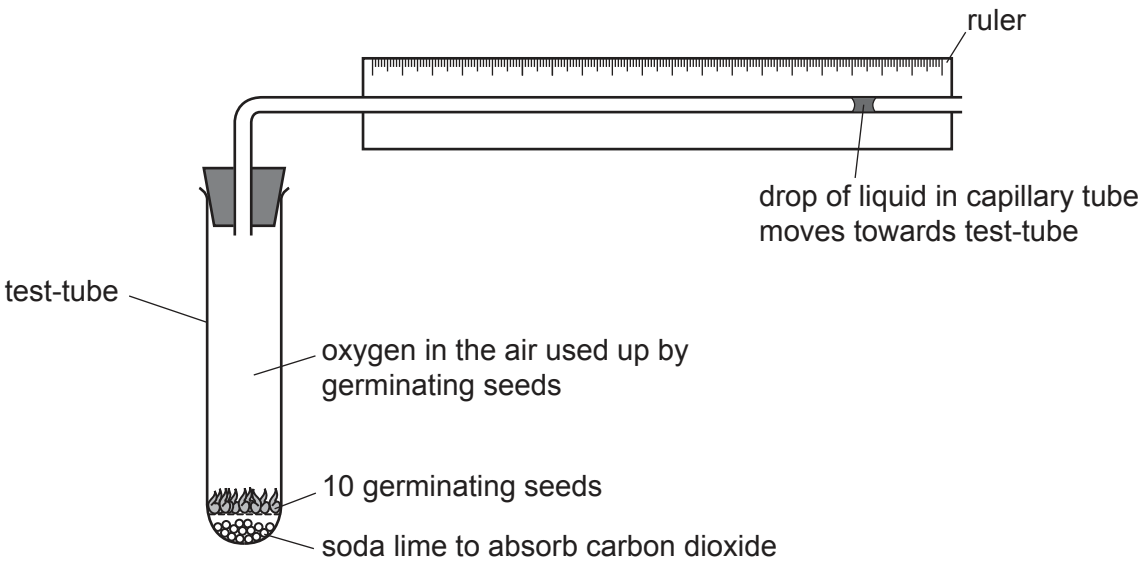


Fig. 2.1

In your plan, include:

- any 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 table that can be used to record the results if you wish.
You do **not** need to include any results in the table.

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..... [7]

3 A student investigates a green liquid.

The green liquid is a mixture of substances dissolved in water.

Some of these substances are coloured and the others are colourless.

(a) The student uses paper chromatography to find out how many coloured substances are in the green liquid.

Procedure

The student:

Step 1 draws a pencil line near the bottom of the chromatography paper

Step 2 places a spot of the green liquid on the pencil line.

(i) Explain why the start line must be drawn in pencil and **not** in ink.

.....

..... [1]

(ii) State the name of a piece of apparatus suitable to put the spot of green liquid on the chromatography paper.

..... [1]

The student:

Step 3 lets the spot of green liquid dry

Step 4 assembles the apparatus shown in Fig. 3.1.

