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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

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PHYSICS **9702/33**

Paper 3 Advanced Practical Skills 1 **May/June 2025**

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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2	
Total	

This document has **12** pages.

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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) • Set up the circuit shown in Fig. 1.1.

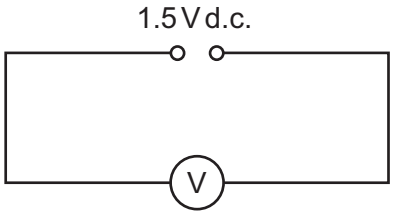


Fig. 1.1

• Record the voltmeter reading *E*.

E = ... [1]

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(b) You have been provided with a metre rule with a wire attached. You have also been provided with two identical resistors placed in component holders, each labelled R.

- Set up the circuit shown in Fig. 1.2.

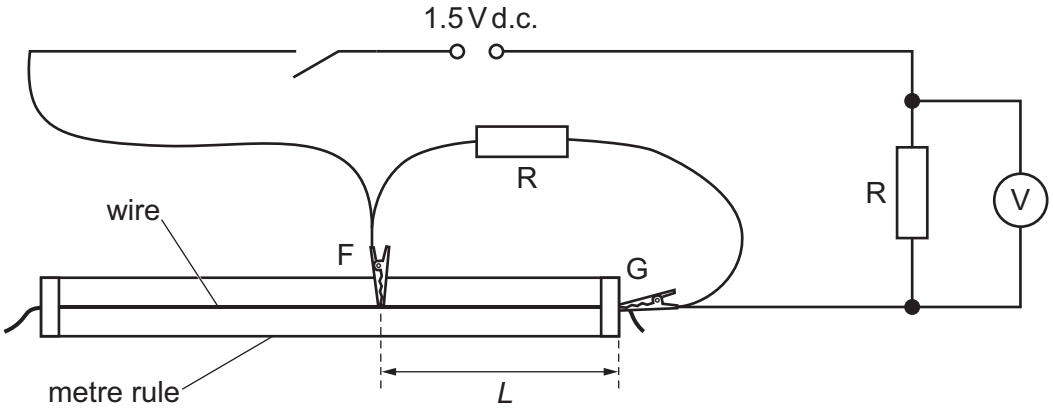


Fig. 1.2

- F and G are crocodile clips.

  The distance between F and G is *L*. Attach F and G to the wire so that *L* is approximately 30 cm.

- Close the switch.

- Record the value of *L* and the voltmeter reading *V*.

  L = ...

  V = ...

- Open the switch.

[1]

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(c) • Write down the value of E from **(a)**.

E = ...

• **Increase** L by changing the position of F on the wire. Record L and V and repeat until you have six sets of values of L and V. Include your values from **(b)**.

Record your results in a table. Include values of $\frac{E - V}{L}$ in your table.

[9]

(d) (i) Plot a graph of $\frac{E - V}{L}$ on the y-axis against V on the x-axis. [3]

