CAMBRIDGE
International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

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.

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[Turn over

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.

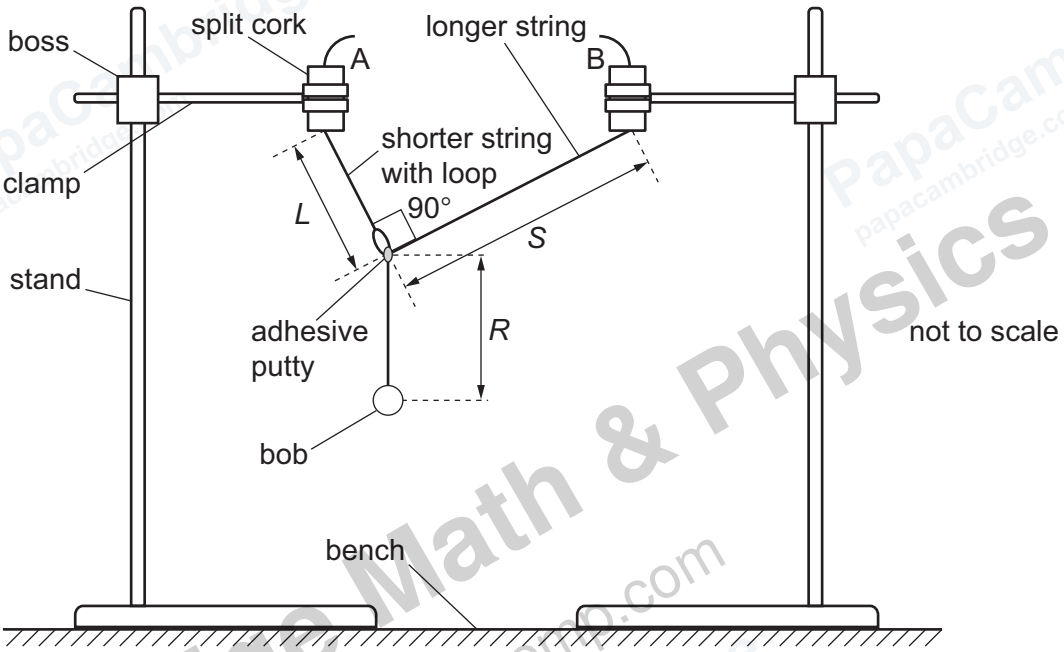


Figure 1.1

- 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 2*L*.
- 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]

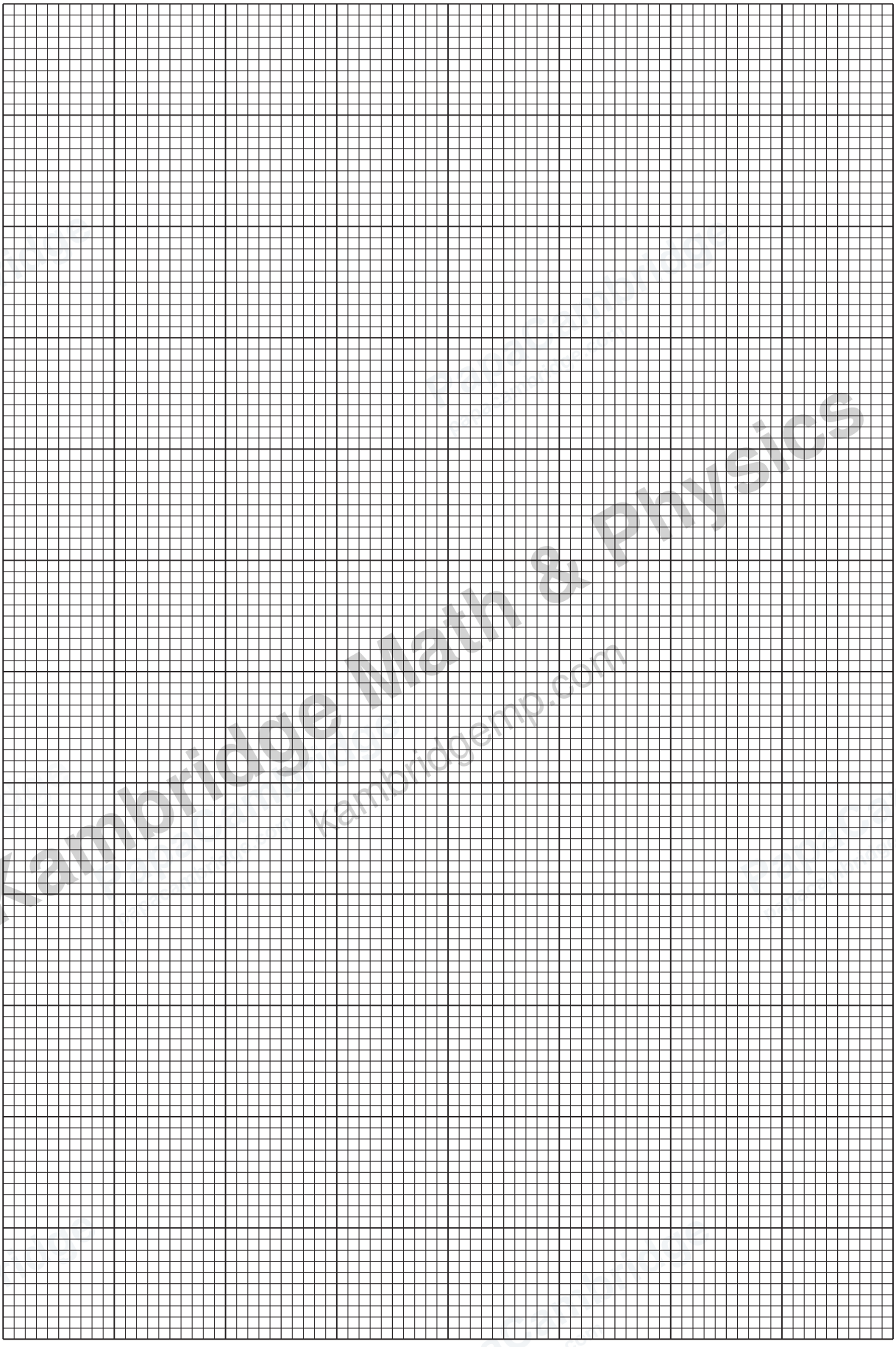
(d) **(i)** Plot a graph of T^2 on the y-axis against L on the x-axis. [3]

