Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

8739838701

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	
1	
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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.

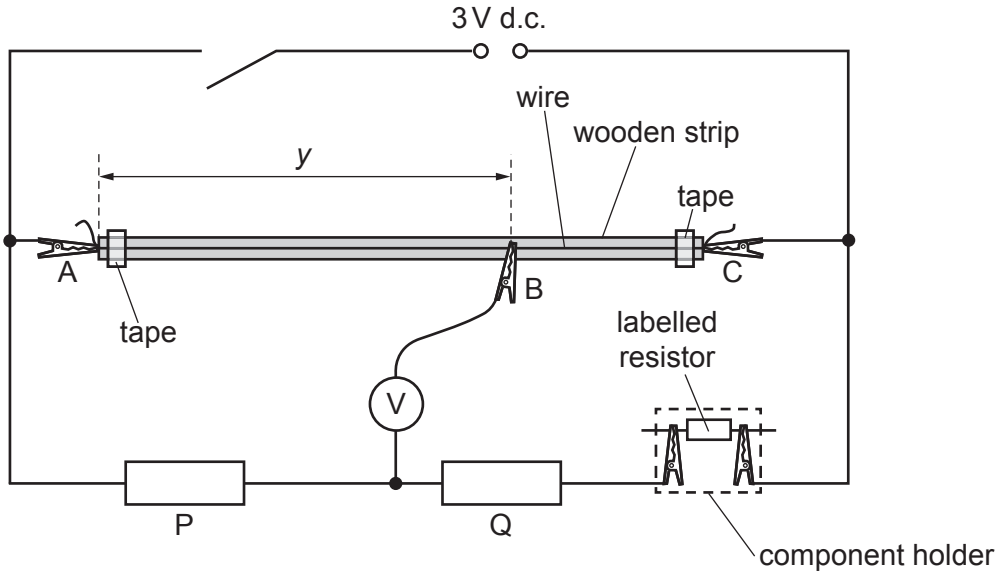


Fig. 1.1

● Record the resistance *R* of the labelled resistor in the component holder.

R = ... Ω

● 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 = ... 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.

[9]

(c) **(i)** Plot a graph of $\frac{1}{y}$ on the y-axis against R on the x-axis. [3]

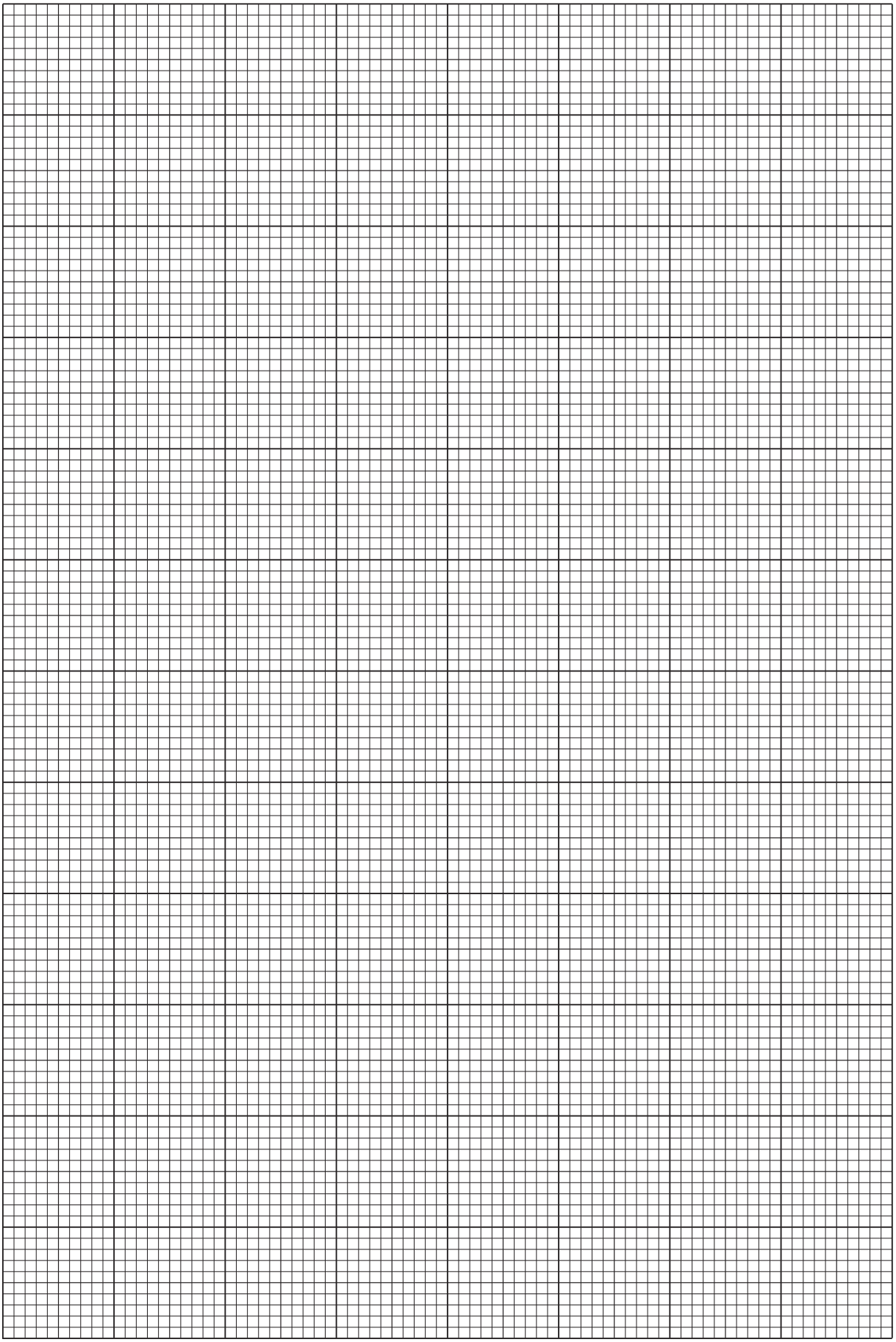
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...