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

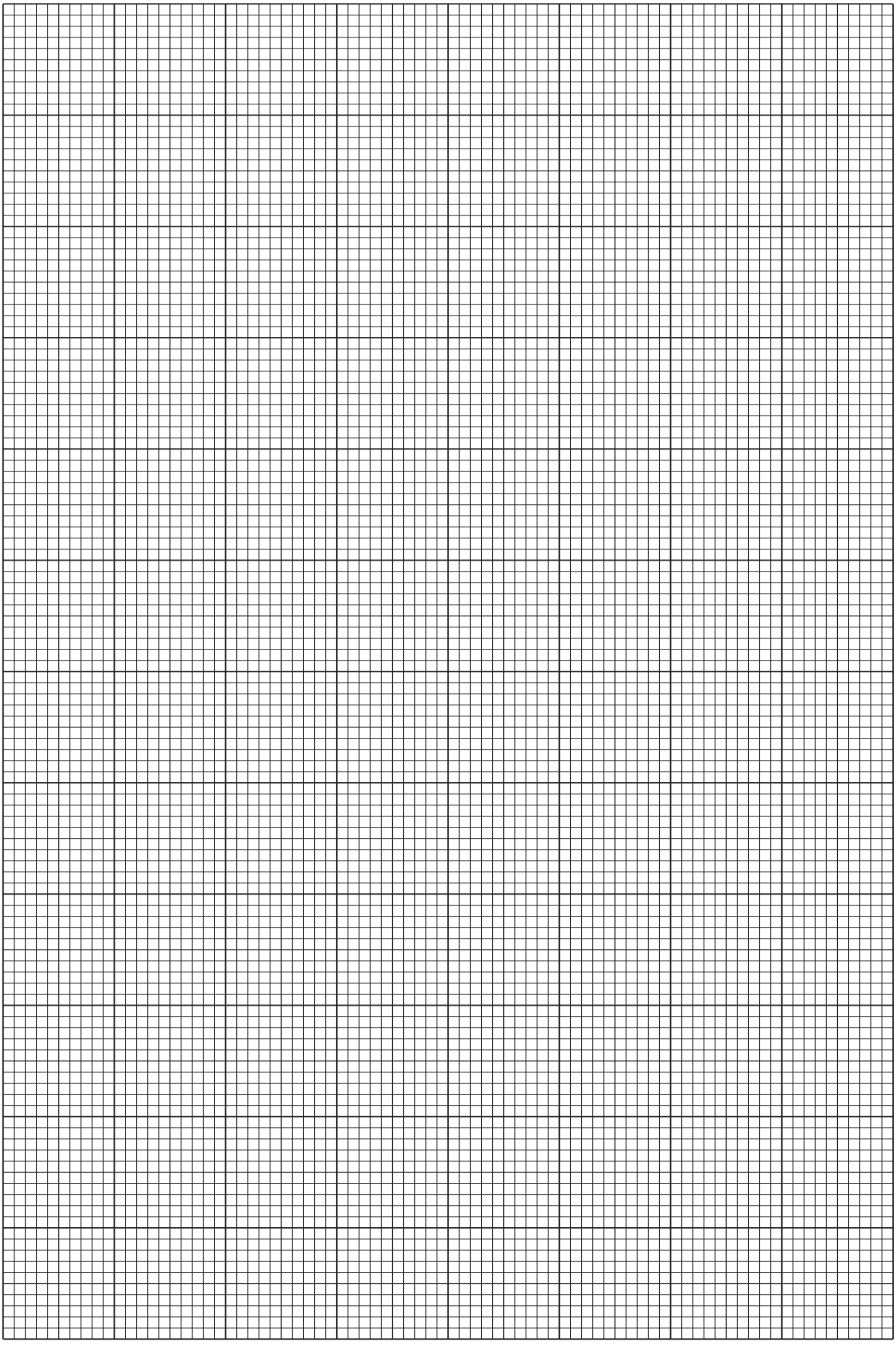
(iii) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...

[2]

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(e) It is suggested that the quantities V and L are related by the equation

$$\frac{E - V}{L} = PV - Q$$

where P and Q are constants.

Using your answers in **(d)(iii)**, determine the values of P and Q.
Give appropriate units.

P = ...

Q = ...
[2]

(f) The resistance of R is R.

Theory suggests that:

- P and Q are both inversely proportional to R
- the graph cuts the x-axis at a value of $V = \frac{E}{2}$ for all values of R.

A student repeats the experiment using two identical resistors, each with a lower value of R than in the original experiment.

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

[Total: 20]

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

2 In this experiment, you will investigate the oscillations of a chain of paper clips.

You have been provided with two spheres of modelling clay.

(a) (i) The diameter of the **smaller** sphere is *d*, as shown in Fig. 2.1.

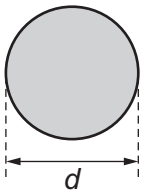


Fig. 2.1

Measure and record *d*.

d = ... [1]

(ii) Estimate the percentage uncertainty in your value of *d*. Show your working.

percentage uncertainty = ...% [1]

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(b) (i) • Set up the apparatus as shown in Fig. 2.2.

