

Cambridge International AS & A Level

 CANDIDATE
NAME

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PHYSICS
9702/34

Paper 3 Advanced Practical Skills 2

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 oscillations of a chain.
- (a) (i) • Assemble the apparatus as shown in Fig. 1.1 with each nail held securely in a boss and at the same height above the bench. Position the stands so that the distance between the nails is approximately 60 cm.

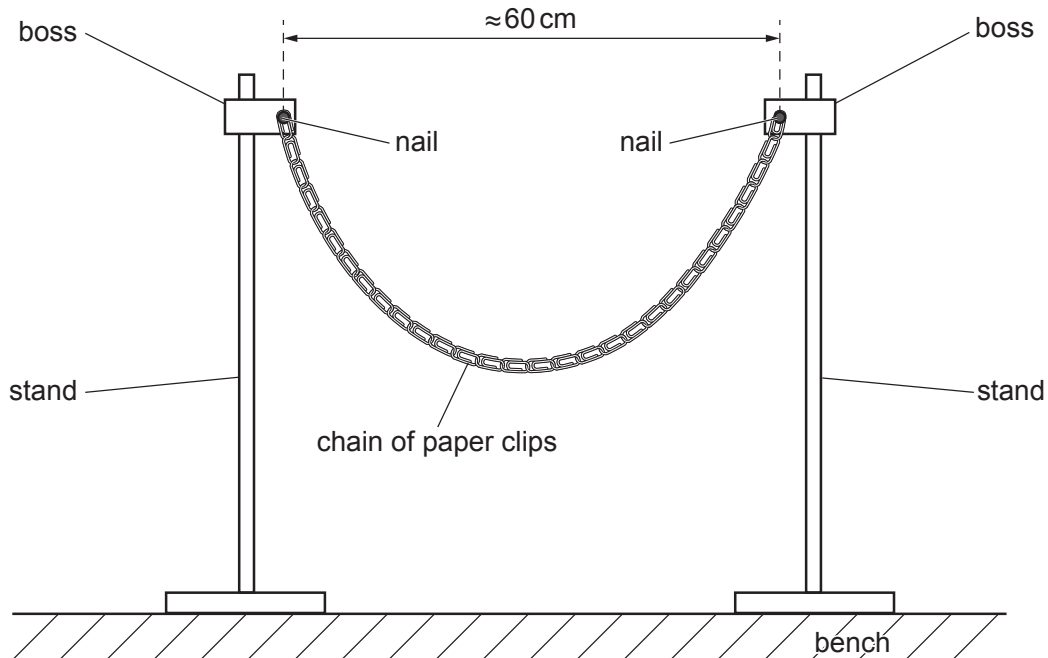


Fig. 1.1

- Rest one of the metre rules on the nails, as shown in Fig. 1.2.

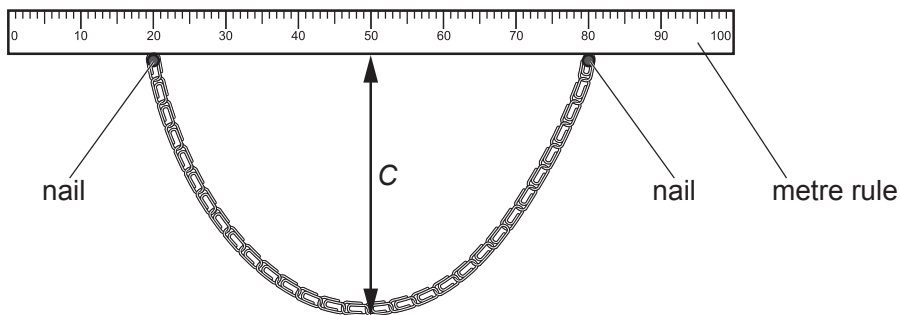


Fig. 1.2

- The vertical distance between the horizontal metre rule and the lowest part of the chain is C .

Using the other metre rule, measure and record C .

