



Cambridge International AS & A Level

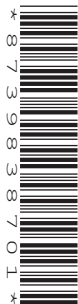
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PHYSICS

9702/36

Paper 3 Advanced Practical Skills 2

October/November 2020

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 | |
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| 1 | |
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| Total | |

This document has **12** pages. 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) • Connect any one of the eight resistors labelled with values in the component holder.
- Assemble the circuit shown in Fig. 1.1.

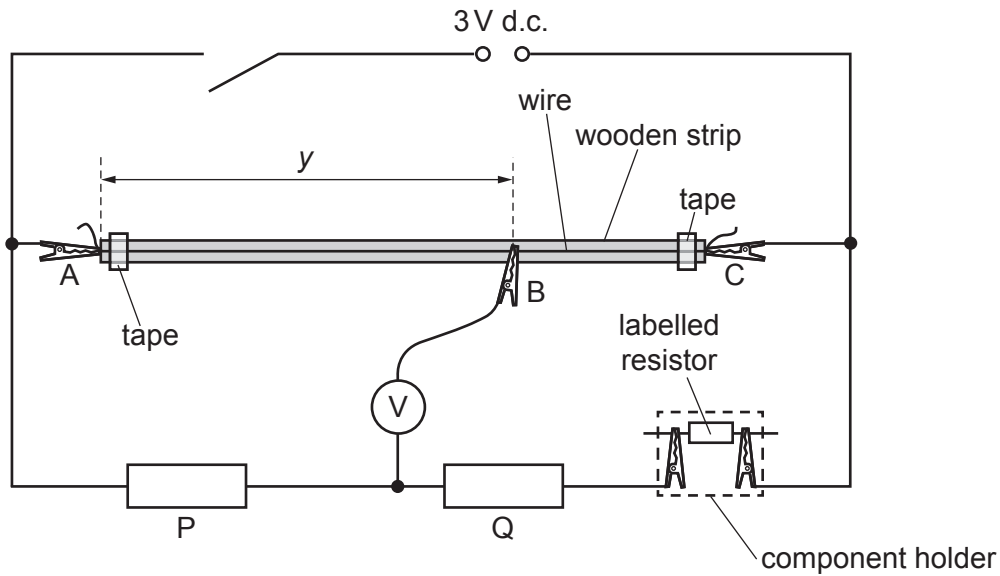


Fig. 1.1

- Record the resistance R of the labelled resistor in the component holder.

$R = \dots\dots\dots \Omega$

- Close the switch. The voltmeter reading will be non-zero.
- A, B and C are crocodile clips.

Adjust the position of B on the wire until the voltmeter reading is as close as possible to zero.

- The distance between A and B is y , as shown in Fig. 1.1.

Measure and record y .

$y = \dots\dots\dots \text{cm}$

- Open the switch.

[1]

- (b) Change the labelled resistor and determine the value of y . Repeat until you have six sets of values of R and y .

