



Cambridge International AS & A Level

CANDIDATE
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PHYSICS

9702/33

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. 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.

(a) You have been provided with two identical wooden strips labelled A and B.

Measure and record the length L of the wire between the nails on strip A, as shown in Fig. 1.1.

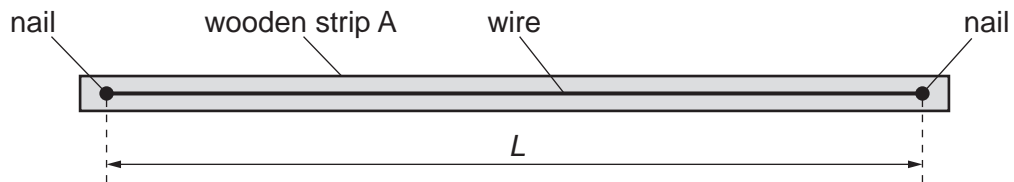


Fig. 1.1

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

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

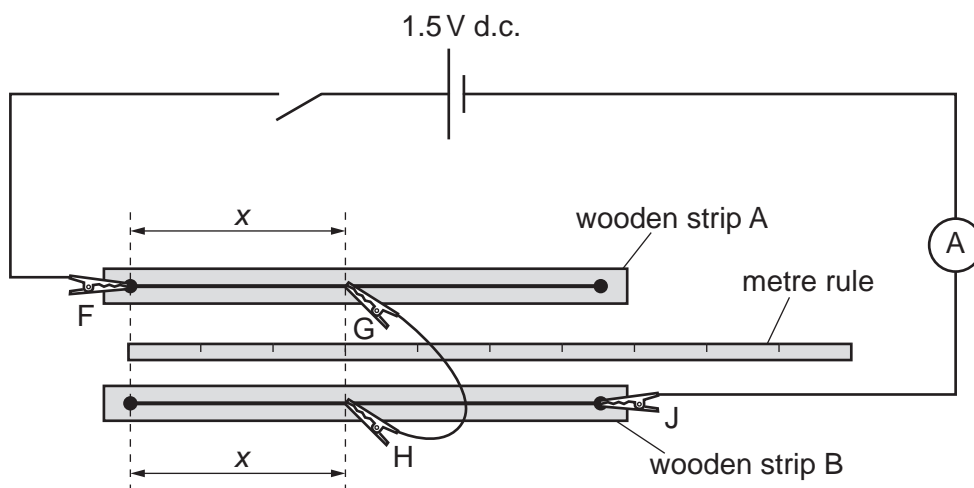


Fig. 1.2

- F, G, H and J are crocodile clips.

Attach G to the wire on wooden strip A so that the distance x between the nail on strip A and G is approximately 30 cm, as shown in Fig. 1.2.

- Attach H to the wire on wooden strip B so that it is the same distance x from the nail on strip B.
- Close the switch.
- Record x and the ammeter reading I .

$x =$

$I =$

- Open the switch.

[1]

4

(c) Vary x and repeat (b) until you have six sets of readings of x and l . Include your values from (b).

