



Cambridge International AS & A Level

CANDIDATE
NAME

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PHYSICS

9702/35

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 **16** pages. Any blank pages are indicated.

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

- 1** In this experiment, you will investigate an electrical circuit.

You have been provided with a metre rule with a wire attached.

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

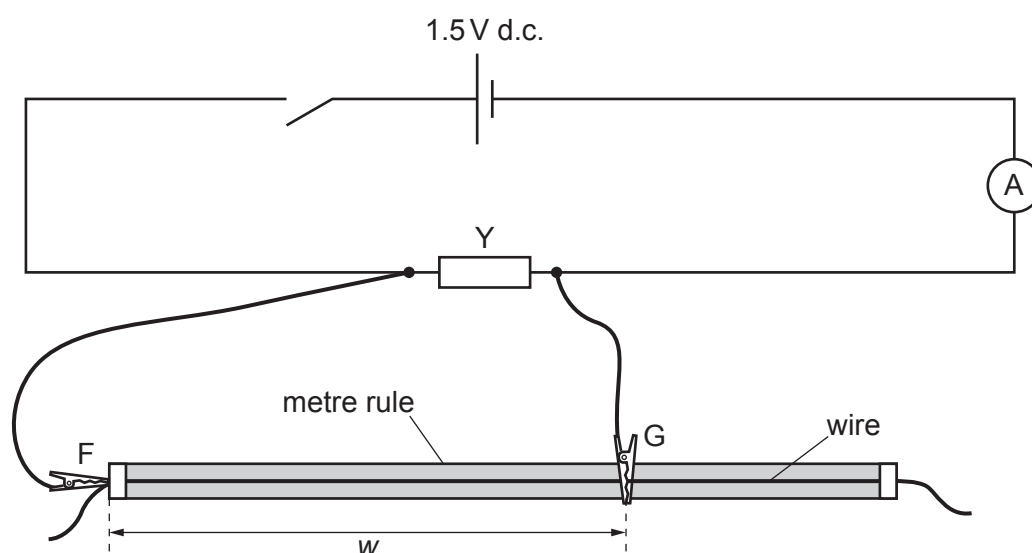


Fig. 1.1

- F and G are crocodile clips.

The distance between F and G is w . Attach G to the wire so that w is approximately 70 cm.

- Close the switch.
- Record the value of w and the ammeter reading I_1 .

$w = \dots\dots\dots$

$I_1 = \dots\dots\dots$

- Open the switch.

[1]

- (b)
- Keep F and G in the **same** positions so that the value of w remains the **same**.
 - Change some of the connecting leads to set up the circuit shown in Fig. 1.2.

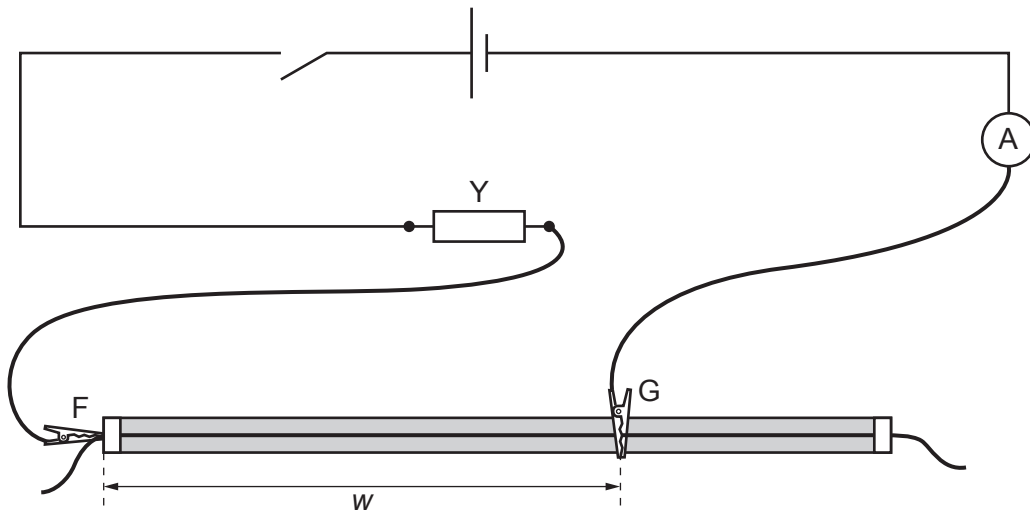


Fig. 1.2

- Close the switch.
- Record the ammeter reading I_2 .

