Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

6477714118 9

PHYSICS **9702/34**

Paper 3 Advanced Practical Skills 2 **October/November 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	

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[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) ● Assemble the circuit shown in Fig. 1.1.

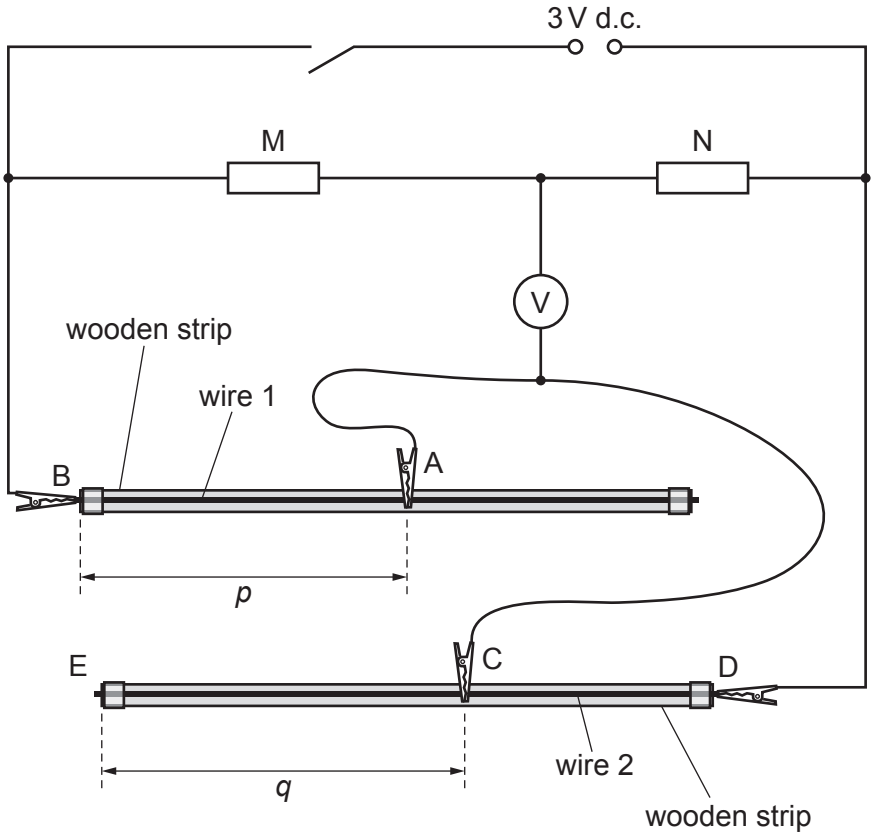


Fig. 1.1

● A, B, C and D are crocodile clips.

Connect A approximately half-way along wire 1.

● Measure and record the distance *p* between B and A, as shown in Fig. 1.1.

p = ... cm

● Close the switch.

● Test your circuit by placing C at end E of wire 2. The voltmeter reading should be non-zero. Record the voltmeter reading.

voltmeter reading = ... V

● Open the switch.

[1]

(ii)
- Close the switch.
- Adjust the position of C on wire 2 until the voltmeter reading is as close as possible to zero.
- The distance between C and E is q, as shown in Fig. 1.1.

  Measure and record q.

  q = ... cm
- Open the switch.

[1]

(b) Move A to a new position on wire 1. Measure and record p and repeat **(a)(ii)**. Repeat until you have six sets of values for p and q.

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

[10]

