



Cambridge International AS & A Level

CANDIDATE
NAME

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CENTRE
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PHYSICS

9702/33

Paper 3 Advanced Practical Skills 1

May/June 2023

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.

You have been provided with a cylinder and a pendulum.

- (a)** • Use adhesive putty to attach the string to the cylinder as shown in Fig. 1.1.

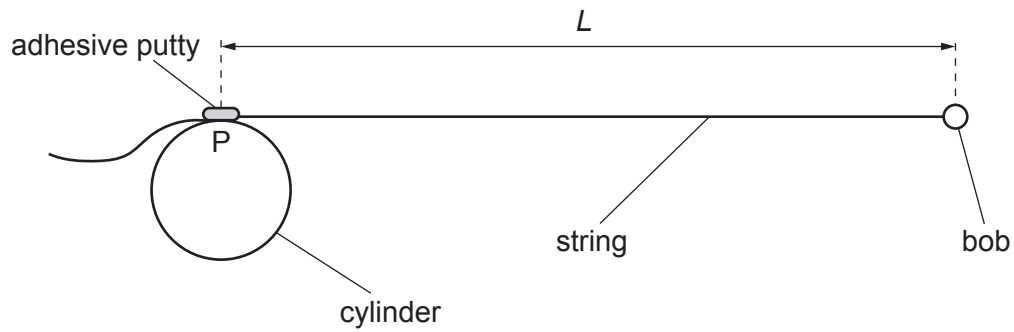


Fig. 1.1

- P is the point at which the string is attached to the cylinder.

The distance between P and the centre of the bob is L .

Adjust the adhesive putty and string so that L is approximately 45 cm.

- Measure and record L .

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

- (b) • Set up the apparatus as shown in Fig. 1.2.

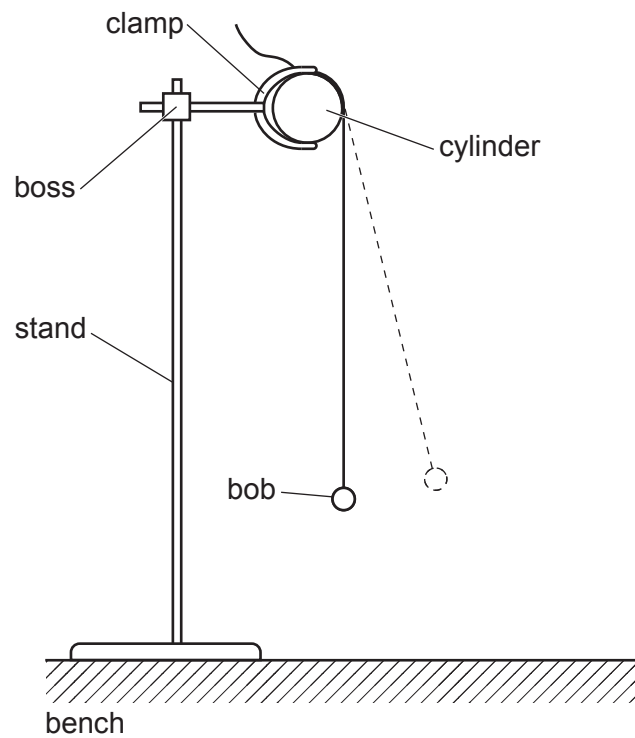


Fig. 1.2

- Move the bob a short distance **away** from the stand, as shown in Fig. 1.2.
- Release the bob. The bob will oscillate.
- Determine the period T of the oscillations of the bob.

$T =$ [2]

- (c) Change L by attaching a different point on the string to the cylinder and determine T . Repeat until you have six sets of values of L and T .

Record your results in a table. Include values of T^3 and L^2 in your table.

[9]

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

[3]

