Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7303204975

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **May/June 2019**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **both** questions.
You will be allowed to work with the apparatus for a maximum of one hour for each question.
You are expected to record all your observations as soon as these observations are made, and to plan the presentation of the records so that it is not necessary to make a fair copy of them.
You are reminded of the need for good English and clear presentation in your answers.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

Additional answer paper and graph paper should be used only if it becomes necessary to do so.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **11** printed pages and **1** blank page.

© UCLES 2019

Cambridge Assessment International Education

[Turn over

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

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

(a) (i) You have been provided with two metre rules. One is labelled P and the other is labelled Q.

- Set up the circuit shown in Fig. 1.1.

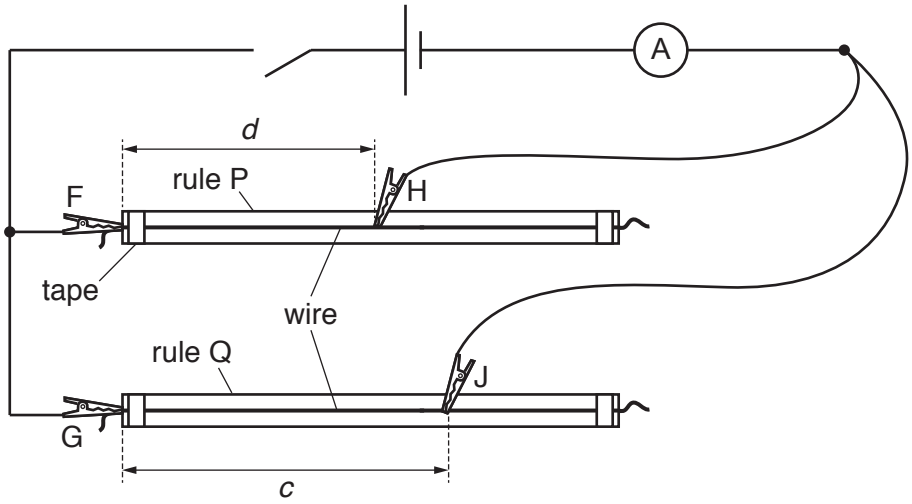


Fig. 1.1

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

  Place H approximately half-way along the wire on rule P.

- The distance between F and H is *d*, as shown in Fig. 1.1.

  Record *d*.

d = ...

- Place J on the wire on rule Q so that the distance between G and J is approximately 60 cm. The distance between G and J is *c*, as shown in Fig. 1.1.

- Record *c*.

c = ...

- Calculate *n*, where $n = \frac{c - d}{d}$.

n = ...
[1]

© UCLES 2019

(ii) • Close the switch.

• Record the ammeter reading I.

I = ...

• Open the switch.

[1]

(b) **Keeping *d* constant**, vary *c* until you have six sets of readings of *c* and I. Do **not** use values of *c* less than *d*.

Record your results in a table. Include values of *n* and $\frac{(n+2)}{(n+1)}$ in your table.

[9]

(c) **(i)** Plot a graph of I on the *y*-axis against $\frac{(n+2)}{(n+1)}$ on the *x*-axis. [3]