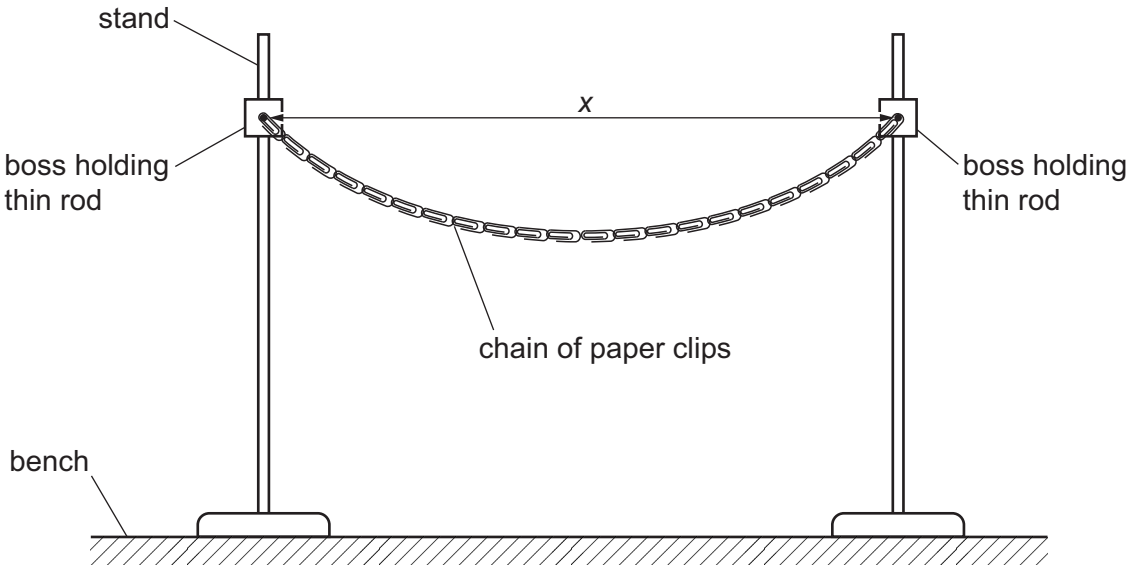


Fig. 2.2

- Ensure that the rods are the same height above the bench.
- Slide the paper clips at the ends of the chain onto the rods.
- The distance between the centres of the rods is *x*.

  Position the stands so that *x* is approximately 70 cm.
- Measure and record *x*.

x = ... cm [1]

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(ii) • Use the hook to attach the **smaller** sphere of modelling clay to the chain of paper clips as shown in Fig. 2.3.

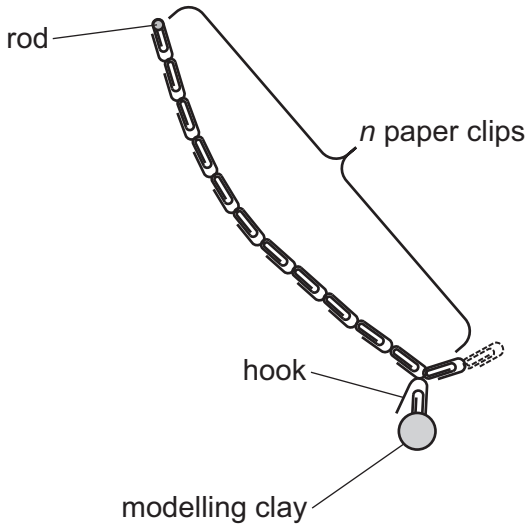


Fig. 2.3

• The number of paper clips between the hook and the end of the chain is n, as shown in Fig. 2.3.

Place the hook so that n is 11.

• Calculate N, where

$$N = \sqrt[3]{n^2}.$$

Give your answer to three significant figures.

N = ... [1]

(c) • Pull the sphere towards you through a short distance. When the sphere is released, it will oscillate.

• Take measurements to determine the period T of these oscillations.

T = ... [2]

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(d) • Roll the two spheres into one larger sphere.

• Measure and record the diameter d of the larger sphere.

d = ...

• Repeat **(b)** and **(c)** with a value x of approximately 80 cm and with the hook placed so that n is 7.

x = ... cm

N = ...

T = ...
[3]

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(e) It is suggested that the relationship between T, d, N and x is

$$T^2 = \frac{kdN}{x^2}$$

where k is a constant.

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

first value of k = ...

second value of k = ...

[1]

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

.....

.....

..... [1]

(f) It is suggested that the percentage uncertainty in the values of k is 15%.

Using this uncertainty, explain whether your results support the relationship in **(e)**.

.....

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.....

..... [1]

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(g) (i) Describe **four** sources of uncertainty or limitations of the procedure for this experiment.

For any uncertainties in measurement that you describe, you should state the quantity being measured and a reason for the uncertainty.

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 .....

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3 .....

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4 .....

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[4]

[Total: 20]

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