[2]



(d) It is suggested that the quantities 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 = ...

b = ...
[2]

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

W = ... cm [1]

(ii) The resistor P has resistance P.

Calculate the value of P using the relationship

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

P = ... Ω [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.

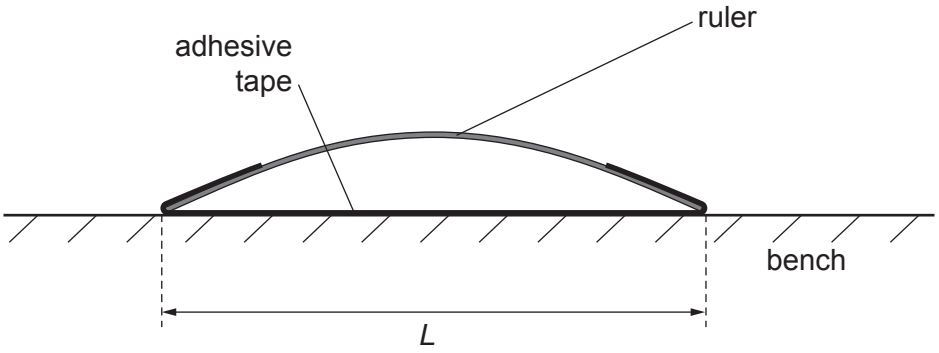


Fig. 2.1

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

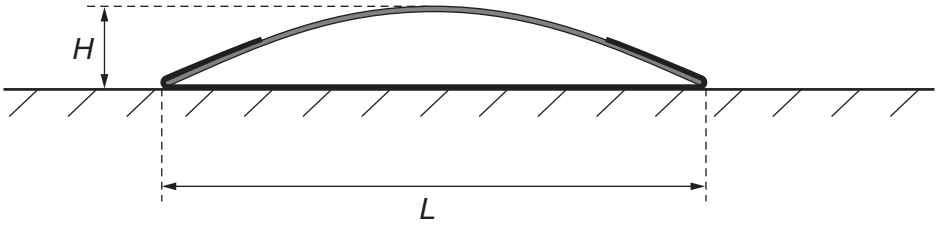


Fig. 2.2

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.

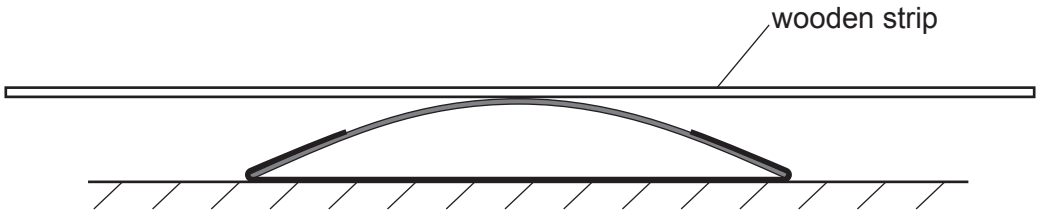


Fig. 2.3

● 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 = ... s [2]

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

L = ... cm

H = ... cm
[1]

(ii) Repeat **(c)**.

T = ... 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 = ...

second value of k = ...
[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 = ... [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. .....

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2. .....

.....

3. .....

.....

4. .....

.....

[4]

[Total: 20]

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