

Cambridge International AS & A Level

CANDIDATE
NAME

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CENTRE
NUMBER

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PHYSICS

9702/35

Paper 3 Advanced Practical Skills 1

May/June 2021

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.

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

1 In this experiment, you will investigate the motion of a pendulum bob.

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

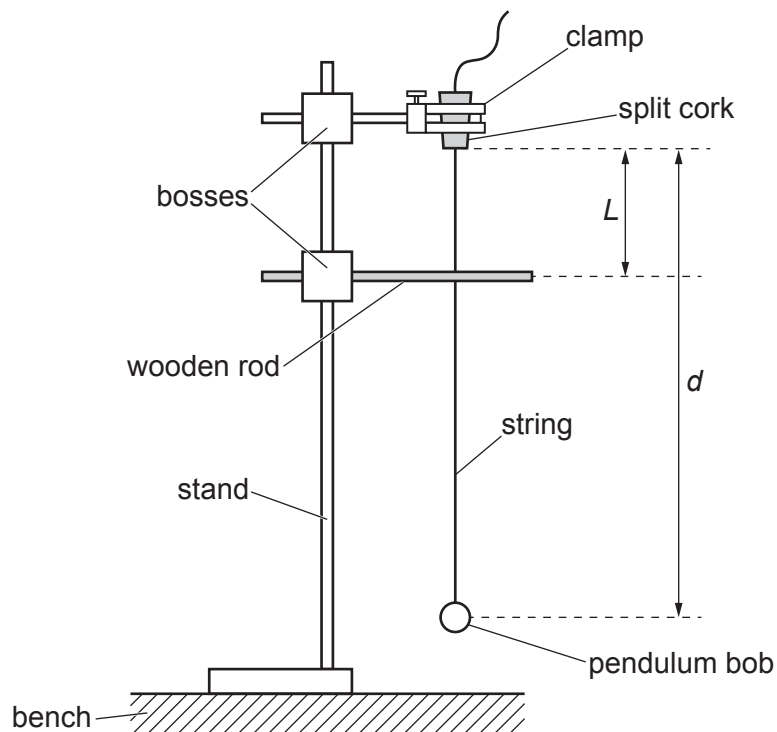


Fig. 1.1

- The distance between the bottom of the cork and the centre of the bob is d .

The distance between the bottom of the cork and the centre of the wooden rod is L .

Adjust the height of the rod until the value of L is approximately 10 cm. Ensure the rod is horizontal and the string is just touching the rod.

- Measure and record L .

$L = \dots\dots\dots$ [1]

- (b)
- Adjust the string in the cork until the value of d is approximately 30 cm.
 - Measure and record d .

$d =$

- Pull the bob towards you through a short distance at right angles to the rod.
- Release the bob. The bob will oscillate.
- Determine the period T of these oscillations.

$T =$ s
[1]

- (c) • Write down your value of L from (a).

$L =$

- Keeping L **constant**, repeat (b) with different values of d until you have five sets of values of d and T .

Record your results in a table. Include values of $\frac{T}{\sqrt{d}}$ and $\sqrt{\frac{(d-L)}{d}}$ in your table.

[10]

- (d) (i) Plot a graph of $\frac{T}{\sqrt{d}}$ on the y -axis against $\sqrt{\frac{(d-L)}{d}}$ on the x -axis.

[3]