$I_2 = \dots\dots\dots$

- Open the switch.
- Calculate $I_1 I_2$.

$I_1 I_2 = \dots\dots\dots$ [1]

- (c) Using values of w greater than 55 cm, change w by placing G at different positions on the wire and record I_1 and I_2 .

Repeat until you have six sets of readings of w , I_1 and I_2 . Include your values from (a) and (b).

Record your results in a table. Include values of $I_1 I_2$ and $\frac{1}{w}$ in your table.

[10]

- (d) (i) Plot a graph of $I_1 I_2$ on the y -axis against $\frac{1}{w}$ on the x -axis.

[3]

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

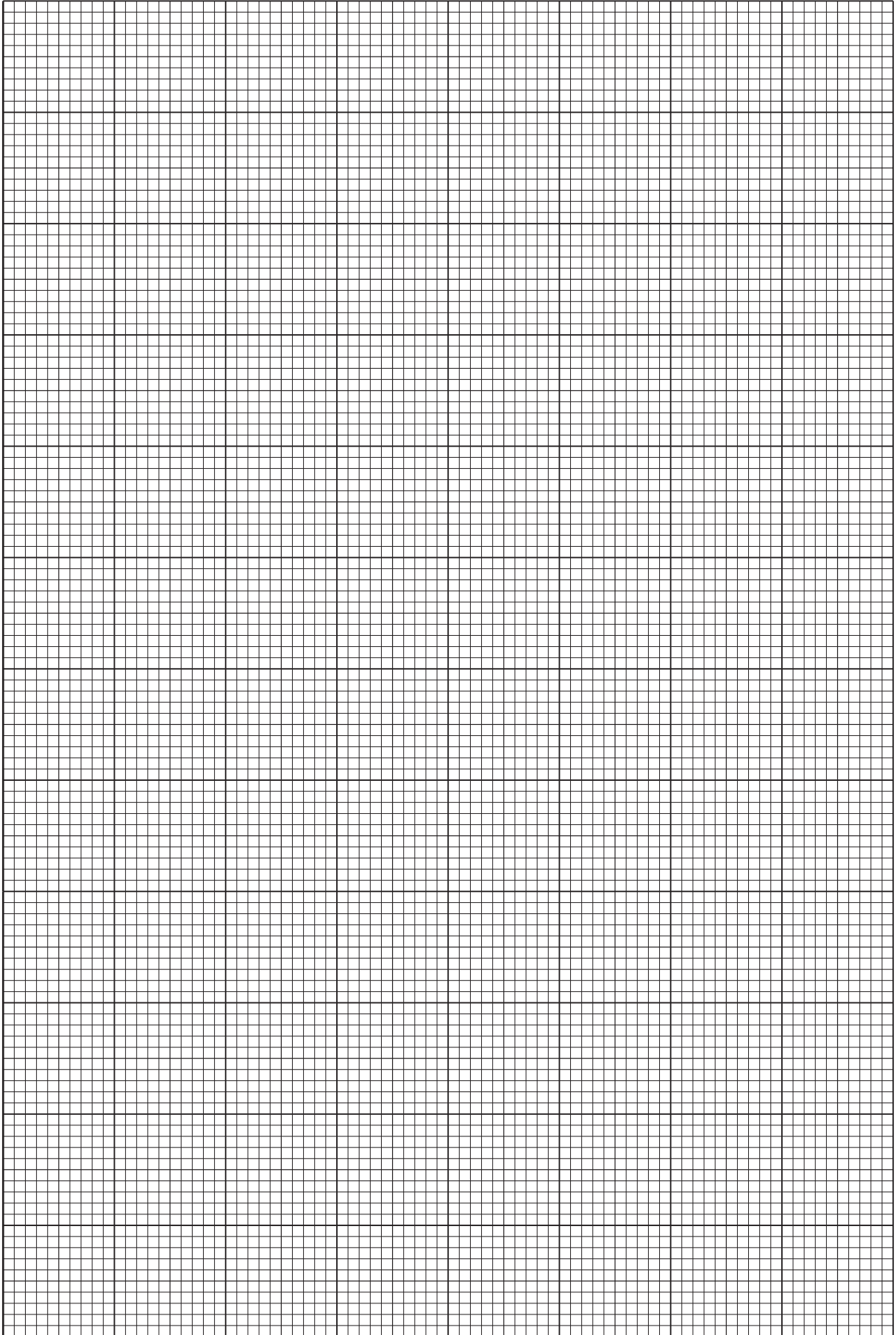
[1]