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

- (ii)
- Push the bottom of the chain a short distance away from you. Release it so that it swings towards and away from you.
 - Take measurements to determine the period T of these oscillations.

$T = \dots\dots\dots$ [2]

4

- (b) Repeat (a) with different distances between the stands until you have six sets of values of C and T .

All values of C must be greater than 15 cm.

Record your results in a table. Include values of $\frac{1}{T}$ and $\frac{1}{\sqrt{C}}$ in your table.

[9]

- (c) (i) Plot a graph of $\frac{1}{T}$ on the y -axis against $\frac{1}{\sqrt{C}}$ on the x -axis.

[3]

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

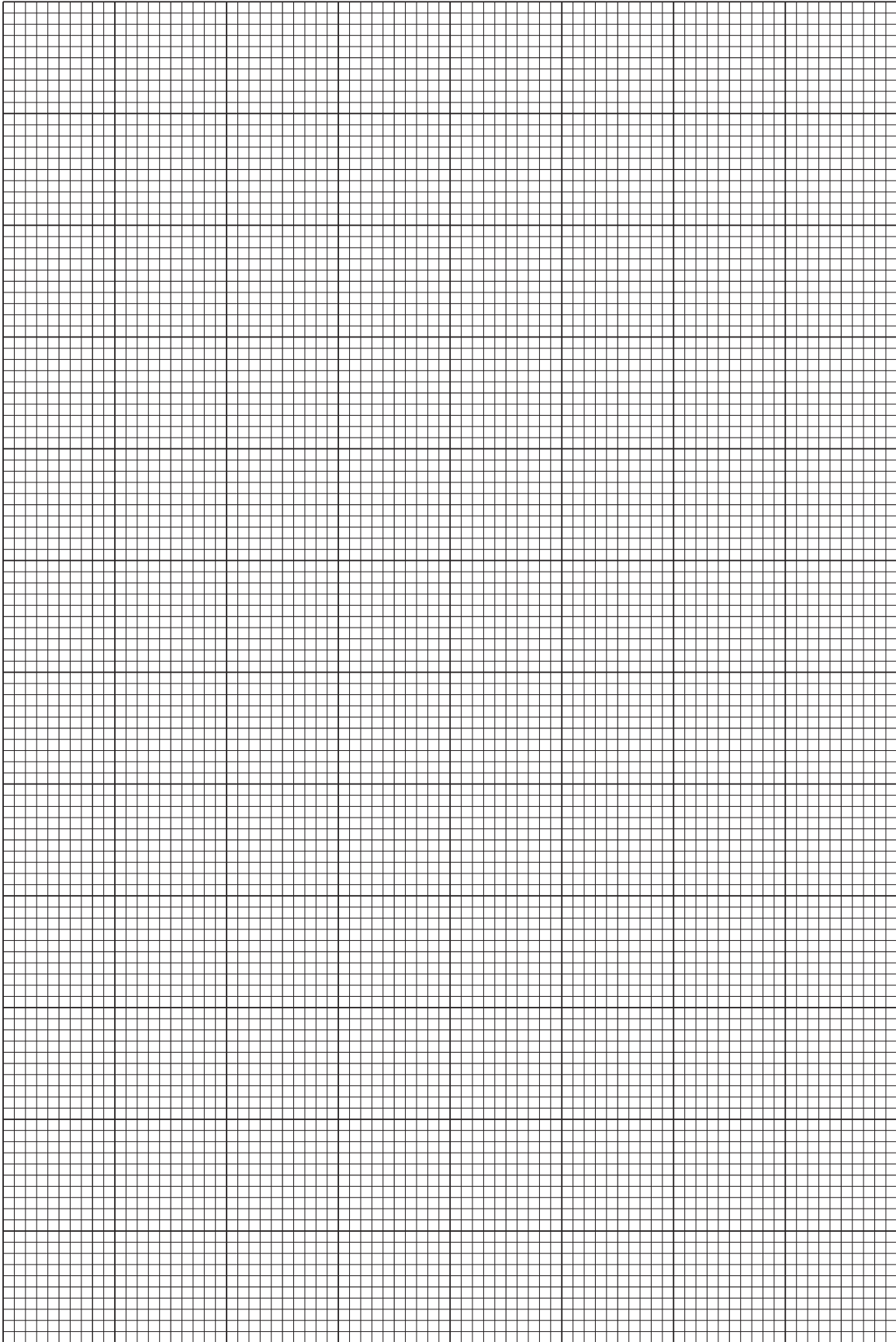
[1]