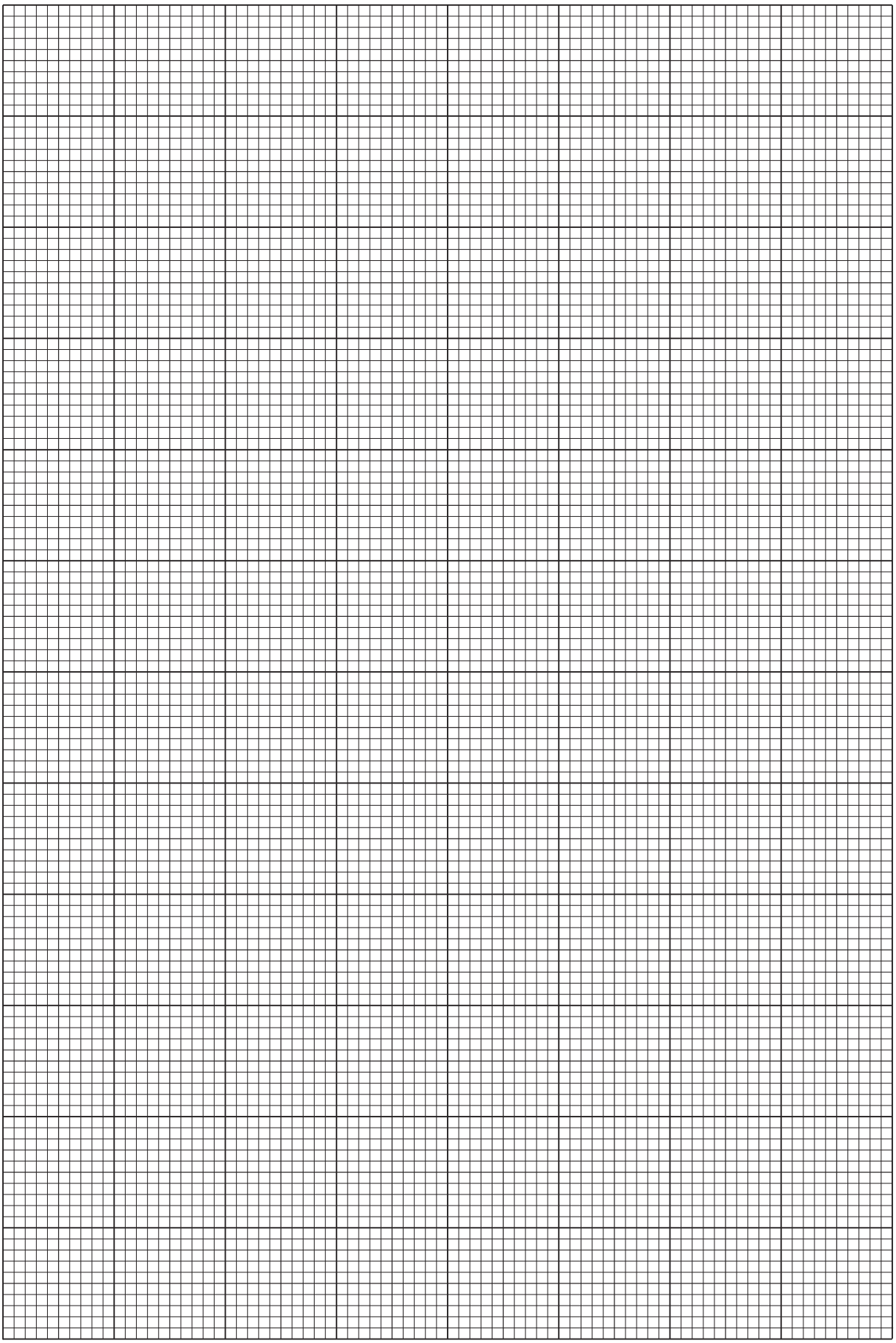
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...
[2]

© UCLES 2019



© UCLES 2019

[Turn over

(d) It is suggested that the quantities I and n are related by the equation

$$I = S\frac{(n+2)}{(n+1)} + T$$

where S and T are constants.

Using your answers in **(c)(iii)**, determine values for S and T.
Give appropriate units.

S = ...

T = ...
[2]

(e) Theory suggests that S is inversely proportional to d and that T is independent of d.
The experiment is repeated using the same equipment but a larger value of d.

For this experiment, draw a second line on the graph to show the expected results.
Label this line W. [1]

[Total: 20]

© UCLES 2019

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

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

(a) • Set up the apparatus as shown in Fig. 2.1.

