Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

PHYSICS **9702/33**

Paper 3 Advanced Practical Skills 1 **October/November 2025**

2 hours

You must answer on the question paper.

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

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 will be allowed to work with the apparatus for a maximum of 1 hour for each question.
- You should record all your observations in the spaces provided in the question paper as soon as these observations are made.
- 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 [ ].

For Examiner's Use	
1	
2	
Total	

This document has **12** pages. Any blank pages are indicated.

[Turn over

You may not need to use all of the materials provided.

1 In this experiment, you will investigate the oscillations of a pendulum on a board.

(a) • Fix the string of the pendulum onto the nail using some of the adhesive putty, as shown in Fig. 1.1.

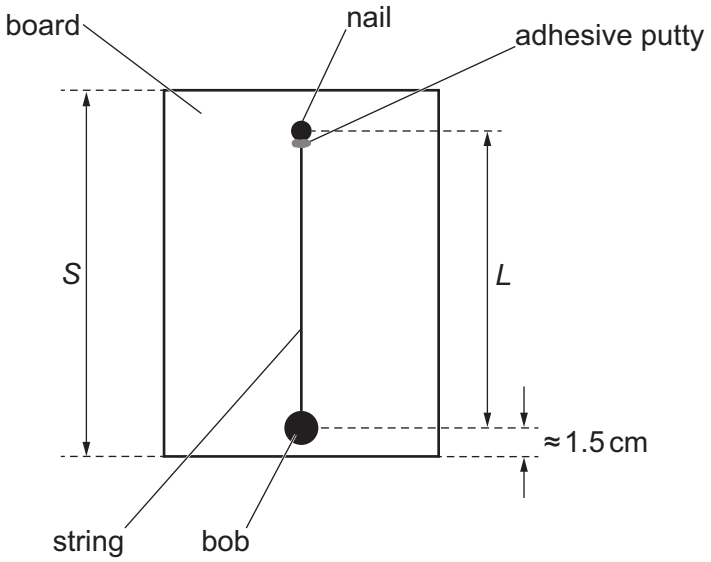


Fig. 1.1

• The distance between the two edges of the board is *S*, as shown in Fig. 1.1.

The length *L* of the pendulum is the distance between the centre of the nail and the centre of the bob.

Adjust the length of the pendulum by wrapping the string around the nail so that the centre of the bob is approximately 1.5 cm from the edge of the board.

• Measure and record *S* and *L*.

S = ... cm

L = ... cm
[1]

(b) • Set up the apparatus as shown in Fig. 1.2.

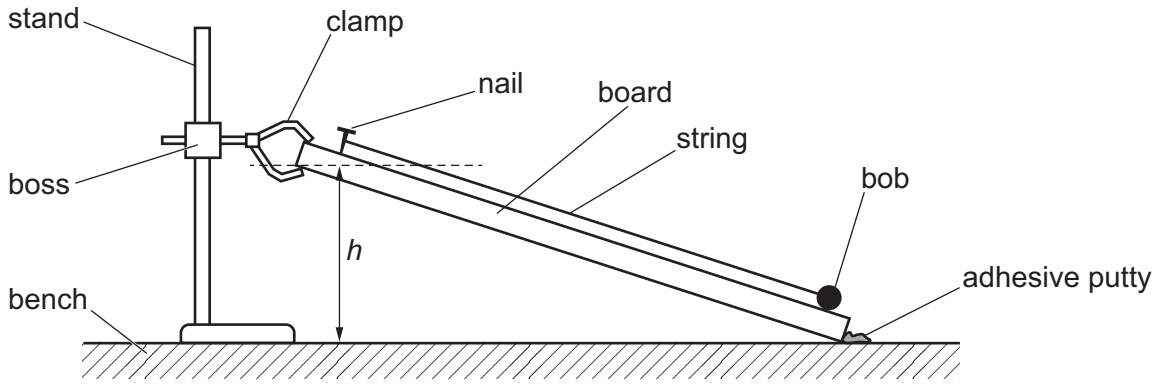


Fig. 1.2

- The distance between the lower edge of the top of the board and the bench is *h*, as shown in Fig. 1.2.