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

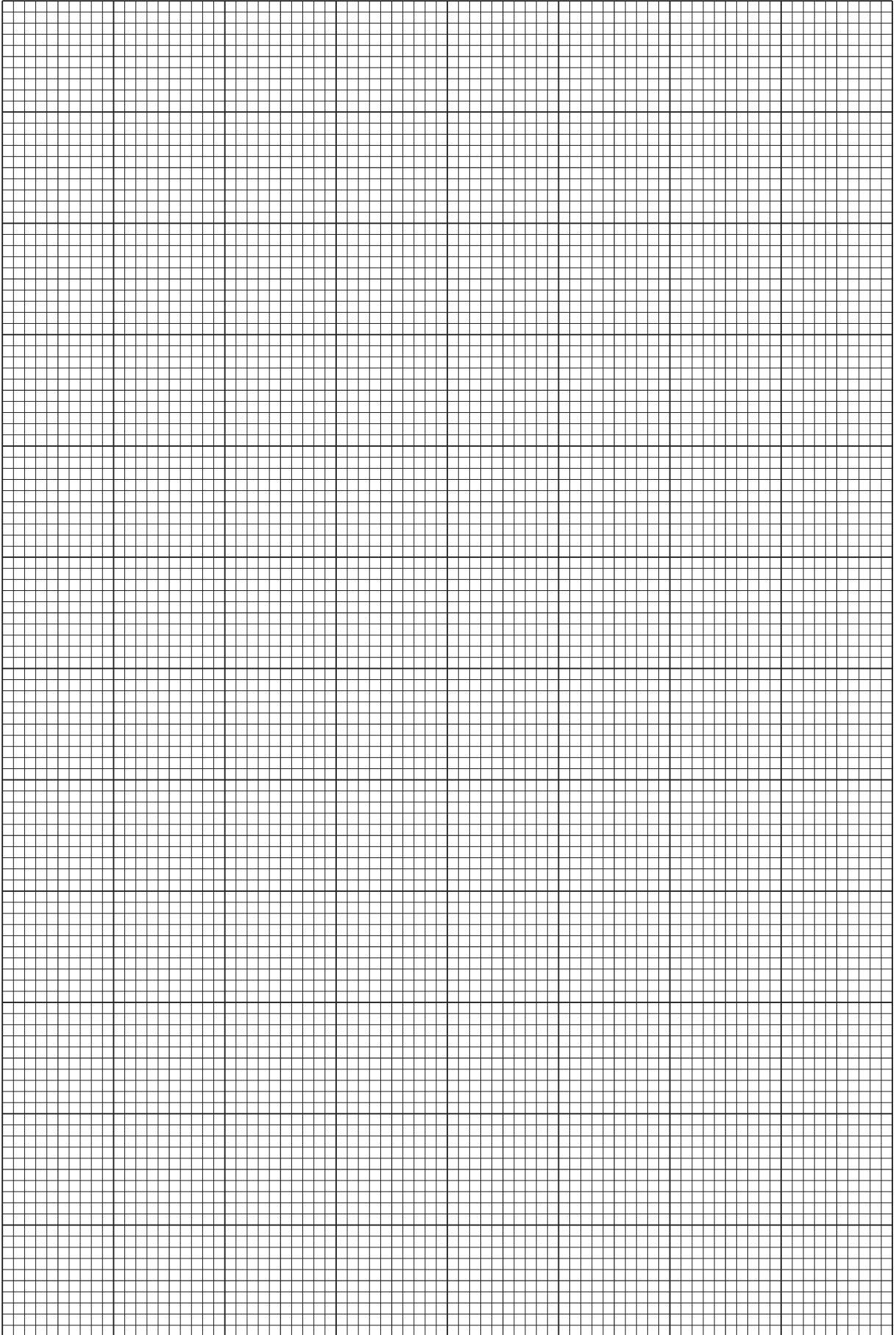
[1]

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

gradient =

y -intercept =

[2]



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

$$\frac{T}{\sqrt{d}} = P\sqrt{\frac{(d-L)}{d}} + Q$$

where P and Q are constants.

Using your answers in (d)(iii), determine the values of P and Q .

Give appropriate units.

$P =$

$Q =$

[2]

[Total: 20]

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

2 In this experiment, you will investigate the equilibrium of a wooden strip.

(a) You have been provided with a wooden strip. There are three holes in the strip and string is attached to two of the holes.

- Press the modelling clay onto the end of the strip as shown in Fig. 2.1.

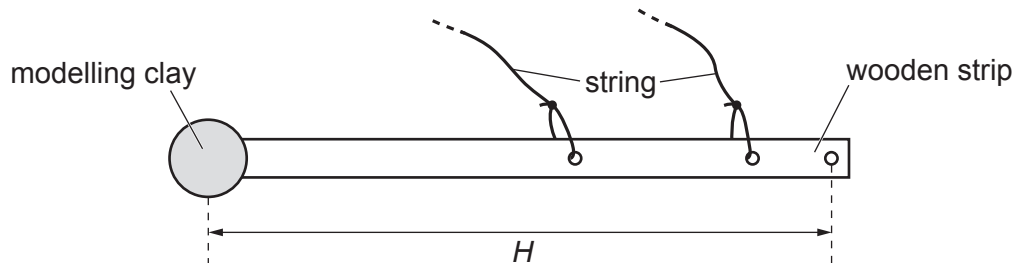


Fig. 2.1

- The distance between the centre of the modelling clay and the centre of the hole at the other end of the strip is H .

Using the ruler, take measurements to determine H .

$H = \dots\dots\dots$ cm [1]

- (b) (i) • Set up the apparatus as shown in Fig. 2.2.