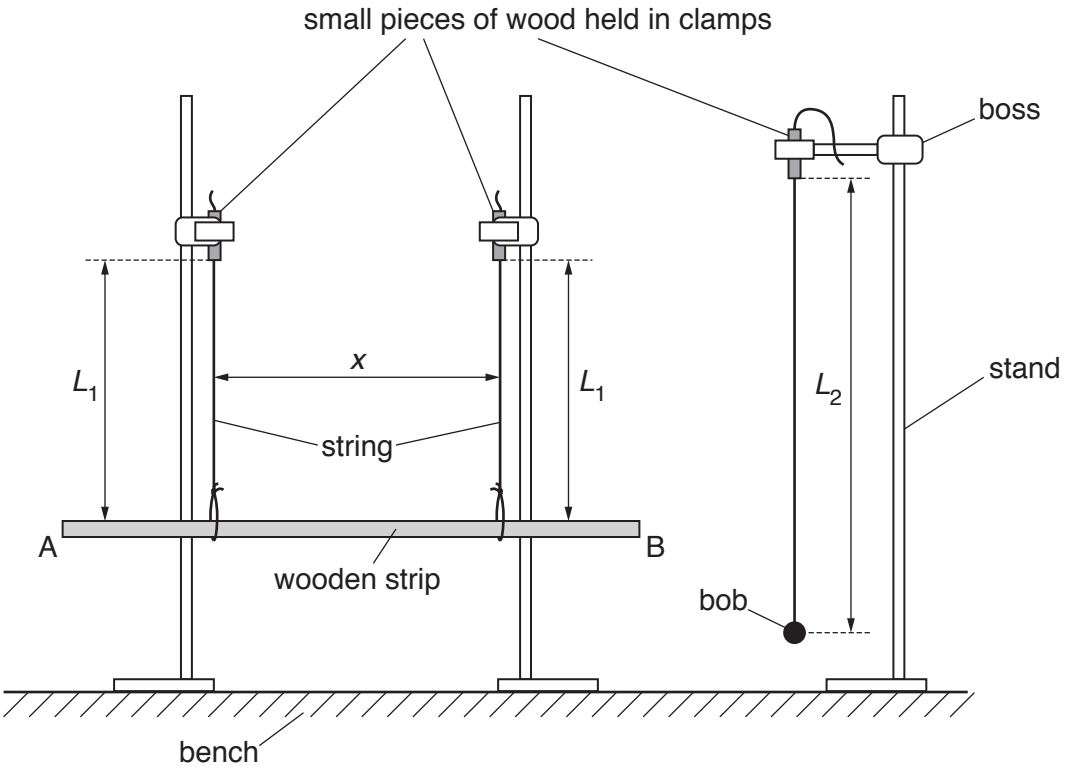


Fig. 2.1

• The distance between the strings supporting the wooden strip is x.

The distances between the top of the strip and the bottom of the small pieces of wood should be equal. These distances are both L_1.

The distance between the centre of the bob and the bottom of the small pieces of wood is L_2.

Adjust the position of the strings so that $x \approx 25\,\text{cm}$, $L_1 \approx 25\,\text{cm}$ and $L_2 \approx 45\,\text{cm}$.

• The strings should be vertical, the strip should be parallel to the bench and the strip should be supported centrally by the strings.

Measure and record x and L_1.

$x =$ ..... cm

$L_1 =$ ..... cm

[2]

© UCLES 2019

[Turn over

(b) (i)
- Pull the bob and end B of the strip towards you through a short distance.
- Release the bob and the strip together so that they oscillate.
- Adjust L_2 until the periods of the oscillations of the bob and of the strip are the same.
- Measure and record L_2.

L_2 = ... cm [1]

(ii) Estimate the percentage uncertainty in your value of L_2.

percentage uncertainty = ... [1]

(iii) Calculate $\frac{L_1}{L_2}$.

$\frac{L_1}{L_2}$ = ... [1]

(iv) Justify the number of significant figures that you have given for your value of $\frac{L_1}{L_2}$.

.....

.....

..... [1]

© UCLES 2019

(c) • Change x to approximately 30 cm and L_1 to approximately 20 cm.

• The strings should be vertical, the strip should be parallel to the bench and the strip should be supported centrally by the strings.

Measure and record x and L_1.

x = ... cm

L_1 = ... cm

• Repeat **(b)(i)** and **(b)(iii)**.

L_2 = ... cm

$\frac{L_1}{L_2}$ = ...
[3]

(d) It is suggested that the relationship between L_1, L_2 and x is

$$\frac{L_1}{L_2} = kx^2$$

where k is a constant.

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

first value of k = ...

second value of k = ...
[1]

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

.....

.....

.....

..... [1]

(e) Theory suggests that

$$k = \frac{3}{l^2}$$

where l is the length of the strip.

Using your second value of k, calculate l.
Give an appropriate unit.

l = ... [1]

© UCLES 2019

(f) **(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 2019

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 2019