  Adjust the position of the boss so that *h* is approximately 22 cm.

- Fix the position of the bottom of the board using adhesive putty.

- Measure and record *h*.

h = ... cm

- Move the bob to the edge of the board, as shown in Fig. 1.3.

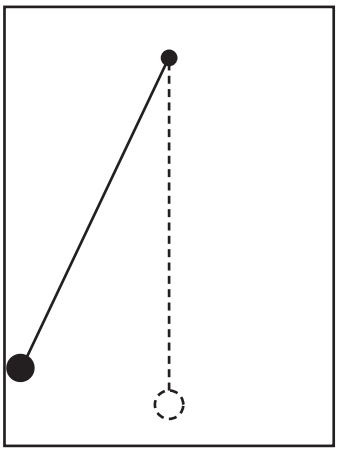


Fig. 1.3

- Release the bob. The bob rolls across the board and the pendulum oscillates.

- Take measurements to determine the period *T* of the oscillations.

T = ... s
[2]

(c) Change h in the range $10.0\,\text{cm} \leqslant h \leqslant 38.0\,\text{cm}$ and determine T. Repeat until you have six sets of values of h and T.

Record your results in a table. Include values of $\frac{S}{h}$ and T^2 in your table.

[8]

(d) (i) Plot a graph of T^2 on the y-axis against $\frac{S}{h}$ on the x-axis. [3]

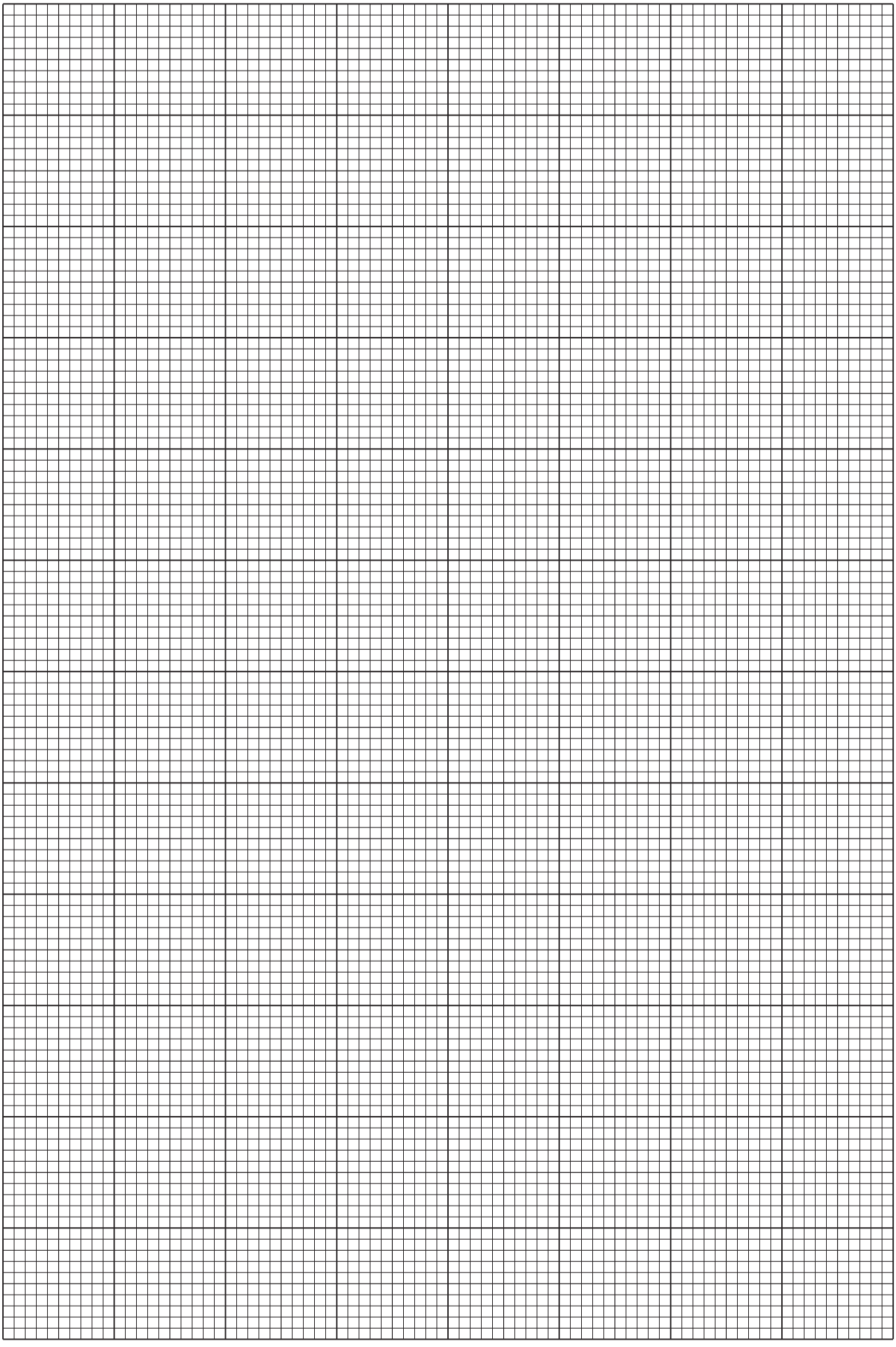
(ii) Draw the straight line of best fit. [1]