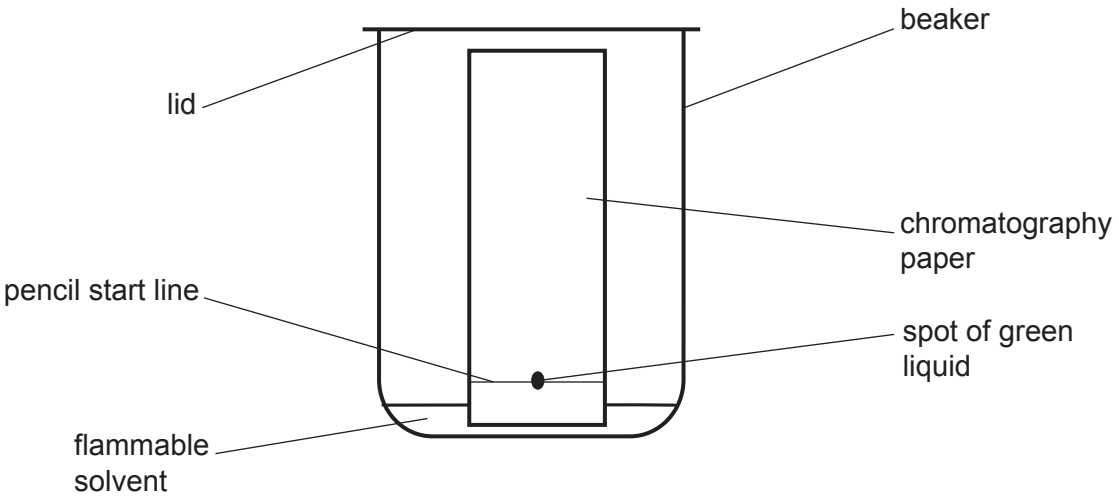

Fig. 3.1

(b) After 15 minutes, the student takes the chromatography paper out of the beaker and lets the paper dry.

Fig. 3.2 shows the chromatography paper after it has dried.

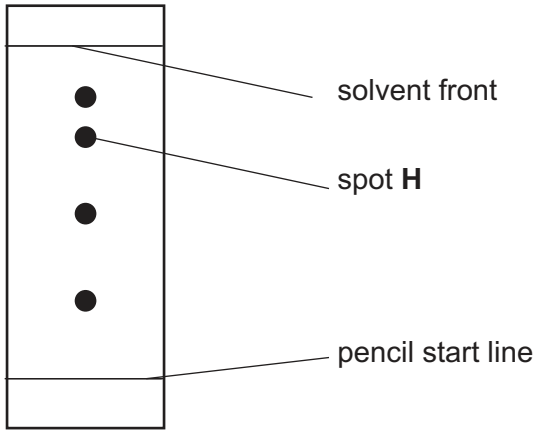

Fig. 3.2

(i) State how many **coloured** substances are in the green liquid.

..... [1]

(ii) Suggest why you **cannot** determine the number of **colourless** substances in the green liquid.

..... [1]

(iii) Measure the distance from the pencil start line to the centre of the spot labelled **H** on Fig. 3.2.

Record this distance in centimetres to the nearest millimetre.

distance to **H** = ... cm [1]

(iv) Measure the distance from the pencil start line to the solvent front on Fig. 3.2.

Record this distance in centimetres to the nearest millimetre.

distance to solvent front = ... cm [1]

(v) Calculate the R_f value for spot **H**.

Use the equation shown.

$$R_f = \frac{\text{distance from the pencil start line to the centre of spot } \mathbf{H}}{\text{distance from the pencil start line to the solvent front}}$$

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

R_f = ... [2]

(c) Describe and explain **one** safety precaution the student must take in **Step 4**.

safety precaution .....

explanation .....

.....
[1]

(d) The student does the chemical tests described in Table 3.1 on the green liquid.

Table 3.1

test		observations
1	acidify with dilute nitric acid, then add aqueous silver nitrate	no change to the green liquid
2	acidify with dilute nitric acid, then add aqueous barium nitrate	white precipitate
3	add excess aqueous sodium hydroxide then warm the mixture	green precipitate gas produced turns damp red litmus paper blue
4	add a few drops of aqueous ammonia then add excess aqueous ammonia	green precipitate green precipitate insoluble

(i) Explain how the observations in Table 3.1 show that the green liquid contains iron(II) ions.

.....

..... [1]

(ii) Explain how the observations in Table 3.1 show that the green liquid contains sulfate ions.

.....

..... [1]

(iii) State the name of the gas formed in test **3**.

..... [1]

(iv) State the name of the cation (positive ion) present that causes the gas to be produced in test **3**.

..... [1]

[Total: 13]

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4 A student determines the mass M of a metre rule.

(a) The apparatus is shown in Fig. 4.1.

The metre rule rests on a pivot at the 20.0 cm mark.
The other end of the metre rule is supported by a newton meter at the 80.0 cm mark.