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

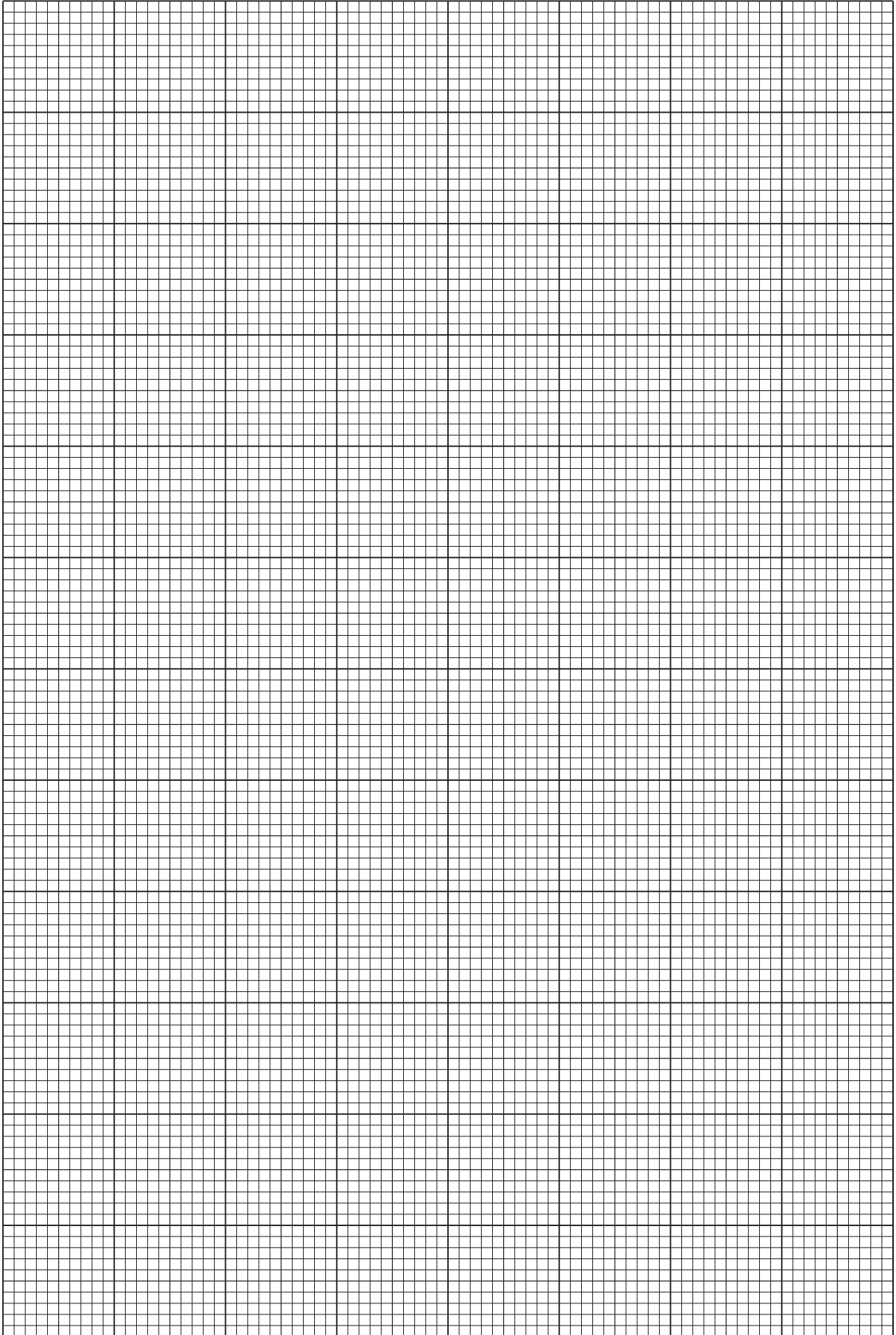
[1]

- (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

$$T^3 = EL^2 + F$$

where E and F are constants.

Using your answers in (d)(iii), determine the values of E and F .
Give appropriate units.

$E =$

$F =$
[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 card.

You have been provided with a card.

- (a)** The card has one edge of length h and another edge of length x , as shown in Fig. 2.1.

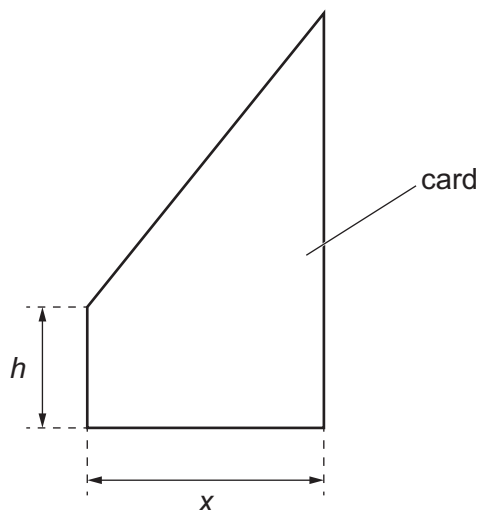


Fig. 2.1

- (i)** Measure and record h and x .