(iii) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...

[2]



(e) (i) It is suggested that the quantities T, S and h are related by the equation

$$T^2 = A\frac{S}{h} + B$$

where A and B are constants.

Using your answers in **(d)(iii)**, determine the values of A and B.
Give appropriate units.

A = ...

B = ...
[2]

(ii) Theory suggests that

$$A = \frac{28\pi^2 L}{5g}$$

where g is the acceleration of free fall.

Use your values in **(a)** and **(e)(i)** to determine a value for g.
Give an appropriate unit.

g = ... [1]

[Total: 20]

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You may not need to use all of the materials provided.

2 In this experiment, you will investigate the resistance of a light-dependent resistor (LDR) using the light from a light-emitting diode (LED).

(a) (i) • Using the LED, set up the circuit shown in Fig. 2.1.

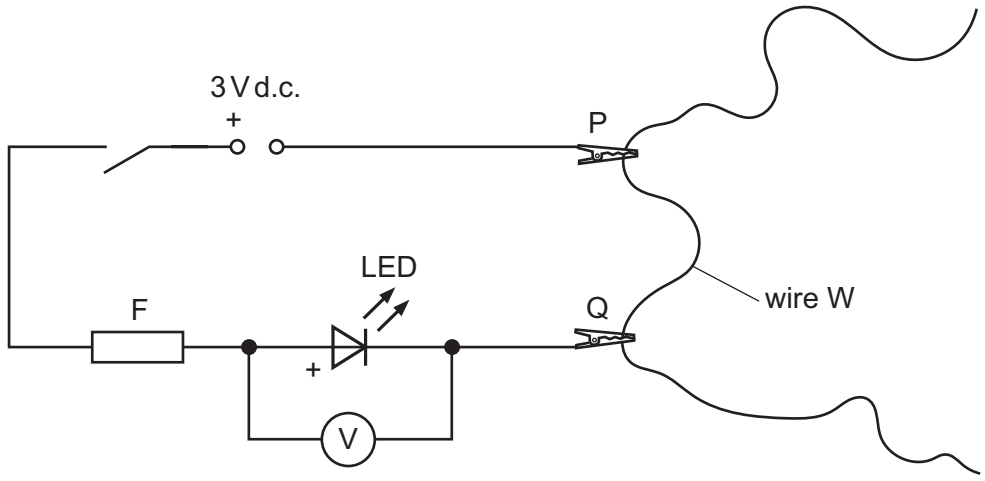

Fig. 2.1

- Ensure that the positive terminal of the power supply and the positive terminal of the LED are connected as shown in Fig. 2.1.
- P and Q are crocodile clips. Position P and Q so that there is approximately 10 cm of wire W between P and Q.
- Close the switch. The LED should light.
- Open the switch.
- Using the LDR and ohmmeter, set up a second circuit as shown in Fig. 2.2.