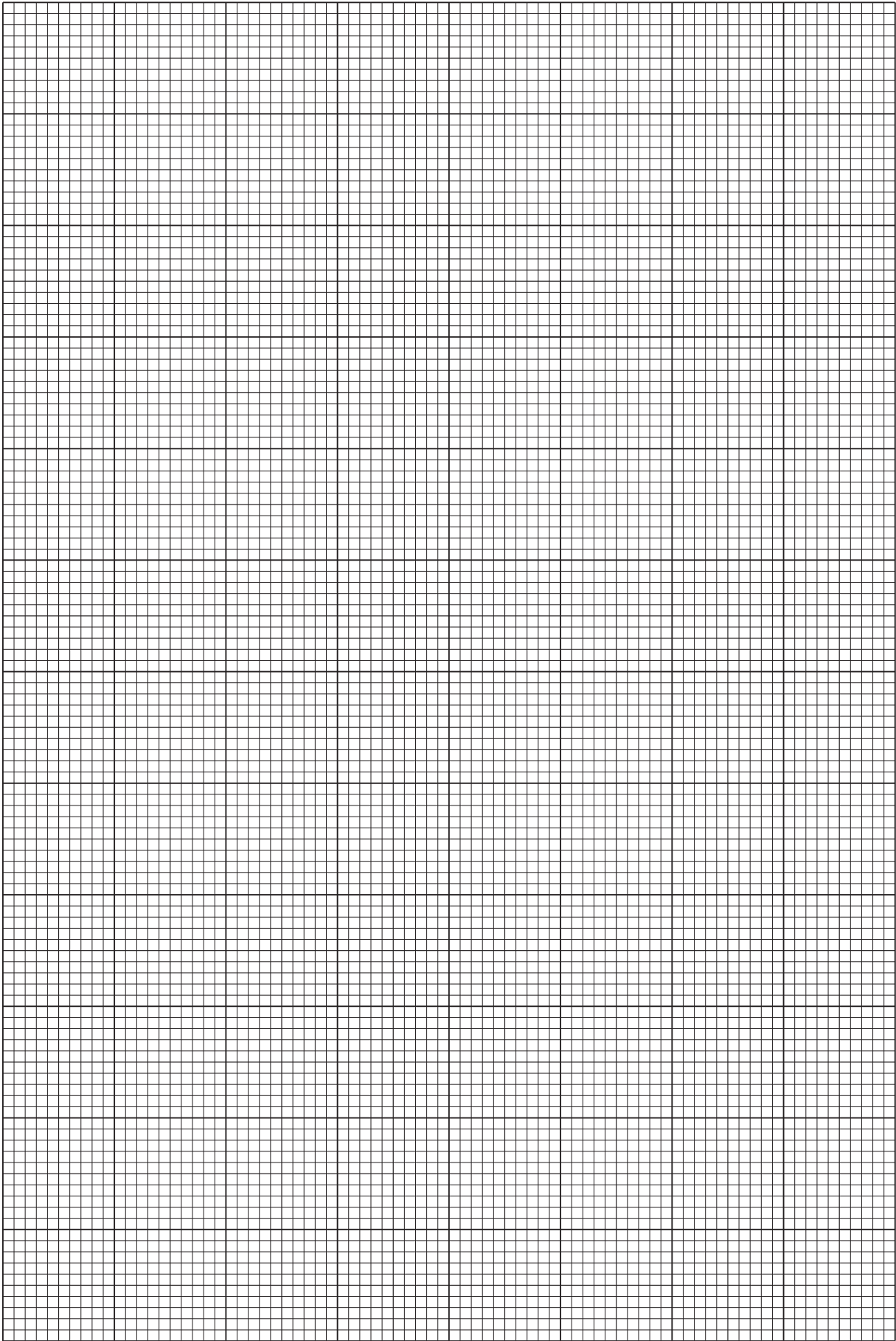
Record your results in a table. Include values of $\frac{1}{y}$ in your table.

- (c) (i) Plot a graph of $\frac{1}{y}$ on the y -axis against R 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]



(d) It is suggested that the quantities y and R are related by the equation

$$\frac{1}{y} = aR + b$$

where a and b are constants.

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

Give appropriate units.

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots$$

[2]

(e) (i) Measure and record the length W of the wire between the crocodile clips A and C.

$$W = \dots\dots\dots \text{ cm [1]}$$

(ii) The resistor P has resistance P .

Calculate the value of P using the relationship

$$a = \frac{1}{PW}.$$

$$P = \dots\dots\dots \Omega [1]$$

[Total: 20]

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

- 2 In this experiment, you will investigate an oscillating system.

You have access to a roll of strong adhesive tape. Cut off a piece of tape of approximate length 40 cm. The exact length is not important.

- (a) • You have been provided with two plastic rulers. Bend one of the rulers so that the distance L between its ends is approximately 29 cm. Use the adhesive tape to fix it in this shape, as shown in Fig. 2.1.