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

gradient =

y -intercept =

[2]



6

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

$$\frac{1}{T} = \frac{a}{\sqrt{C}} + b$$

where a and b are constants.

Use your answers in (c)(iii) to determine the values of a and b .
Give appropriate units.

$a =$

$b =$

[2]

[Total: 20]

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

2 In this experiment, you will investigate the deformation of a foam ring.

- (a) (i) • Assemble the apparatus as shown in Fig. 2.1.
The wooden rod should pivot freely on the nail.

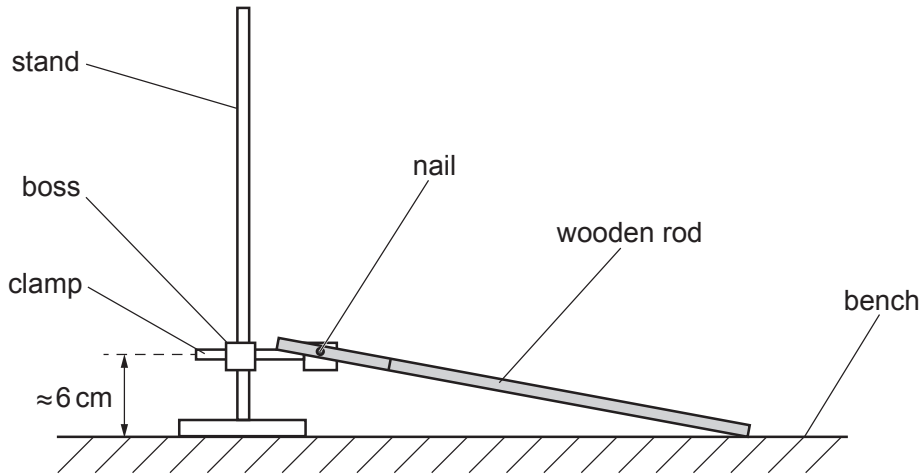


Fig. 2.1

- Take the **larger** of the two foam rings.
- Using the metre rule, measure and record the inner diameter D_1 and the outer diameter D_2 , as shown in Fig. 2.2.

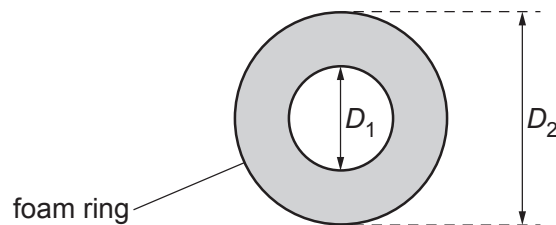


Fig. 2.2

$D_1 = \dots\dots\dots$ mm

$D_2 = \dots\dots\dots$ mm
[2]

- (ii) Estimate the percentage uncertainty in your value of D_2 . Show your working.

percentage uncertainty = [1]

- (b) • Position the ring under the line on the rod and centrally on the wooden block, as shown in Fig. 2.3.

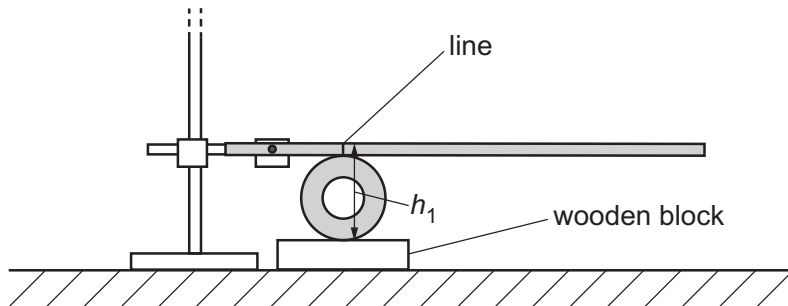


Fig. 2.3

- Adjust the height of the boss so that the rod is horizontal.
- The vertical distance, next to the ring, of the top of the rod above the block is h_1 , as shown in Fig. 2.3.