Fig. 2.2

- Arrange the apparatus as shown in Fig. 2.3.

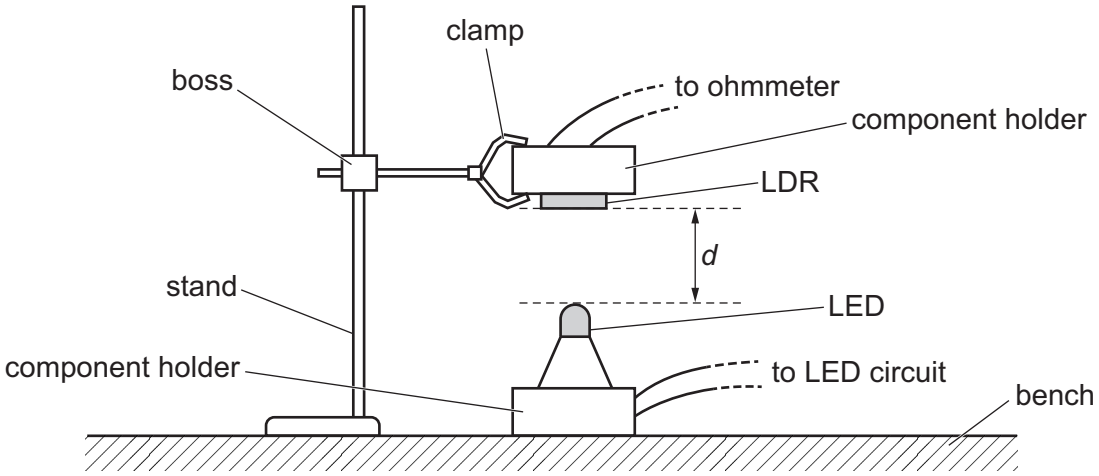

Fig. 2.3 (not to scale)

- The distance between the top of the LED and the surface of the LDR is *d*.

  Adjust the position of the LDR so that *d* is approximately 0.03 m.

- Measure and record *d*.

d = ... m [2]

(ii) Estimate the percentage uncertainty in your value of *d*. Show your working.

percentage uncertainty = ... % [1]

(b) • The length of wire W between P and Q is L.

Measure and record L.

L = ...

• Close the switch.

• The potential difference V across the LED is given by the voltmeter.

The resistance R of the LDR is given by the ohmmeter.

Measure and record V and R.

V = ...

R = ...

• Open the switch.

[2]

(c) • Change the length of wire W between P and Q so that L is approximately 90 cm.

• Repeat **(b)**.

L = ...

V = ...

R = ...

[3]

(d) It is suggested that the relationship between V, d and R is

$$V = \frac{Zd}{R} + k$$

where Z has the value $1.00 \times 10^3 \,\text{V}\,\Omega\,\text{m}^{-1}$ and k is a constant.

(i) Using your data, calculate **two** values of k.

first value of k = ...

second value of k = ...

[1]

(ii) Justify the number of significant figures that you have given for your values of k.

.....

.....

..... [1]

(e) It is suggested that the percentage uncertainty in the values of k is 5%.

Using this uncertainty, explain whether your results support the relationship in **(d)**.

.....

.....

.....

..... [1]

(f) It is suggested that

$$k = \frac{hc}{e\lambda}$$

where h is 6.63×10^{-34} J s,
c is 3.00×10^{8} m s^{-1},
e is 1.60×10^{-19} C and
λ is the wavelength of the light emitted by the LED.

Use your second value of k to determine λ.

λ = ... m [1]

(g) (i) Describe **four** sources of uncertainty or limitations of the procedure for this experiment.

For any uncertainties in measurement that you describe, you should state the quantity being measured and a reason for the uncertainty.

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

.....

[4]

(ii) Describe **four** improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

.....

[4]

[Total: 20]