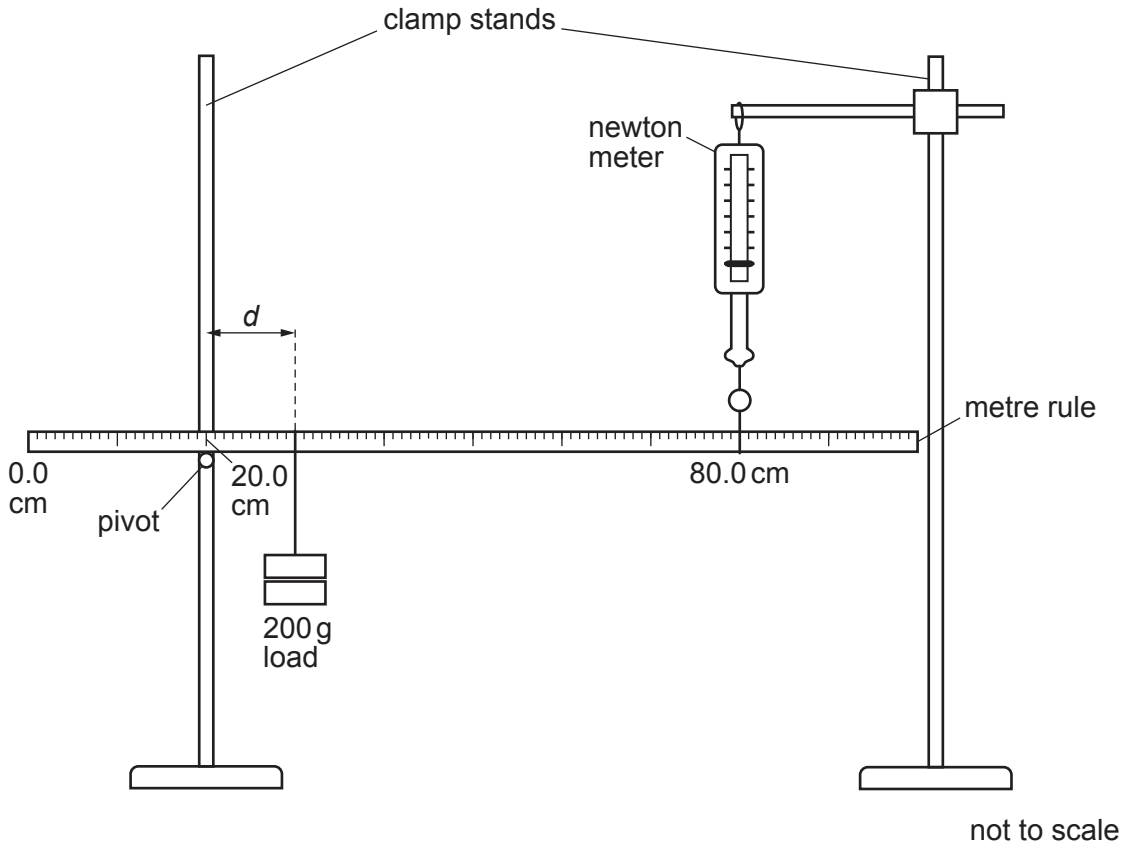


Fig. 4.1

Procedure

The student:

- hangs a load of mass 200 g at a distance d = 10.0 cm from the pivot
- measures the force F using the newton meter
- records in Table 4.1 the distance d and the force F.

The student repeats the procedure for values of d = 20.0 cm, 30.0 cm, 40.0 cm and 50.0 cm.

Fig. 4.2 shows the readings on the newton meter for d = 30.0 cm and d = 40.0 cm.

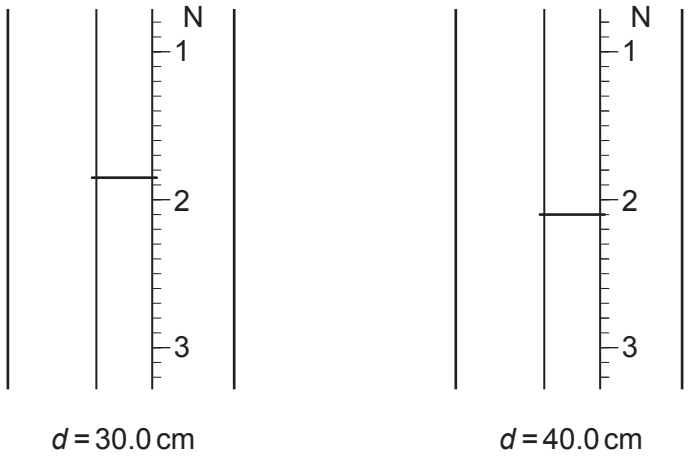


Fig. 4.2

(i) Record the **two** values of F in Table 4.1.

