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	
2	
Total	

This document has **12** pages. Blank pages are indicated.

© UCLES 2020

BLANK PAGE

© UCLES 2020

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.

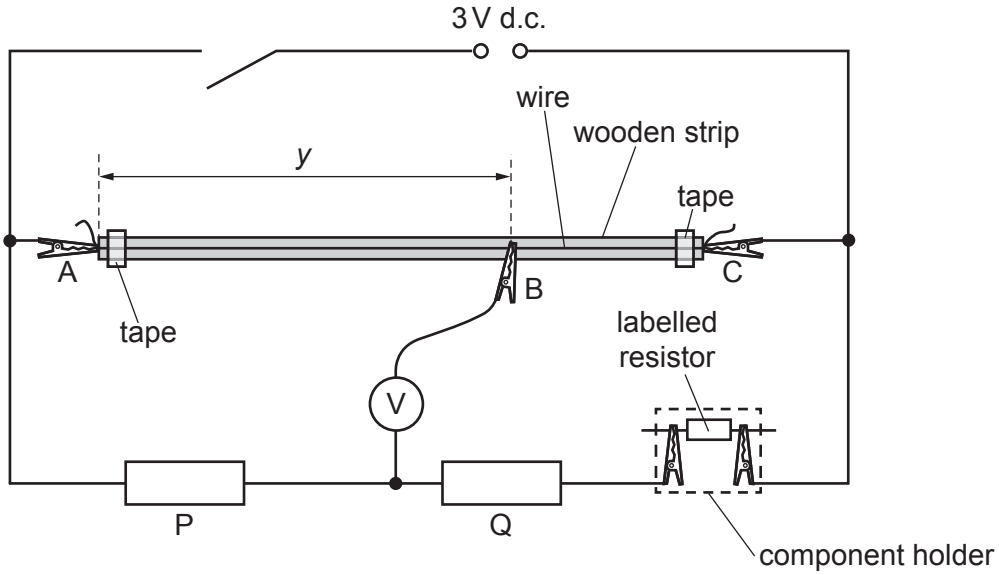


Fig. 1.1

● 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]

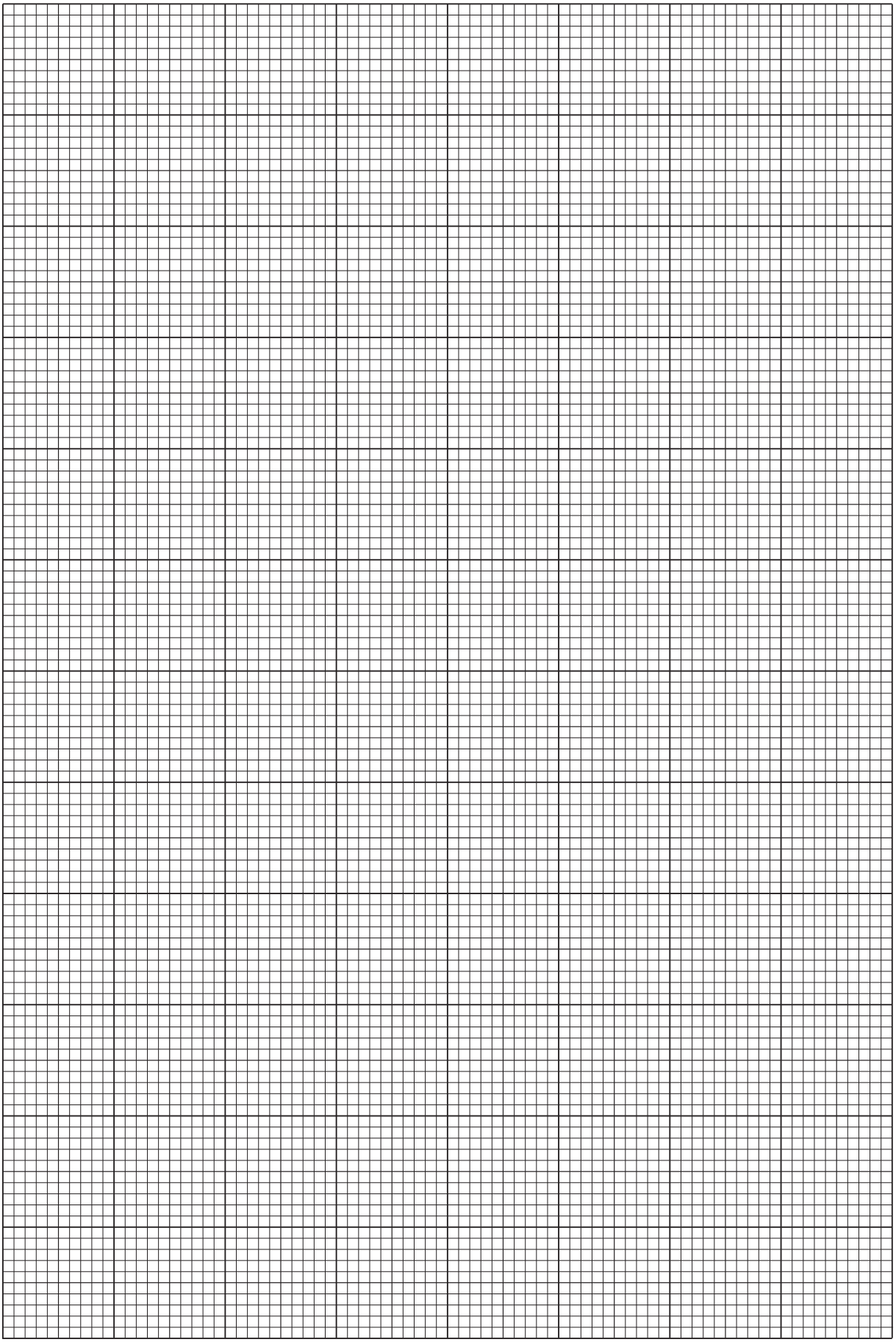
(ii) Draw the straight line of best fit. [1]

