



Cambridge International AS & A Level

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PHYSICS

9702/33

Paper 3 Advanced Practical Skills 1

May/June 2026

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. Do **not** use correction fluid or tape.
- 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.

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

- 1 In this experiment, you will investigate how the lengths of strings affect the period of oscillation of a pendulum bob.

You have been provided with two strings. The longer string is connected to a pendulum bob. The shorter string has a loop at one end.

- (a) • Set up the apparatus as shown in Figure 1.1.

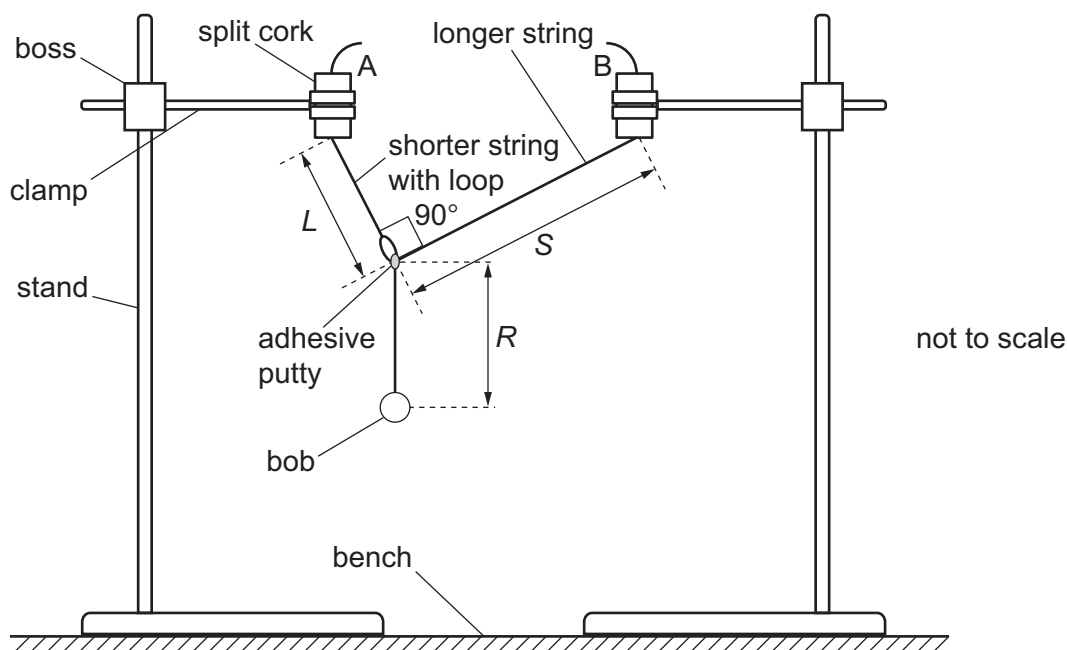


Figure 1.1

- A and B are split corks. Adjust the bosses so that A and B are at the same height above the bench.
- Clamp the shorter string in split cork A.
- The distance between the bottom of split cork A and the end of the loop is L .
Adjust the position of the shorter string in split cork A so that L is approximately 15 cm.
- Pass the longer string through the loop.
- The distance between the end of the loop and the centre of the bob is R .
Adjust the position of the loop so that R is equal to L .
- Use the adhesive putty to fix the loop at this position on the longer string.
- Clamp the longer string in split cork B.
- The distance between the end of the loop and the bottom of split cork B is S .
Adjust the position of the longer string in split cork B so that S is equal to $2L$.
- Move the stands so that the angle between the strings is 90° , as shown in Figure 1.1.





- Measure and record L and S .

$L =$

$S =$

[2]

- (b)
- Pull the bob towards you through a short distance.
 - Release the bob. The bob will oscillate.
 - Determine the period T of these oscillations.

$T =$ s [2]





- (c) Change L . Adjust the apparatus so that R is equal to L , S is equal to $2L$ and the angle between the strings is 90° . Determine T . Repeat until you have five sets of values of L and T .

Record your results in a table. Include values of T^2 in your table.

[7]

- (d) (i) Plot a graph of T^2 on the y -axis against L on the x -axis.

[3]

- (ii) Draw the straight line of best fit.