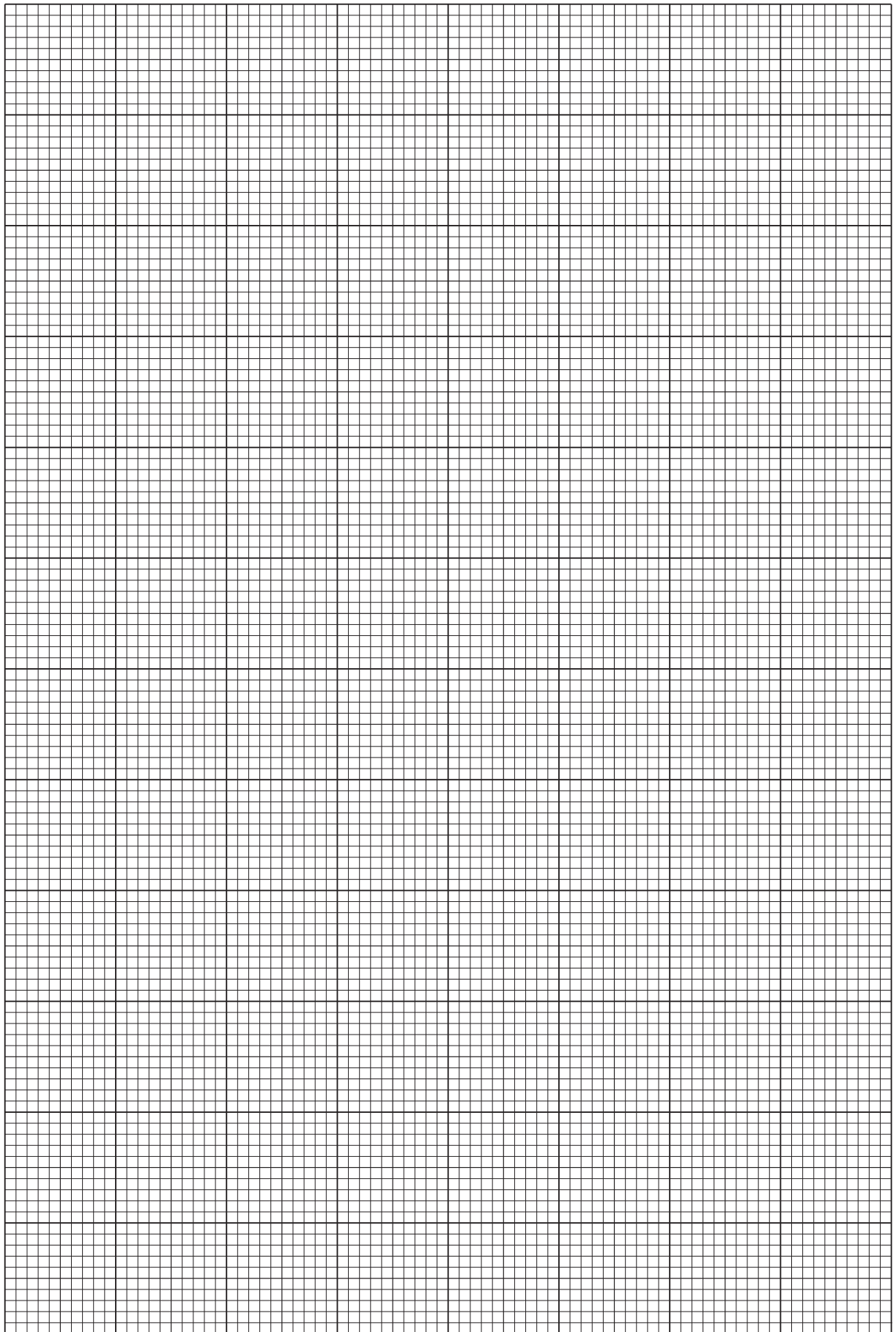
Record your results in a table. Include values of $\frac{1}{l}$ in your table.

- (d) (i) Plot a graph of $\frac{1}{l}$ on the y -axis against x on the x -axis. [9]
- (ii) Draw the straight line of best fit. [3]
- (iii) Determine the gradient and y -intercept of this line. [1]

gradient =

y -intercept =

[2]



- (e) It is suggested that the quantities I and x are related by the equation

$$\frac{1}{I} = Px + Q$$

where P and Q are constants.

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

$$P = \dots\dots\dots$$

$$Q = \dots\dots\dots$$

[2]

- (f) Theory suggests that

$$\frac{P}{Q} = \frac{\left(\frac{\rho_A}{\rho_B} - 1\right)}{L}$$

where ρ_A is the resistivity of the wire on strip A and ρ_B is the resistivity of the wire on strip B.

Calculate $\frac{\rho_A}{\rho_B}$.

$$\frac{\rho_A}{\rho_B} = \dots\dots\dots [1]$$

[Total: 20]

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

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

(a) You have been provided with a rectangular wooden strip with a hole in its centre.

- Use some of the adhesive putty to attach the two 100 g masses as near as possible to one end of the strip, as shown in Fig. 2.1 and Fig. 2.2.