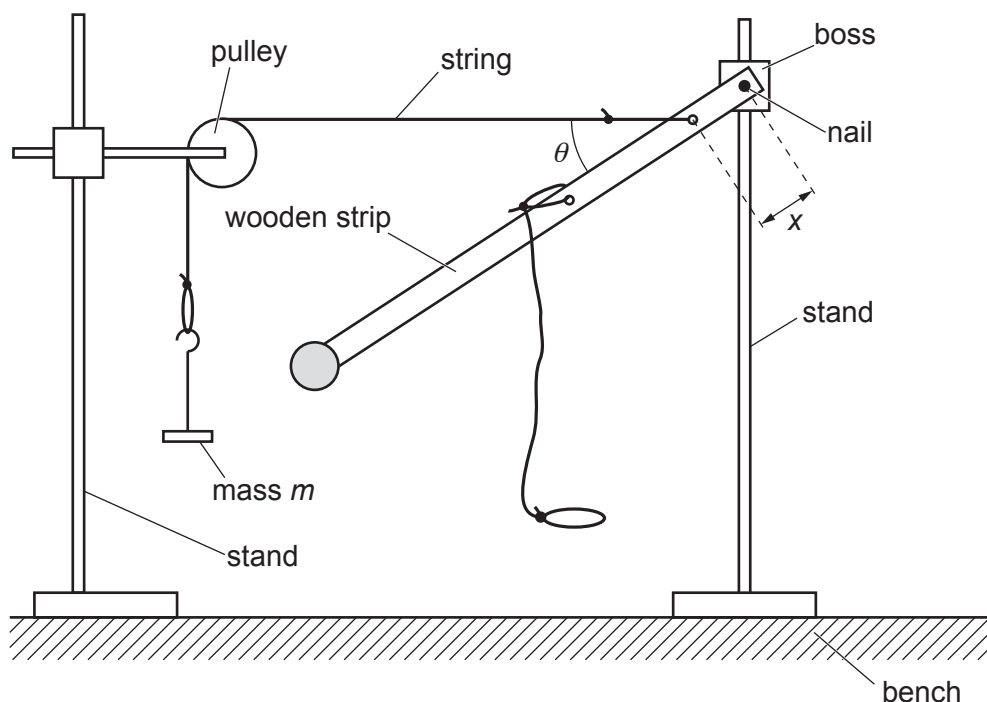


Fig. 2.2 (not to scale)

- Hang a mass m of 100 g from the string.
- Adjust the heights of the boss and pulley until the string between the strip and the pulley is horizontal.
- The distance between the nail and the hole through which the string is attached is x .

The angle between the strip and the horizontal string is θ .

Measure and record x and θ .

$x = \dots\dots\dots$ cm

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

[2]

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

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

(iii) Calculate $x \tan \theta$.

$x \tan \theta = \dots\dots\dots$ cm [1]

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

.....
.....
..... [1]

- (c)
- Remove the mass and the string from the pulley.
 - Set up the apparatus as shown in Fig. 2.3 using the other string.

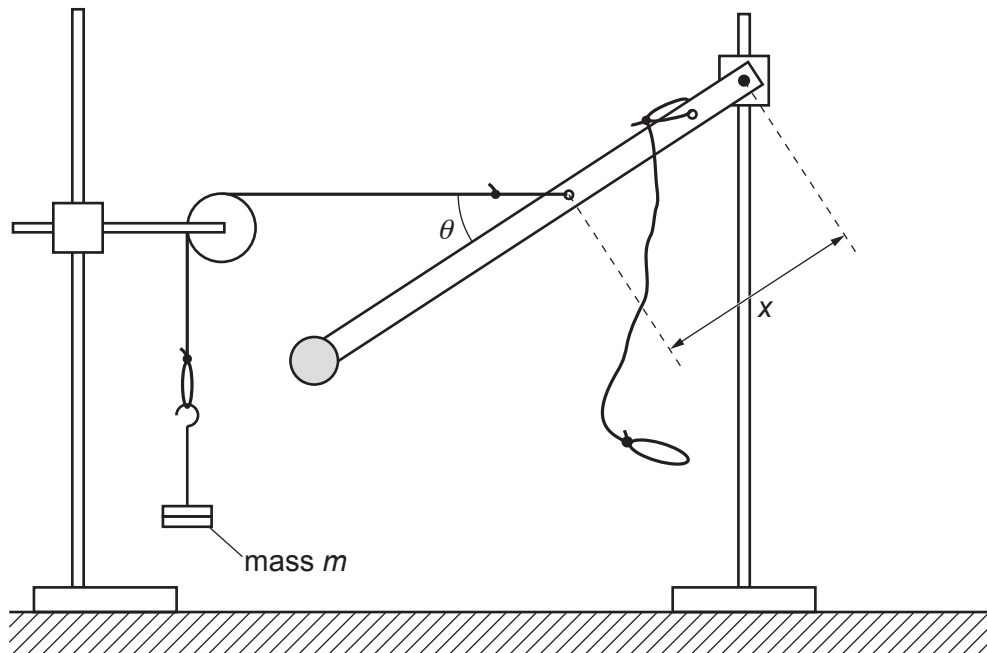


Fig. 2.3 (not to scale)

- Hang a mass m of 200 g from the string.
- Adjust the heights of the boss and pulley until the string between the strip and the pulley is horizontal.
- The distance between the nail and the hole through which the string is attached is x .

The angle between the strip and the horizontal string is θ .

Measure and record x and θ .

$x = \dots\dots\dots$ cm

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

- Calculate $x \tan \theta$.

$x \tan \theta = \dots\dots\dots$ cm
[3]

- (d) It is suggested that the relationship between x , θ and m is

$$x \tan \theta = \frac{k}{m}$$

where k is a constant.

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

first value of k =

second value of k = [1]

- (ii) Explain whether your results support the suggested relationship.

.....

 [1]

- (e) Theory suggests that

$$k = \frac{5HM}{6}$$

where M is the mass of the wooden strip.

Use your second value of k to calculate a value for M .
 Give an appropriate unit.

M = [1]

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

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]

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