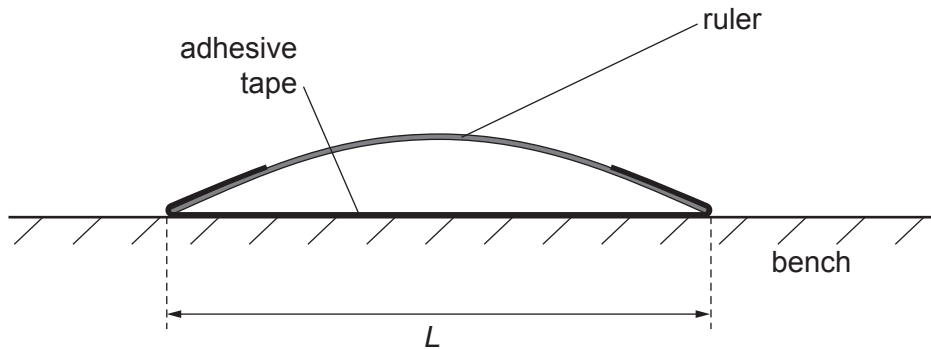


Fig. 2.1

- Measure and record the length L and the height H of the bent ruler, as shown in Fig. 2.2.

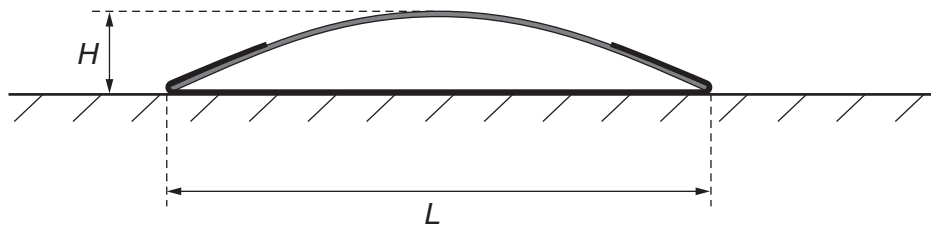


Fig. 2.2

$L =$ cm

$H =$ cm
[2]

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

percentage uncertainty = [1]

- (c) • Balance the wooden strip on top of the ruler, as shown in Fig. 2.3.

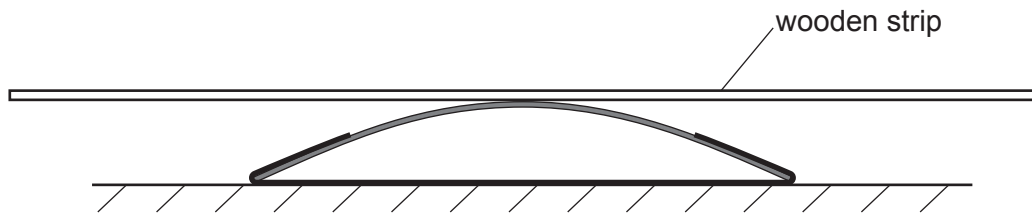


Fig. 2.3

- Push one end of the strip down a short distance and release it so that it oscillates.
- Determine the period T of the oscillations.

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

- (d) (i) Repeat (a) using a length L of approximately 27 cm.

$L = \dots\dots\dots$ cm

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

- (ii) Repeat (c).

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

- (e) It is suggested that the relationship between T , L and H is

$$T^2L^2 = kH$$

where k is a constant.

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

first value of $k = \dots\dots\dots$

second value of $k = \dots\dots\dots$

[1]

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

.....

 [1]

- (iii) Explain whether your results in (e)(i) support the suggested relationship.

.....

 [1]

(f) The length S of the wooden strip is 91 cm.

An approximate value for the acceleration of free fall g is given by

$$3gk = \pi^4 S^2.$$

Use your second value of k to calculate g .

Give an appropriate unit.

$g = \dots\dots\dots$ [1]

(g) (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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