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

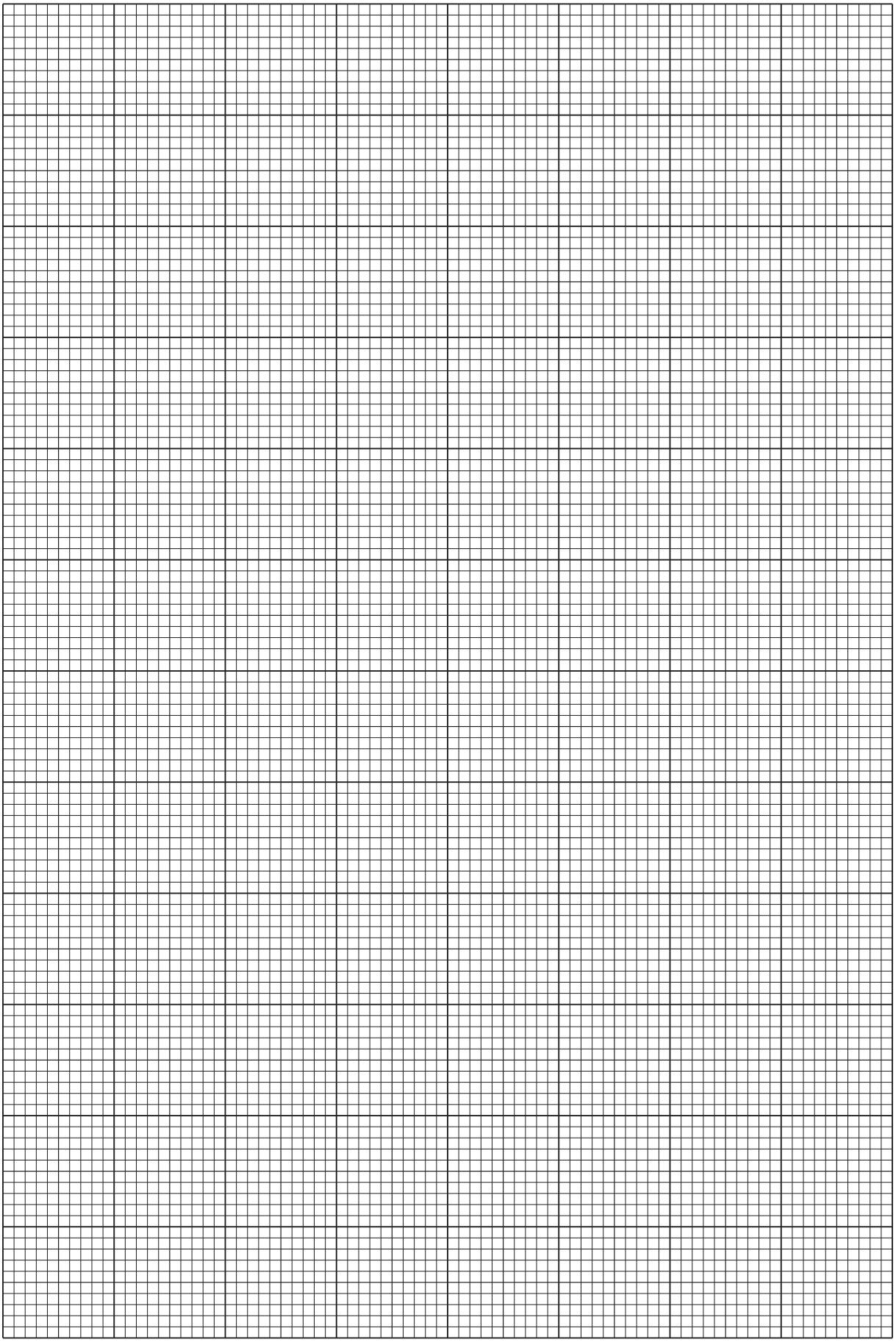
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...

[2]



(d) It is suggested that the quantities p and q are related by the equation

$$\frac{1}{q} = a\left(\frac{p}{q}\right) + b$$

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]

[Total: 20]

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

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

(a) (i) ● You are provided with a pin pushed into a cork.

Clamp the cork to the stand so that the pin is horizontal and approximately 50 cm above the bench.

● You are provided with a rod with two strings attached.

The distance between the two holes in the rod is *y*, as shown in Fig. 2.1.

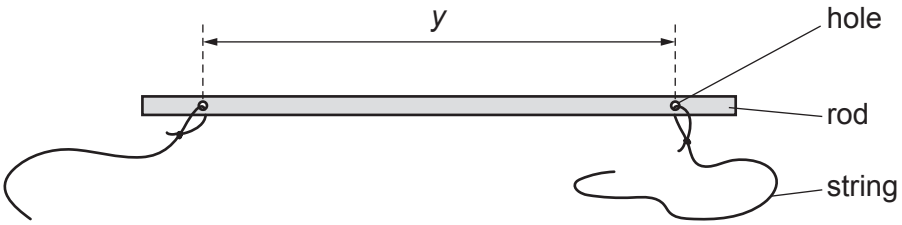


Fig. 2.1

Measure and record *y*.

y = ... cm [1]

(ii) ● Set up the apparatus as shown in Fig. 2.2.