$h =$ cm

$x =$ cm
[1]

- (ii)** Calculate the area A of the card, where

$$A = hx + \frac{5x^2}{8}.$$

$A =$ cm² [1]

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

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

- (b) (i) • Use the nail to make a hole close to one corner of the card, as shown in Fig. 2.2.

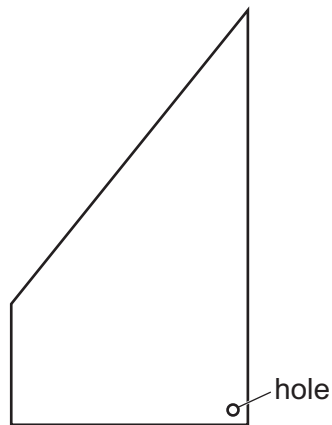


Fig. 2.2

- Set up the apparatus as shown in Fig. 2.3.

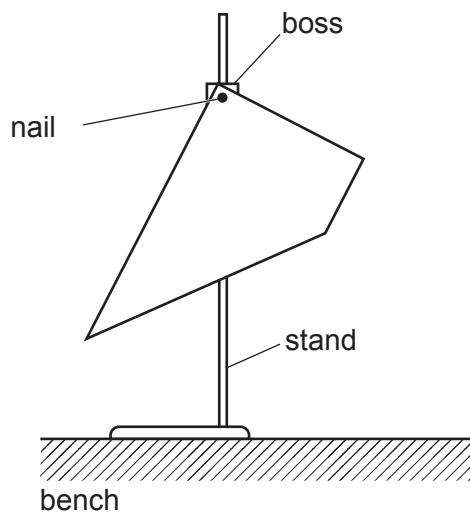


Fig. 2.3

- Push the nail through the hole in the card.
- Fix the nail in the boss.
- Ensure that the card swings freely from the nail.
- Use the set square and the ruler to draw a vertical line on the card below the nail.
- Repeat using **two** more holes close to two other corners of the card.

- Fig. 2.4 shows an example of the card with three lines drawn on it.

The three lines cross at distances c and d from the two edges of the card shown in Fig. 2.4.

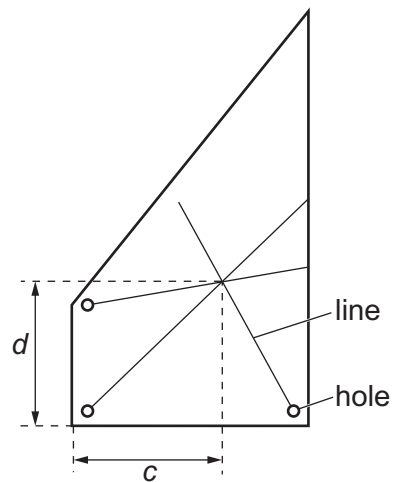


Fig. 2.4

Measure and record c and d .

$c =$ cm

$d =$ cm
[2]

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

percentage uncertainty = % [1]

- (c) (i) • Cut the card as shown in Fig. 2.5 so that x is approximately 9 cm.

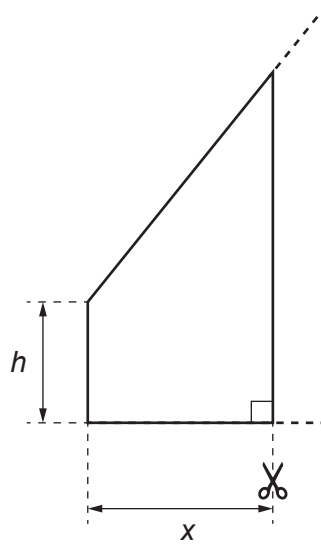


Fig. 2.5

- Measure and record x .

$x =$ cm [1]

- (ii) Repeat (a)(ii) and (b)(i).

$A =$ cm²

$c =$ cm

$d =$ cm
[3]

- (d) It is suggested that the relationship between c , A , h and x is

$$cA = \frac{hx^2}{2} + kx^3$$

where k is a constant.

Using your data, calculate two values of k .

first value of k =

second value of k = [1]

- (e) It is suggested that the percentage uncertainty in the values of k is 5%.

Using this uncertainty, explain whether your results support the relationship in (d).

.....

 [1]

- (f) (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

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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

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2

.....

3

.....

4

.....

[4]

[Total: 20]

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