



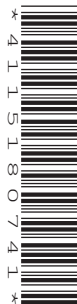
Cambridge International AS & A Level

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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	
1	
2	
Total	

This document has **12** pages.

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.

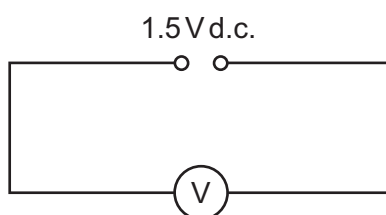


Fig. 1.1

- Record the voltmeter reading E .

$E =$ [1]



(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.

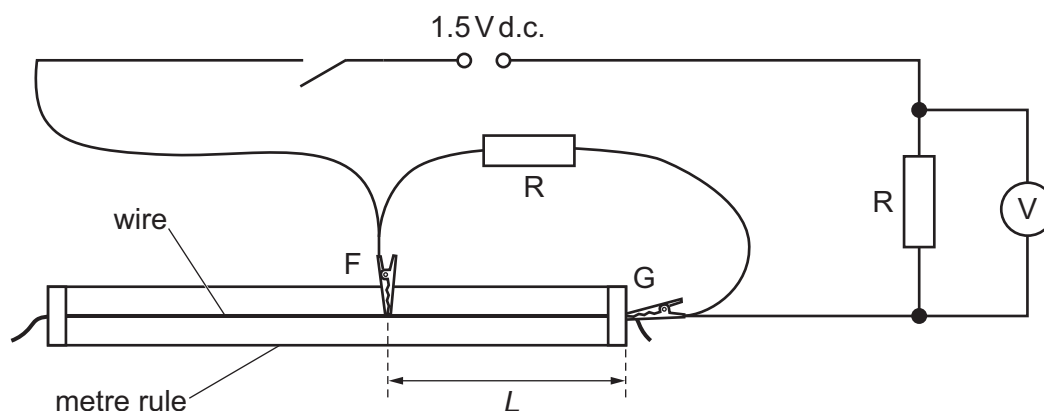


Fig. 1.2

- 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]





- (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]



* 0000800000005 *



(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]





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.

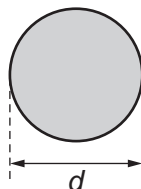


Fig. 2.1

Measure and record d .

$d =$ [1]

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

percentage uncertainty =% [1]





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

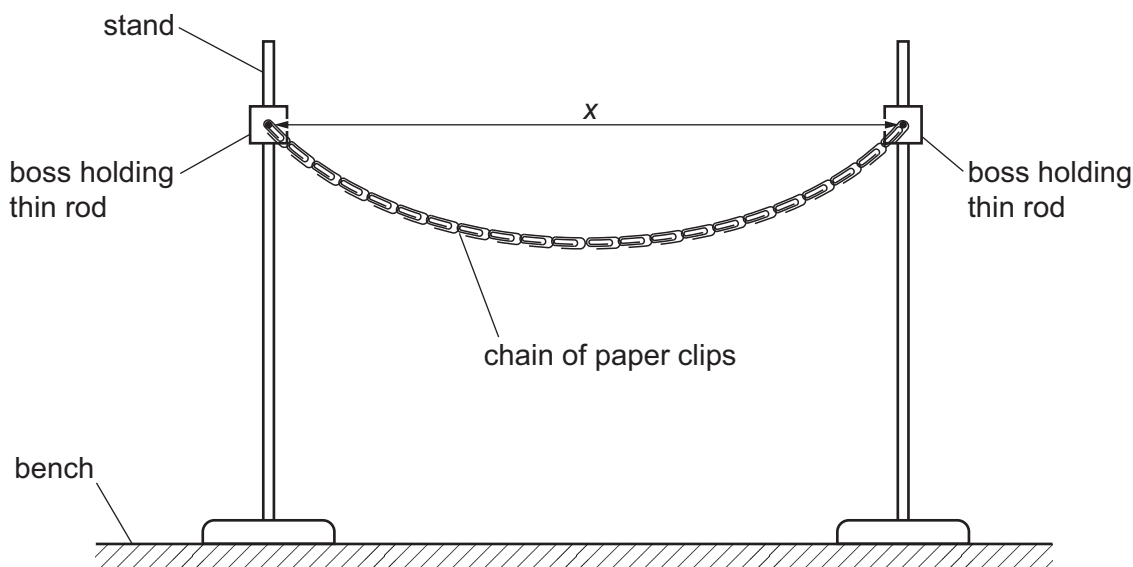


Fig. 2.2

- 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 .

$x = \dots\dots\dots$ cm [1]



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

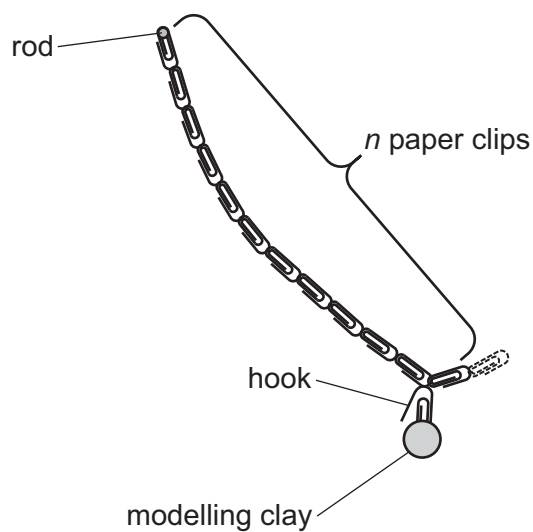


Fig. 2.3

- 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.

$$N = \dots\dots\dots [1]$$

- (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.

$$T = \dots\dots\dots [2]$$





- (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]



- (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).

.....

 [1]



- (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

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2

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3

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4

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[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

.....

[4]

[Total: 20]

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