Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME										
CENTRE NUMBER						CANDIDATE NUMBER				

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.

DC (LK/CT) 200281/2

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.

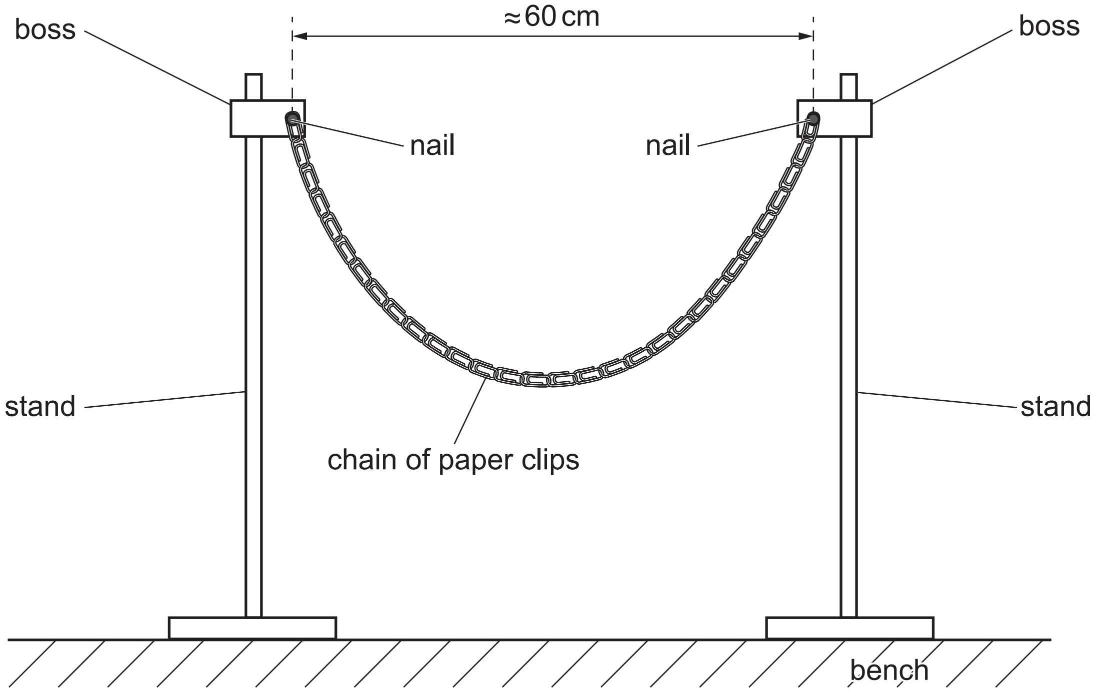

Fig. 1.1

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

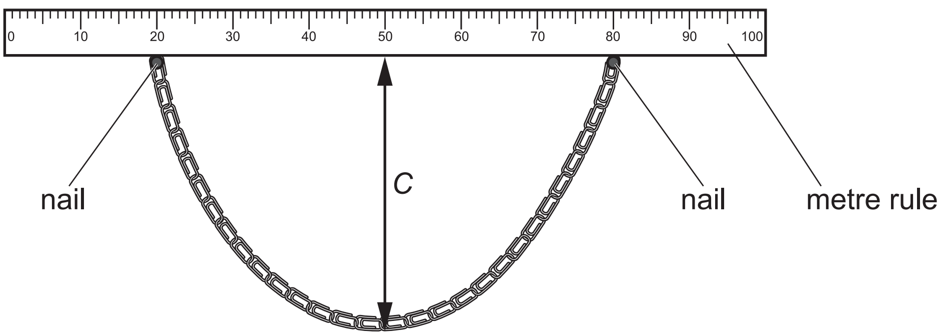

Fig. 1.2

• 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 = ... 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 = ... [2]

(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]

(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.