Table 4.1

d / cm	F / N
10.0	0.95
20.0	1.40
30.0	
40.0	
50.0	2.45

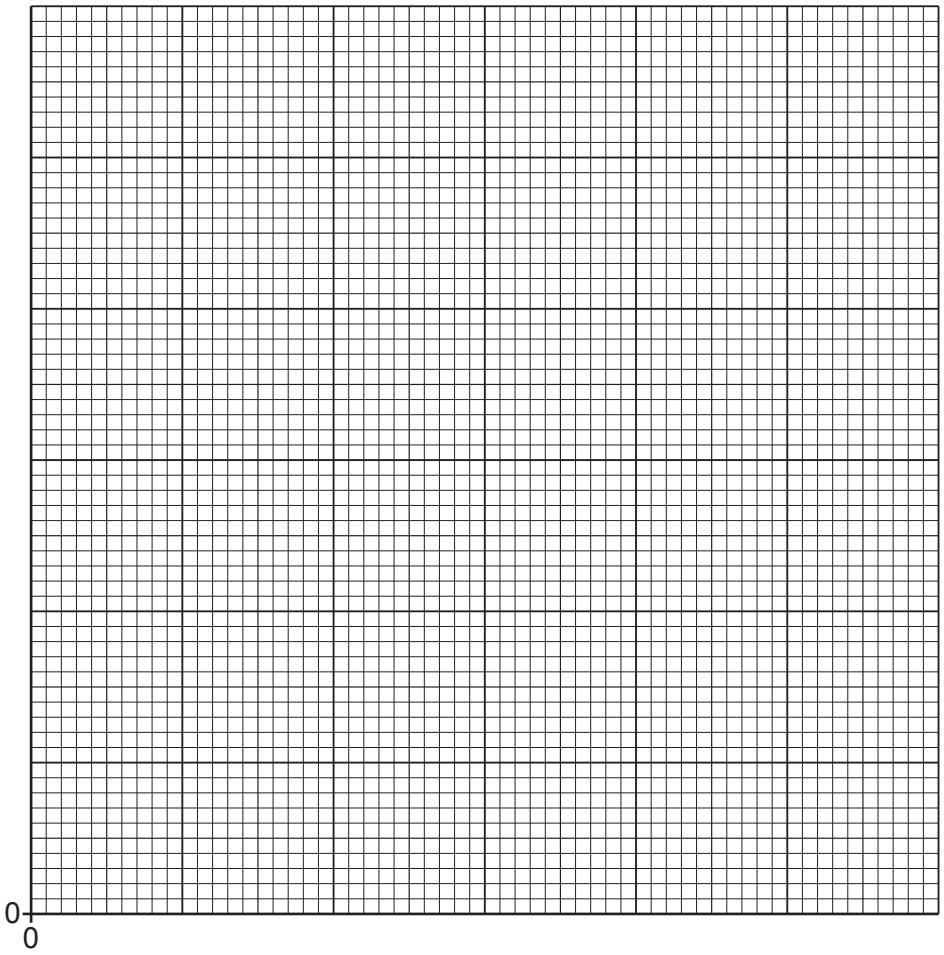
[2]

(ii) State **one** precaution the student takes to make the readings from the newton meter as accurate as possible.

.....

..... [1]

(b) (i) On the grid, plot a graph of F (vertical axis) against d.



[3]

(ii) Draw the best-fit straight line.

Extend your best-fit line to cross the vertical axis.

[1]

(iii) Use the graph to determine the value of the force F_0 when d = 0.0 cm.

F_0 = ... N [1]

(iv) The weight W of the metre rule is calculated using the equation shown.

$$W = 2 \times F_0$$

Calculate W.

W = ... N [1]

(v) The mass of the metre rule M is calculated using the equation shown.

$$M = \frac{W}{g}$$

Use $g = 10\,\text{N/kg}$ for your calculation.

Give your answer in grams.

$M =$ ..... grams
[2]

(c) The teacher states that the value of F_0 can be measured directly by removing the 200 g load and taking a single reading of F_0 on the newton meter.

Suggest why the uncertainty in the value of F_0 is less using the graph than with taking a single reading.

.....

..... [1]

(d) Suggest an alternative piece of equipment to measure the mass of the metre rule.

..... [1]

[Total: 13]

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