(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 = ...

Q = ...
[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 = ... [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.

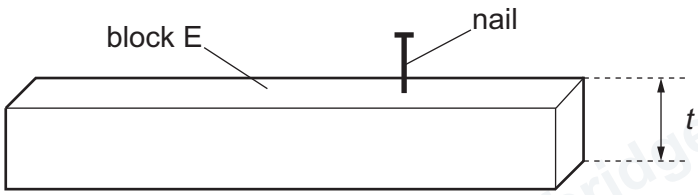


Figure 2.1

Measure and record *t*.

t = ... [1]

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

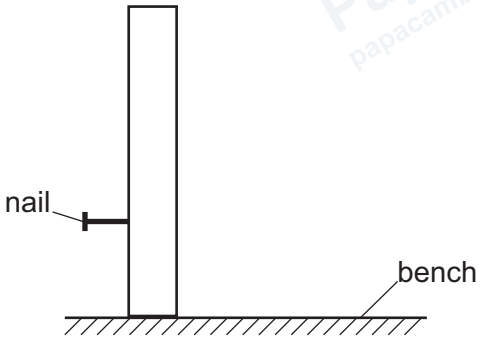


Figure 2.2

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

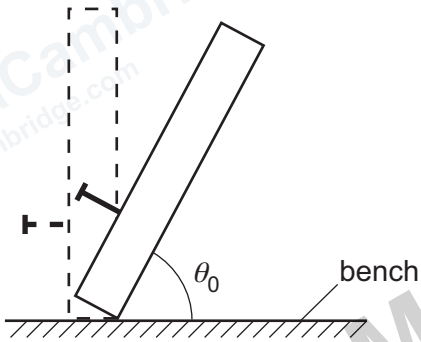


Figure 2.3

• 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.

θ_0 = ...° [2]

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

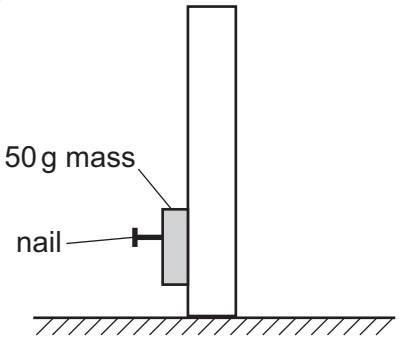


Figure 2.4

• Record m.

m = ... g

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

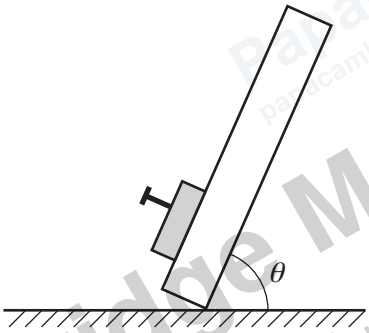


Figure 2.5

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

Measure and record θ.

θ = ... °
[1]

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

percentage uncertainty = ...% [1]

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

$\frac{\tan\theta}{\tan\theta_0}$ = ... [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 100 g, repeat **2(a)**, **2(b)**, **2(c)(i)** and **2(c)(iii)**.

t = ...

θ_0 = ... °

m = ... g

θ = ... °

$\frac{\tan\theta}{\tan\theta_0}$ = ...
[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)**.

.....

.....

.....

..... [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]