[1]

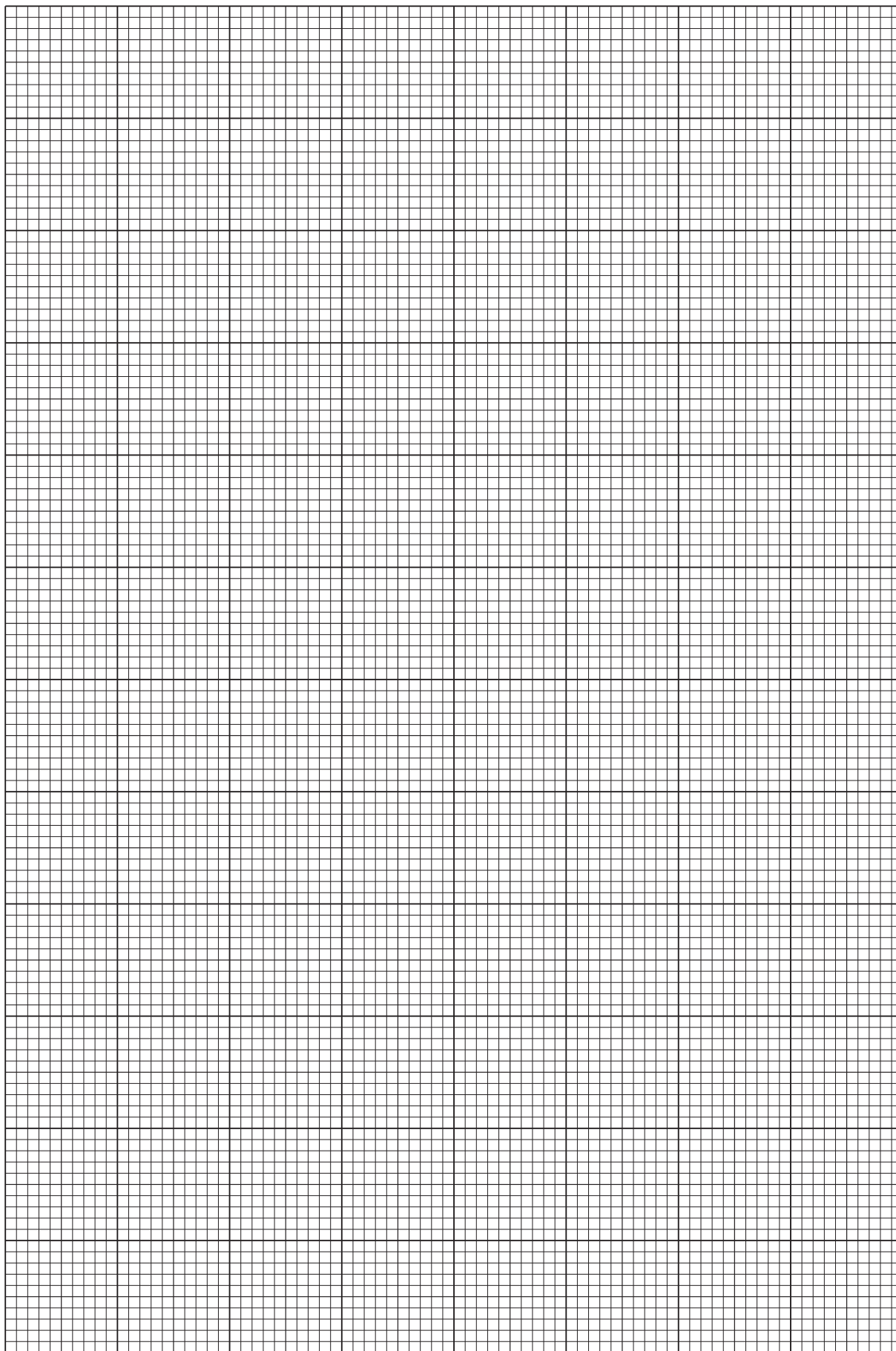
- (iii) Determine the gradient and y -intercept of this line.

gradient =

y -intercept =

[2]







- (e) It is suggested that the quantities T and L are related by the equation

$$T^2 = PL + Q$$

where P and Q are constants.

Using your answers in **1(d)(iii)**, determine the values of P and Q .
Give appropriate units.

$$P = \dots\dots\dots$$

$$Q = \dots\dots\dots [2]$$

- (f) Theory suggests that

$$g = \frac{4\pi^2 \left(1 + \frac{2}{\sqrt{5}}\right)}{P}$$

where g is the acceleration of free fall.

Use your answer in **1(e)** to determine a value for g .
Give an appropriate unit.

$$g = \dots\dots\dots [1]$$

[Total: 20]



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

- 2 In this experiment, you will investigate the stability of a wooden block.

You have been provided with two wooden blocks labelled E and F. Each block has a square cross-section.

- (a) The thickness of block E is t as shown in Figure 2.1.

