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Cambridge Assessment International Education

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8829031047

COMBINED SCIENCE **0653/63**

Paper 6 Alternative to Practical **October/November 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.

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[Turn over

1 A student investigates phototropism in a plant.

Phototropism is a response in which parts of a plant grow towards the direction from which light is coming.

Fig. 1.1 shows a plant growing towards the light, where:

- θ_L = the angle of the light to the ground
- θ_P = the angle that the plant grows to the ground.

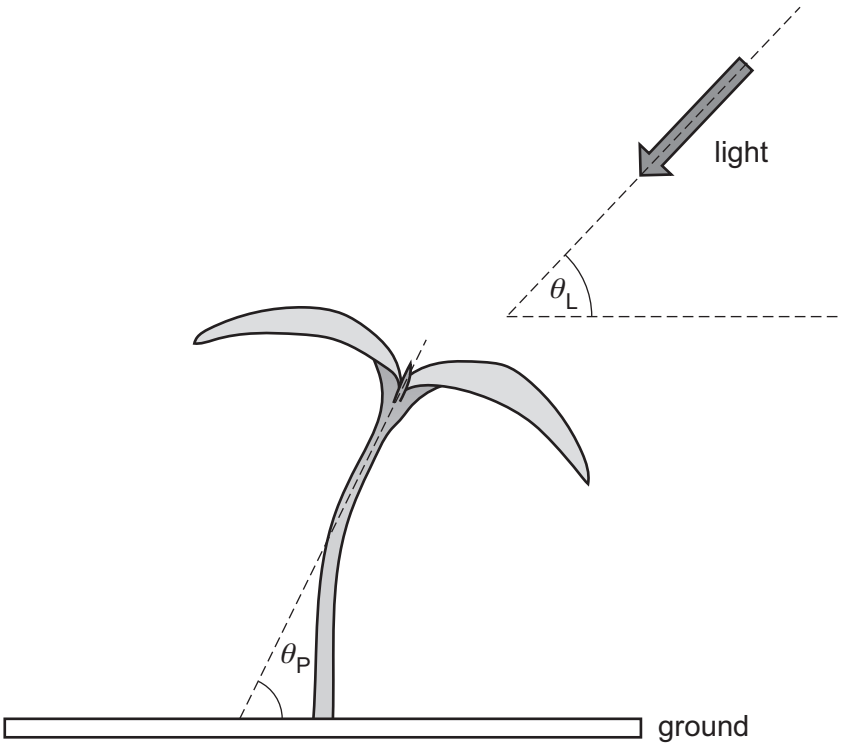

Fig. 1.1

The student investigates the relationship between θ_L and θ_P.

Procedure

The student:

- takes six plants, **A**, **B**, **C**, **D**, **E** and **F**
- shines light on each plant at a different value of θ_L
- allows the plants to grow for 24 hours
- measures the value of θ_P for each plant
- records the values in Table 1.1.

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(a) The plants are left for 24 hours before θ_P is measured.

Suggest why the plants are left for 24 hours.

.....

..... [1]

(b) The student states:

For a fair test, the light intensity is kept constant during the investigation, and the same light intensity is used for each plant.

(i) Explain why keeping the light intensity constant in this way makes it a fair test.

.....

.....

..... [1]

(ii) Suggest **one** way that the student makes sure that the light intensity is kept constant.

.....

.....

..... [1]

(iii) Suggest **one** other factor that is kept constant in this investigation.

..... [1]

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(c) Fig. 1.2 shows plant **D** after 24 hours.