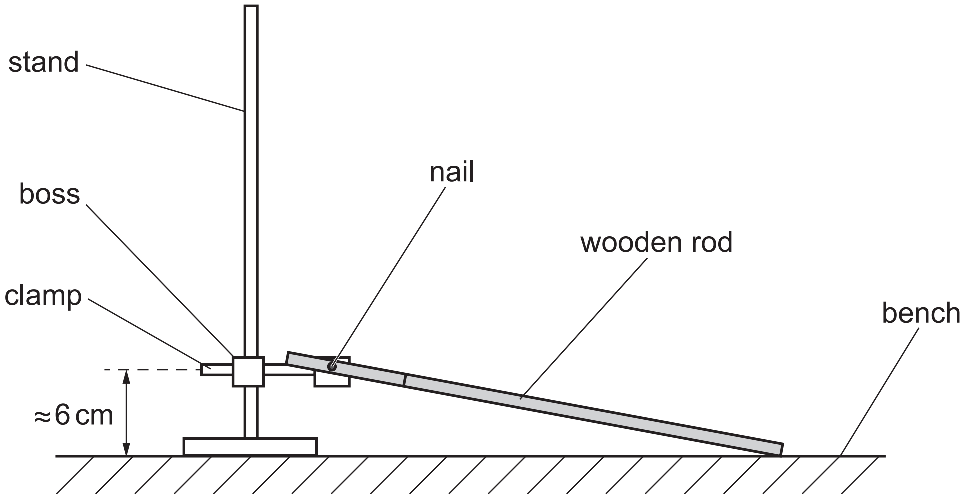

Fig. 2.1

• 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.

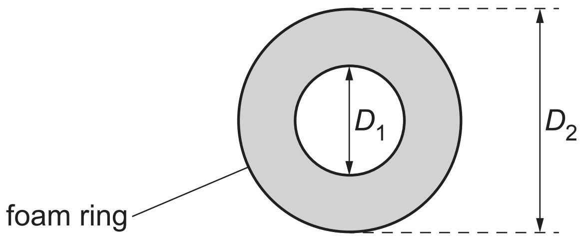

Fig. 2.2

D_1 = ... mm

D_2 = ... 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.

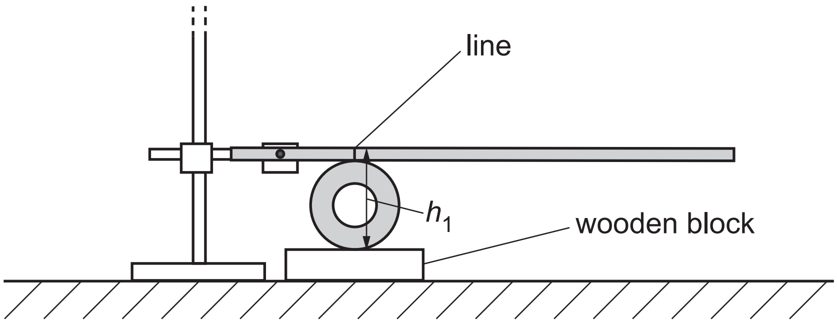

Fig. 2.3

• 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 = ... mm

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

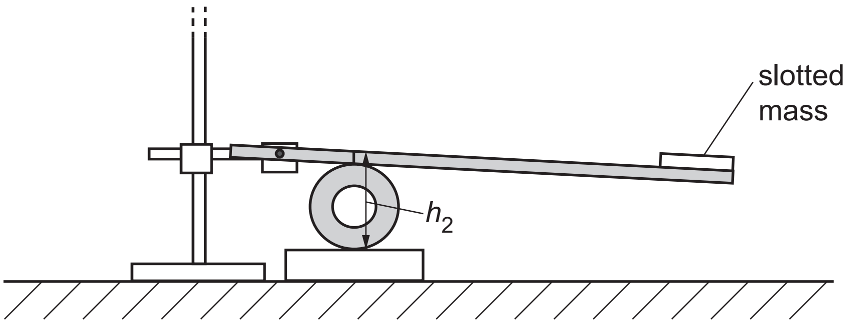

Fig. 2.4

- 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 = ... mm

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

y = ... 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.

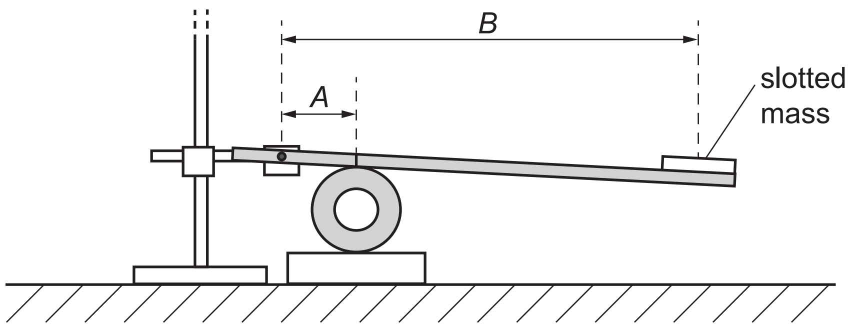

Fig. 2.5

Measure and record A and B.

A = ... cm

B = ... cm
[1]

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

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

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

F = ... N [1]

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

....

....

.... [1]

(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 = ... mm

D_2 = ... mm

• Repeat **(b)** using the smaller ring.

h_1 = ... mm

h_2 = ... mm

y = ... 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]