● Tie the two strings together so that, when the rod is suspended from the pin, the top of the rod is approximately 30 cm below the pin.

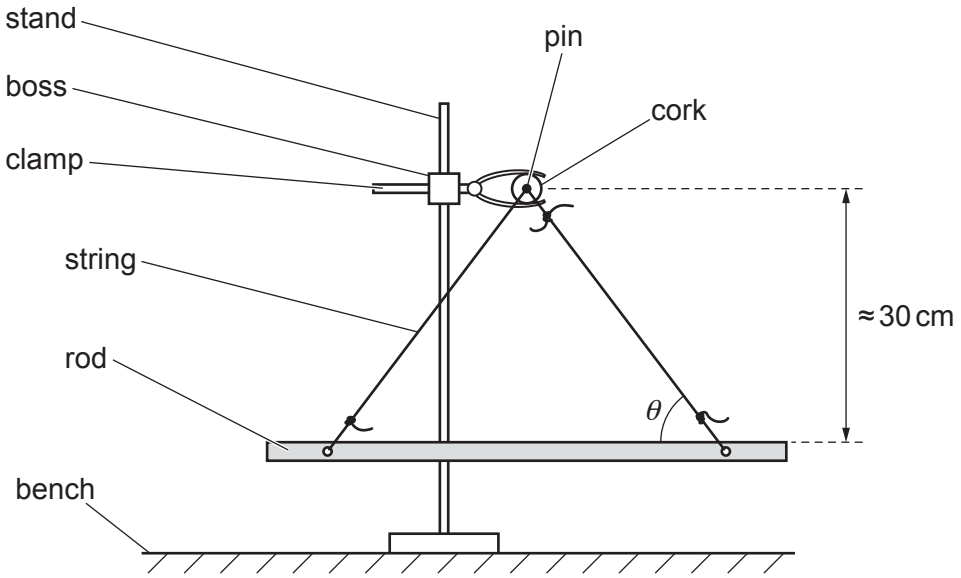


Fig. 2.2

● Ensure that the rod is horizontal.

● The angle between the rod and the string is θ, as shown in Fig. 2.2.

Measure and record θ.

θ = ...° [1]

(iii) Estimate the percentage uncertainty in your value of θ. Show your working.

percentage uncertainty = ... [1]

(iv) Calculate D where

$$D = \frac{y \tan \theta}{2}.$$

D = ... [1]

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(v) Justify the number of significant figures that you have given for your value of *D*.

.....

.....

..... [1]

(b) (i) ● Push the rod approximately 2 cm **to one side** and then release it so that it swings as shown in Fig. 2.3.

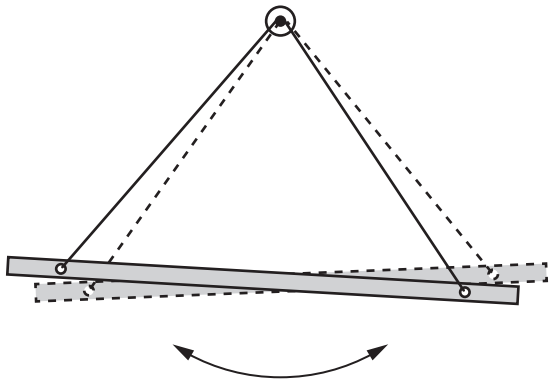


Fig. 2.3

● Take measurements to determine the period *S* of these oscillations.

S = ... [2]

(ii) ● Return the rod to a horizontal and stationary position.

● Push the whole rod approximately 2 cm **away from you** and release it so that it swings towards and away from you.
As it swings, the rod should always remain parallel to its stationary position with no twisting or sideways motion.

● Take measurements to determine the period *B* of these oscillations.

B = ... [1]

(c) ● Adjust the lengths of the two strings so that, when the rod is suspended from the pin and horizontal, the top of the rod is approximately 15 cm below the pin.

● Ensure that the rod is horizontal.

● Measure and record θ.

θ = ... °

● Calculate D.

D = ...

● Repeat **(b)**.

S = ...

B = ...
[2]

(d) It is suggested that the relationship between D, S and B is

$$\frac{k}{D} = (S^2 - B^2)$$

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) (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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