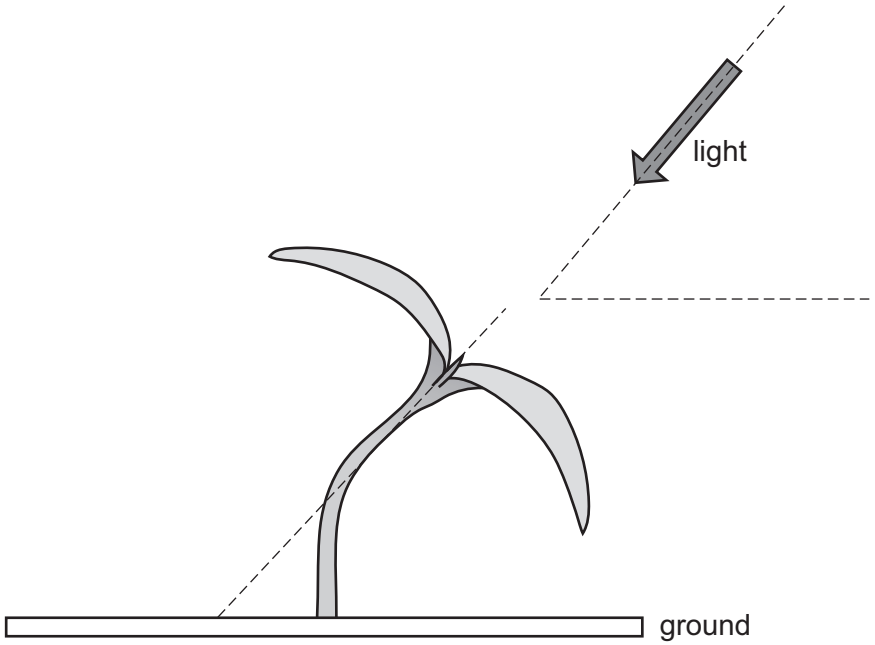

Fig. 1.2

Use a protractor to measure θ_L and θ_P for plant **D** in Fig. 1.2.

Record in Table 1.1 these values to the nearest degree.

Table 1.1

plant	θ_L / °	θ_P / °
A	0	8
B	10	19
C	30	32
D		
E	70	68
F	90	86

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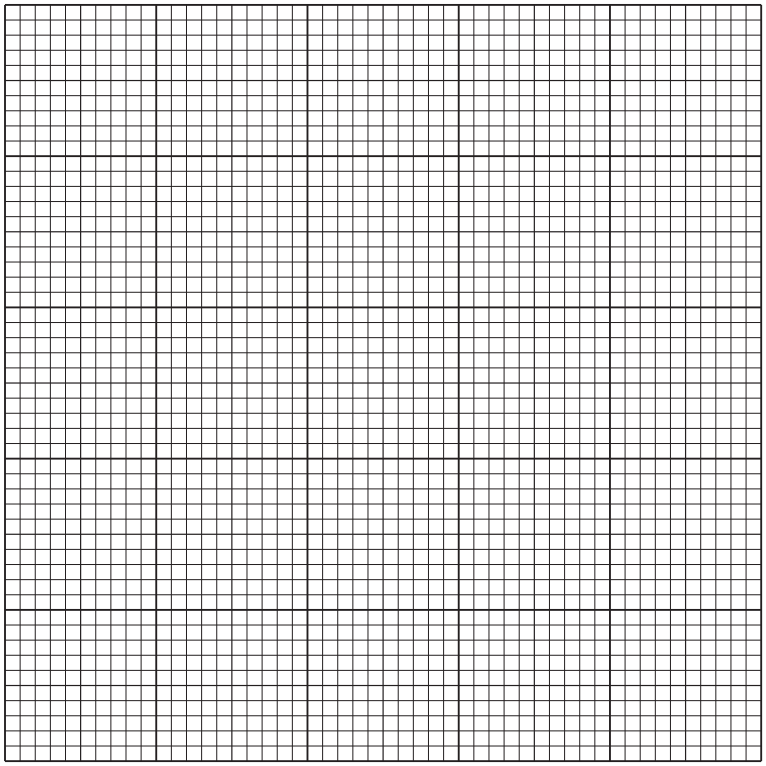
(d) (i) Use the data in Table 1.1 to plot on the grid a graph of θ_P (vertical axis) against θ_L.



[3]

(ii) Draw the straight line of best fit. [1]

(iii) Describe the relationship between θ_L and θ_P.

.....

..... [1]

(iv) Use your graph to estimate θ_P when θ_L = 60°.

Show on your graph how you obtain your answer.

θ_P = ...° [2]

[Total: 13]

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2 A student prepares a pure dry sample of the insoluble salt, barium sulfate.

Procedure

The student:

step 1 puts 75 cm^3 of aqueous sodium sulfate into a beaker
step 2 adds an excess of aqueous barium nitrate to the beaker
step 3 stirs the reaction mixture
step 4 filters the reaction mixture
step 5 pours distilled water over the residue in the filter paper
step 6 dries the filter paper and residue in a warm oven
step 7 uses a spatula to scrape the barium sulfate off the filter paper and puts the barium sulfate into a sample bottle
step 8 measures the mass of the pure dry barium sulfate prepared.

(a) Fig. 2.1 shows the volume of aqueous barium nitrate the student adds to the beaker.