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

gradient =

y -intercept =

[2]



- (e) It is suggested that the quantities I_1 , I_2 and w are related by the equation

$$I_1 I_2 = \frac{P}{w} + Q$$

where P and Q are constants.

Using your answers in (d)(iii), determine values for P and Q .
Give appropriate units.

$P =$

$Q =$

[2]

[Total: 20]

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

- 2** In this experiment, you will investigate the oscillations of a pendulum.

You have been provided with two cylinders A and B.

- (a) (i)** The diameter of cylinder A is D , as shown in Fig. 2.1.

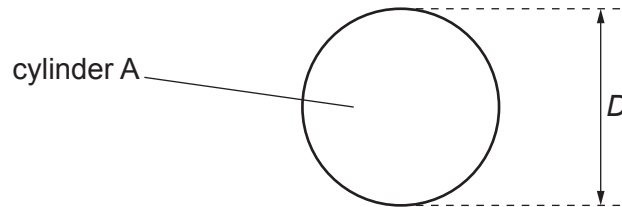


Fig. 2.1

Measure and record D .

$D =$ [1]

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

percentage uncertainty = % [1]

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

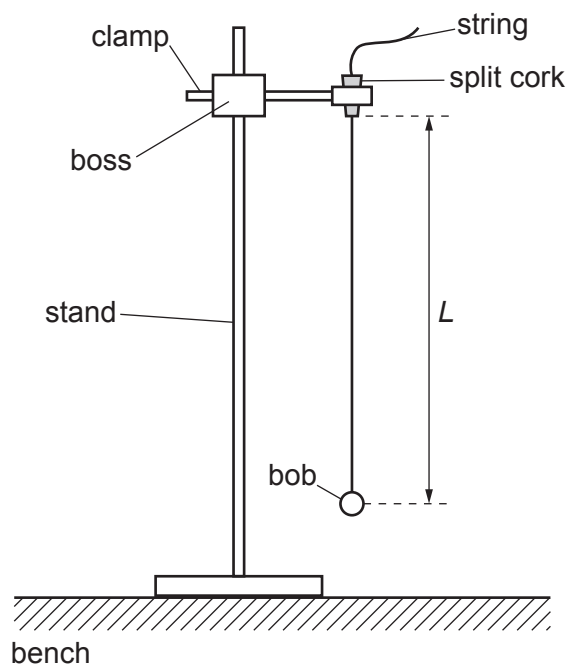


Fig. 2.2

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

Adjust the position of the string in the split cork until the value of L is approximately 50 cm.

- Measure and record L .

$L =$

- Move the bob through a short distance.
- Release the bob. The bob will oscillate.
- Determine the period T_1 of the oscillations of the bob.

$T_1 =$ [2]

- (c) (i) • Use adhesive putty to attach the string to cylinder A as shown in Fig. 2.3.