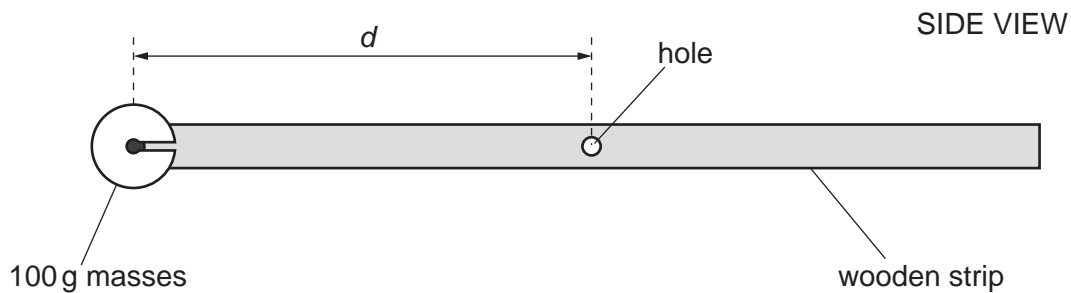


Fig. 2.1

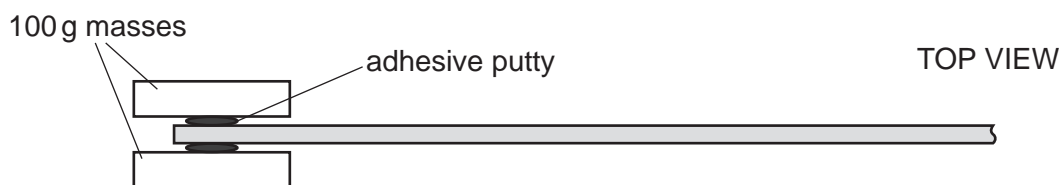


Fig. 2.2

- The distance between the centre of the masses and the hole is d , as shown in Fig. 2.1. Measure and record d .

$d = \dots\dots\dots$ [1]

(b) Estimate the percentage uncertainty in your value of d . Show your working.

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

- (c) (i)
- Attach the two 50 g masses to the other end of the strip so that the distance between the centres of these masses and the hole is also equal to d .
 - Set up the apparatus as shown in Fig. 2.3.

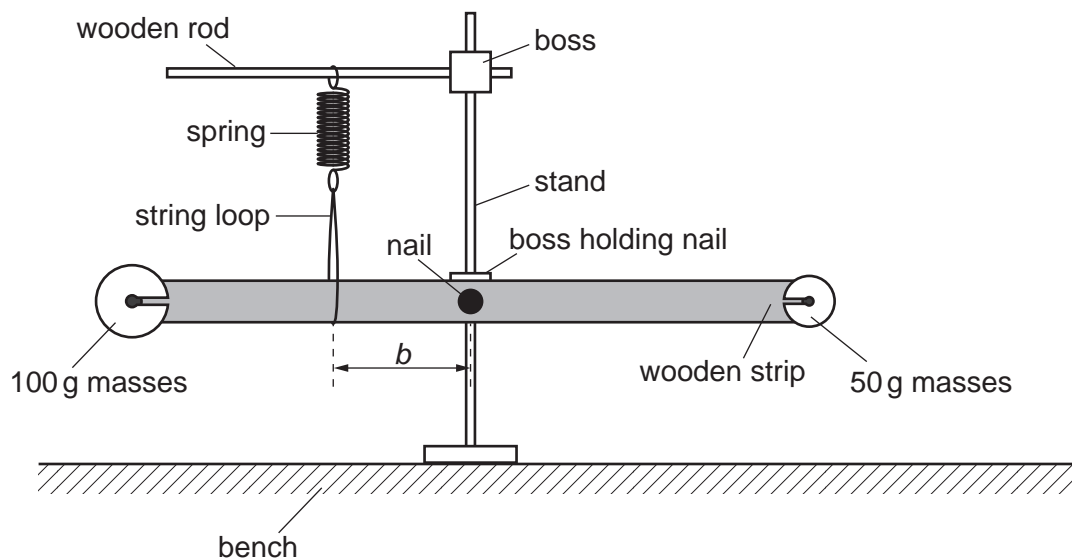


Fig. 2.3 (not to scale)

- The distance between the string loop and the nail in the centre of the strip is b . Adjust the position of the string loop and spring until b is approximately 10 cm.
- Adjust the heights of the bosses until the strip is horizontal and the spring and string loop are vertical.
- Measure and record b .

$b = \dots\dots\dots$ [1]

(ii) Calculate α where

$$\alpha = \frac{b}{d}.$$

$\alpha = \dots\dots\dots$ [1]

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

.....

 [1]

9

- (d)
- Move the end of the strip with the 100 g masses down through a short distance.
 - Release the end of the strip. The strip will oscillate up and down.
 - Take measurements to determine the period T of these oscillations.

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

- (e)
- Change the value of b to approximately 20 cm.
 - Adjust the heights of the bosses until the strip is horizontal and the spring and string loop are vertical.
 - Measure and record b .

$b = \dots\dots\dots$

- Repeat (c)(ii) and (d).

$\alpha = \dots\dots\dots$

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

10

- (f) It is suggested that the relationship between T and α is

$$T = \frac{C}{\alpha}$$

where C is a constant.

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

first value of $C = \dots\dots\dots$

second value of $C = \dots\dots\dots$

[1]

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

.....

 [1]

- (g) Theory suggests that

$$C = 2\pi\sqrt{\frac{3m}{k}}$$

where m is 0.100 kg and k is the spring constant of the spring.

Use your second value of C to determine a value for k . Give an appropriate unit.

$k = \dots\dots\dots$ [1]

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

1.

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2.

.....

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.

.....

2.

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3.

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4.

.....

[4]

[Total: 20]

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