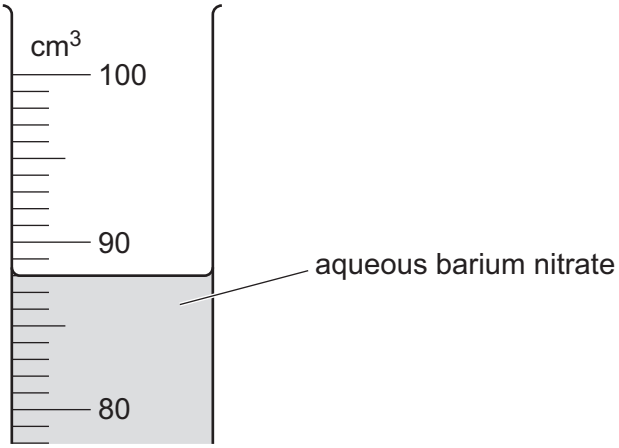

Fig. 2.1

Record the volume of aqueous barium nitrate the student uses.

volume = ... cm^3 [1]

(b) Describe the observation made during **step 2**.

..... [1]

(c) Explain why the student stirs the reaction mixture in **step 3**.

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..... [1]

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(d) Draw a labelled diagram to show the assembled apparatus used in **step 4**.

Include a label to show where the barium sulfate is found.

[2]

(e) Explain the importance of **step 5**.

.....

..... [1]

(f) The mass of pure dry barium sulfate prepared by the student is less than expected.

Describe **one** practical reason why the mass is less than expected.

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..... [1]

[Total: 7]

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3 Antacids are used to neutralise excess acid in the stomach.

Stomach acid has a pH of 2. When antacid is added to stomach acid, the pH increases.

Plan an investigation to determine the relationship between the mass of antacid and the pH increase when antacid is added to excess stomach acid.

You are provided with:

- dilute hydrochloric acid with a pH of 2, to use as stomach acid
- antacid powder
- 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 and explain 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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4 A student investigates the effects of two factors on the period T of a simple pendulum.

The period T of a pendulum is the time for one oscillation (swing) of the pendulum. This is shown in Fig. 4.1, where the period is the time taken for the pendulum bob to move from **P** to **Q** and back to **P** again.

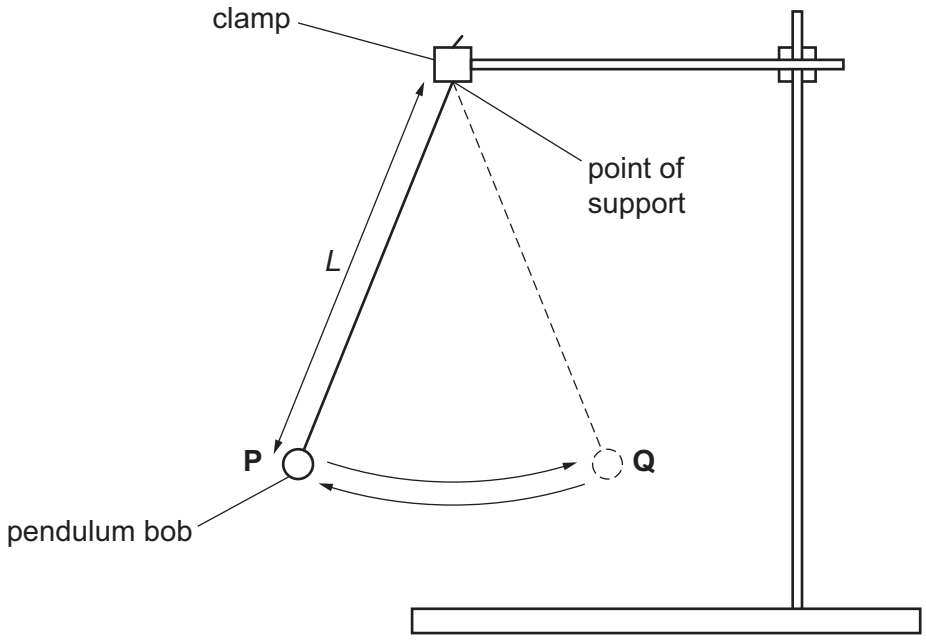

Fig. 4.1

(a) The student first investigates the effect of varying the length L of the pendulum.

Procedure

The student:

- sets the pendulum length L to 20.0 cm
- measures the time t for 15 oscillations
- calculates the period T
- calculates T^2.

The student repeats the procedure for L = 40.0, 60.0, 80.0 and 100.0 cm.

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Table 4.1 shows some of the student's data.

Table 4.1

L / cm	t / s	T / s	T^2 / s^2
20.0	13.4	0.893	0.797
40.0	19.0	1.27	1.61
60.0			
80.0	26.9	1.79	3.20
100.0	30.1	2.01	4.04

(i) Fig. 4.2 shows the reading on the stop-watch for time t when L = 60.0 cm.