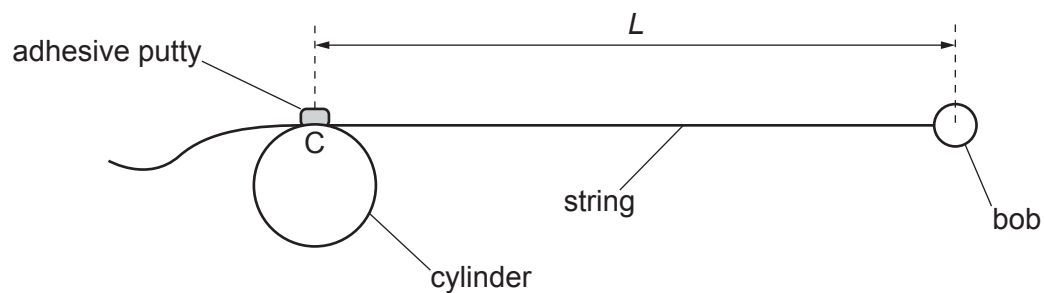


Fig. 2.3

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

Adjust the position of the adhesive putty until the distance between C and the centre of the bob is equal to your value of L from (b).

- Set up the apparatus as shown in Fig. 2.4.

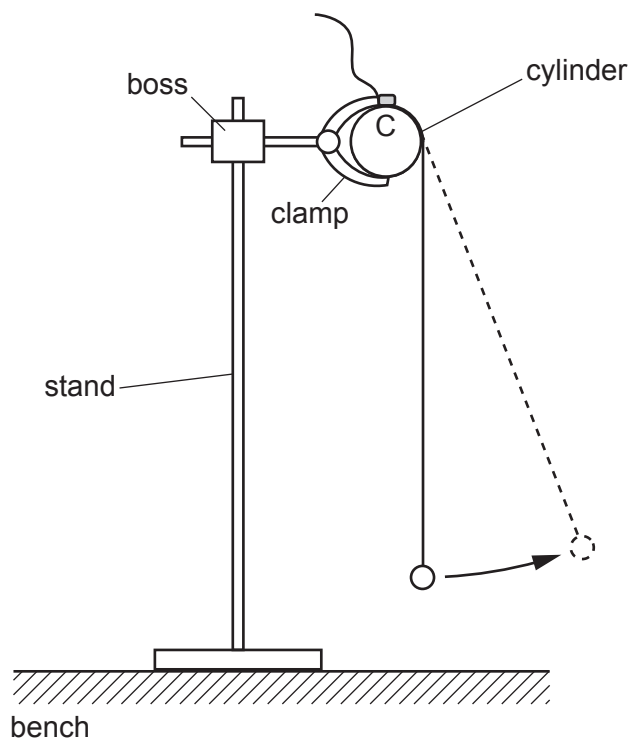


Fig. 2.4

- Move the bob a short distance **away** from the stand, as shown in Fig. 2.4.
- Release the bob. The bob will oscillate.
- Determine the period T_2 of the oscillations of the bob.

$$T_2 = \dots\dots\dots [1]$$

(ii) Calculate $(T_1 - T_2)$.

$$(T_1 - T_2) = \dots\dots\dots [1]$$

(d) Using cylinder B and a value of L of approximately 40 cm, repeat (a)(i), (b) and (c).

$$D = \dots\dots\dots$$

$$L = \dots\dots\dots$$

$$T_1 = \dots\dots\dots$$

$$T_2 = \dots\dots\dots$$

$$(T_1 - T_2) = \dots\dots\dots [3]$$

- (e) It is suggested that the relationship between T_1 , T_2 , D and L is

$$(T_1 - T_2) = \frac{kD}{L}$$

where k is a constant.

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

first value of k =

second value of k =

[1]

- (ii) Justify the number of significant figures that you have given for your values of k .

.....

 [1]

- (f) It is suggested that the percentage uncertainty in the values of k is 10%.

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

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2

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3

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4

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[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

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3

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4

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[4]

[Total: 20]

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