(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]

© UCLES 2020

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.

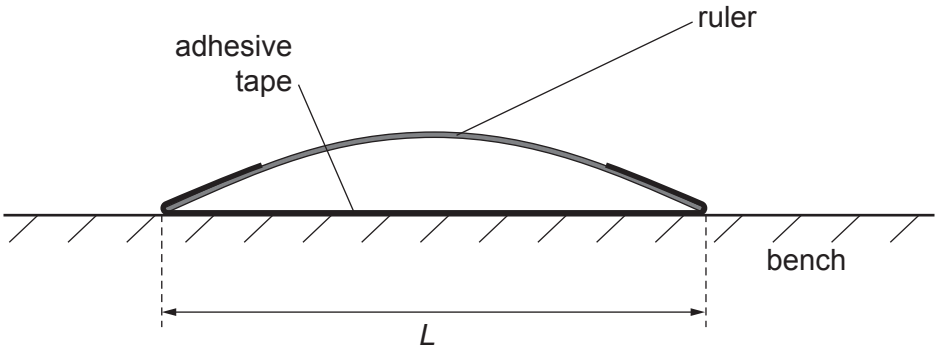


Fig. 2.1

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

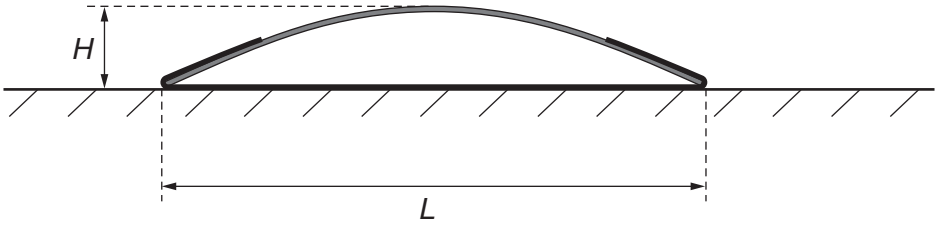


Fig. 2.2

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.

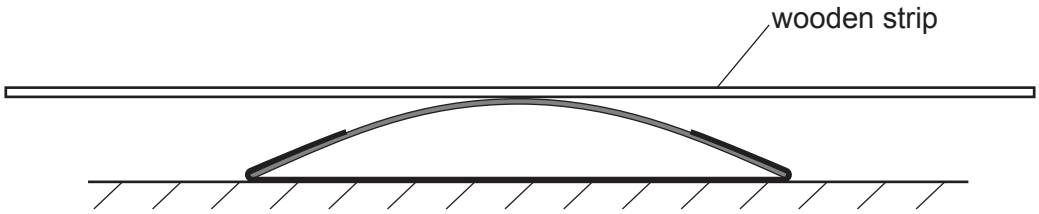


Fig. 2.3

● 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]

© UCLES 2020

(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. .....

.....

2. .....

.....

3. .....

.....

4. .....

.....

[4]

[Total: 20]

© UCLES 2020

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

© UCLES 2020