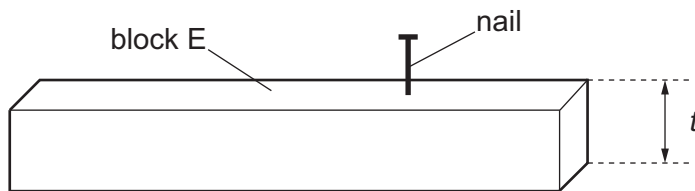


Figure 2.1

Measure and record t .

$t =$ [1]

- (b) • Place E on the bench as shown in Figure 2.2.

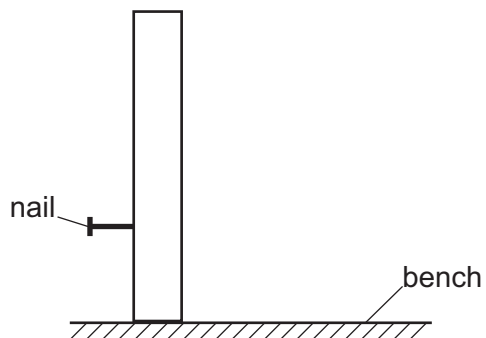


Figure 2.2

- Gently push the block until it overbalances as shown in Figure 2.3.

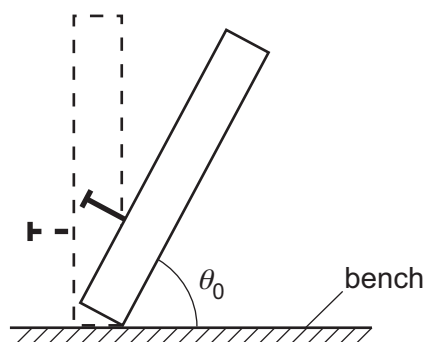


Figure 2.3

- The angle between the edge of the block and the bench at the point the block just overbalances is θ_0 .

Measure and record θ_0 .

$$\theta_0 = \dots\dots\dots^\circ \quad [2]$$



- (c) (i) • Place E on the bench. Hang a mass m of 50 g on the nail as shown in Figure 2.4.

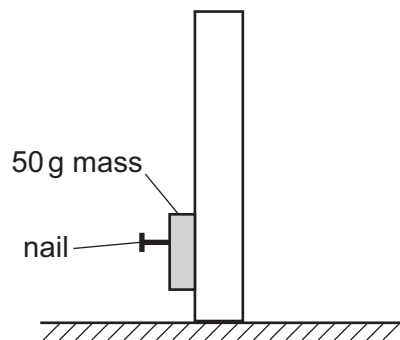


Figure 2.4

- Record m .

$m = \dots\dots\dots$ g

- Gently push the block until it overbalances as shown in Figure 2.5.

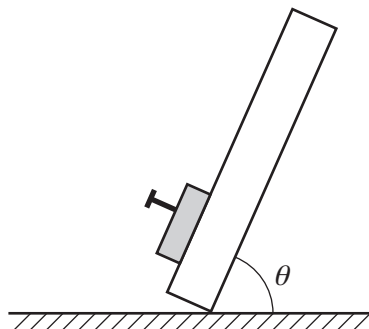


Figure 2.5

- The angle between the edge of the block and the bench at the point the block just overbalances is θ .

Measure and record θ .

$\theta = \dots\dots\dots^\circ$
[1]

- (ii) Estimate the percentage uncertainty in this value of θ . Show your working.

percentage uncertainty = $\dots\dots\dots\%$ [1]



(iii) Calculate $\frac{\tan \theta}{\tan \theta_0}$.

$$\frac{\tan \theta}{\tan \theta_0} = \dots\dots\dots [1]$$

(iv) Justify the number of significant figures that you have given for your value of $\frac{\tan \theta}{\tan \theta_0}$.

.....

 [1]

(d) Using block F and a mass m of 100g, repeat **2(a)**, **2(b)**, **2(c)(i)** and **2(c)(iii)**.

$$t = \dots\dots\dots$$

$$\theta_0 = \dots\dots\dots^\circ$$

$$m = \dots\dots\dots \text{ g}$$

$$\theta = \dots\dots\dots^\circ$$

$$\frac{\tan \theta}{\tan \theta_0} = \dots\dots\dots [3]$$



- (e) It is suggested that the relationship between θ , θ_0 , t and m is

$$\frac{\tan \theta}{\tan \theta_0} = \frac{kt}{\sqrt{m}}$$

where k is a constant.

Using your data, calculate **two** values of k .

first value of k =

second value of k =

[1]

- (f) It is suggested that the percentage uncertainty in the values of k is 15%.

Using this uncertainty, explain whether your results support the relationship in **2(e)**.

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.....

.....

..... [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

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2

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3

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4

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[4]

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

1

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2

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3

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4

.....

[4]

[Total: 20]

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