Fig. 4.2

Record this value of t in the row for L = 60.0 cm in Table 4.1. [1]

(ii) Complete Table 4.1 by calculating T and T^2.

Record T and T^2 to **three** significant figures. [3]

(iii) The student thinks that either T or T^2 is proportional to L.

State which variable, T or T^2, is proportional to L.

Use values from Table 4.1 to justify your answer.

variable .....

justification .....

.....

.....

.....

[2]

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(iv) Fig. 4.3 shows a diagram of the pendulum of length L = 60.0 cm. The diagram is drawn to scale.

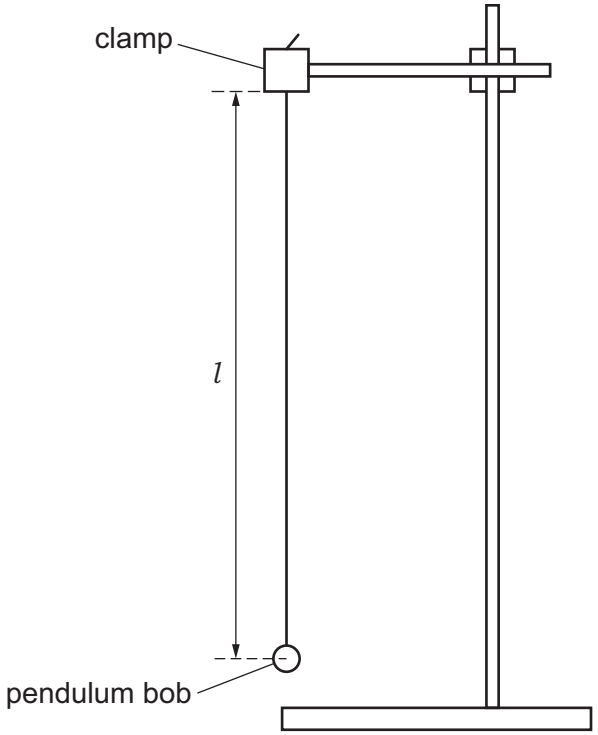

Fig. 4.3 (drawn to scale)

Record to the nearest 0.1 cm the length l of the pendulum shown in Fig. 4.3.

l = ... cm [1]

(v) Calculate the scale of the diagram in Fig. 4.3.

Use your answer to **(a)(iv)** and the equation shown.

$$\text{scale} = \frac{l}{60.0}$$

scale = ... [1]

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(b) The student now uses a protractor to investigate the effect of varying the angle of displacement α of the pendulum.

The angle of displacement α of the pendulum is the initial angle from the vertical at which the pendulum is released, as shown in Fig. 4.4.

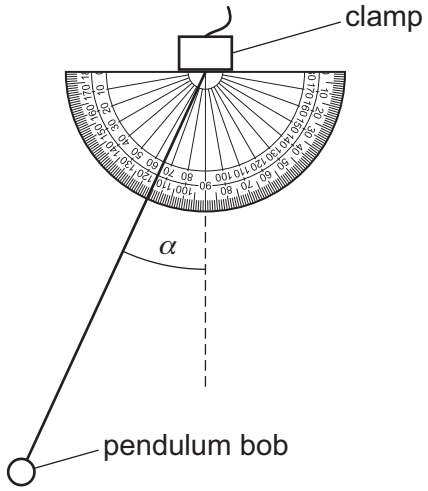

Fig. 4.4

Procedure

The student:

- sets the pendulum length L to 80.0 cm
- measures the time t for 15 oscillations at five different values of α
- calculates the period T for each value of α
- records α, t and T in Table 4.2.

Table 4.2

α/°	t/s	T/s
10.0	27.1	1.81
20.0	27.0	1.80
25.0	27.2	1.81
35.0	27.5	1.83
40.0	28.1	1.87

(i) Suggest **one** precaution the student takes to make an accurate measurement of angle α.

.....

..... [1]

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(ii) Values are considered to be equal within the limits of experimental accuracy if they are within 10% of each other.

State whether the five values of T in Table 4.2 are equal within the limits of experimental accuracy.

Justify your statement with a calculation.

statement .....

.....

.....
[2]

(c) (i) Explain why the student measures the time t for 15 oscillations and then calculates the period T, rather than measuring T directly.

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..... [1]

(ii) Suggest why the student does **not** choose to measure the time for 150 oscillations.

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..... [1]

[Total: 13]

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