Using the calipers, measure and record h_1 .

$h_1 = \dots\dots\dots$ mm

- Place the slotted mass at the end of the rod, as shown in Fig. 2.4.

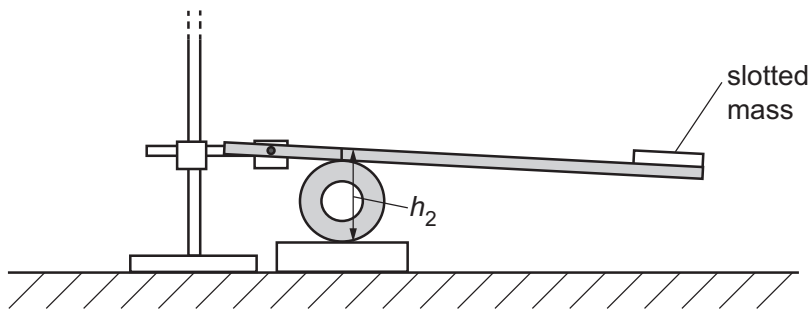


Fig. 2.4

- The vertical distance, next to the ring, of the top of the rod above the block is now h_2 , as shown in Fig. 2.4.

Measure and record h_2 .

$h_2 = \dots\dots\dots$ mm

- Calculate y where $y = h_1 - h_2$.

$y = \dots\dots\dots$ mm
[2]

- (c) (i) The distance between the nail and the line is A and the distance between the nail and the centre of the slotted mass is B , as shown in Fig. 2.5.

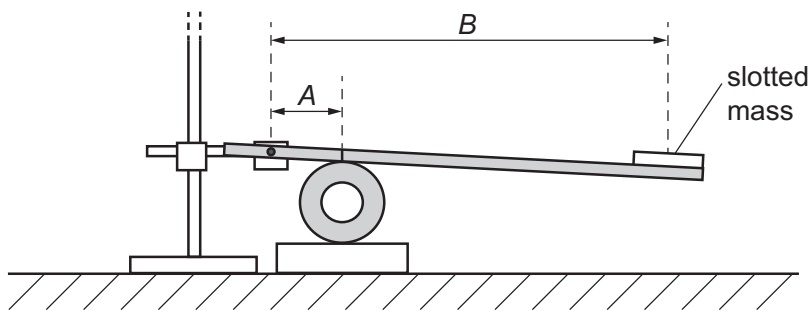


Fig. 2.5

Measure and record A and B .

$A = \dots\dots\dots$ cm

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

- (ii) Calculate the additional force F on the ring using

$$F = \frac{mgB}{A}$$

where $g = 9.81 \text{ N kg}^{-1}$ and $m = 0.100 \text{ kg}$.

$F = \dots\dots\dots$ N [1]

- (iii) Justify the number of significant figures you have given for your value of F .

.....

 [1]

10

- (d) • Take the **smaller** of the two foam rings.
- Using the metre rule, measure and record the inner diameter D_1 and the outer diameter D_2 .

 $D_1 = \dots\dots\dots \text{ mm}$ $D_2 = \dots\dots\dots \text{ mm}$

- Repeat (b) using the smaller ring.

 $h_1 = \dots\dots\dots \text{ mm}$ $h_2 = \dots\dots\dots \text{ mm}$ $y = \dots\dots\dots \text{ mm}$
[2]

- (e) It is suggested that the relationship between D_1 , D_2 , F and y is

$$\frac{(D_2^2 - D_1^2)}{D_2^3} = \frac{kF}{y}$$

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]

(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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