Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

3836321574

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **May/June 2015**

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.

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

1 In this experiment, you will investigate how the voltage across components in a circuit varies as the resistance of the circuit is changed.

(a) (i) Set up the circuit as shown in Fig. 1.1.

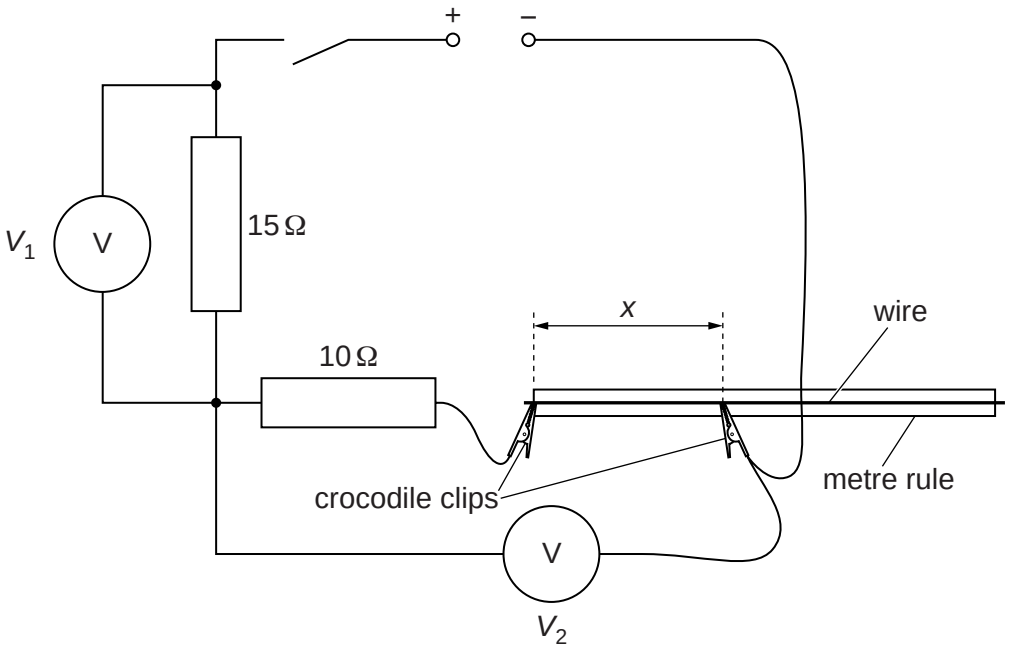


Fig. 1.1

Attach the crocodile clips to the wire so that the distance x is approximately 30 cm.

(ii) Measure and record x.

x = ...[1]

(b) (i) Close the switch.

(ii) Record the voltmeter readings V_1 and V_2.

V_1 = ...

V_2 = ...
[1]

(iii) Open the switch.

(c) Change x and repeat **(a)(ii)** and **(b)** until you have six sets of readings of x, V_1 and V_2.

Include values of $\frac{V_2}{V_1}$ in your table.

[10]

(d) **(i)** Plot a graph of $\frac{V_2}{V_1}$ on the y-axis against x on the x-axis. [3]

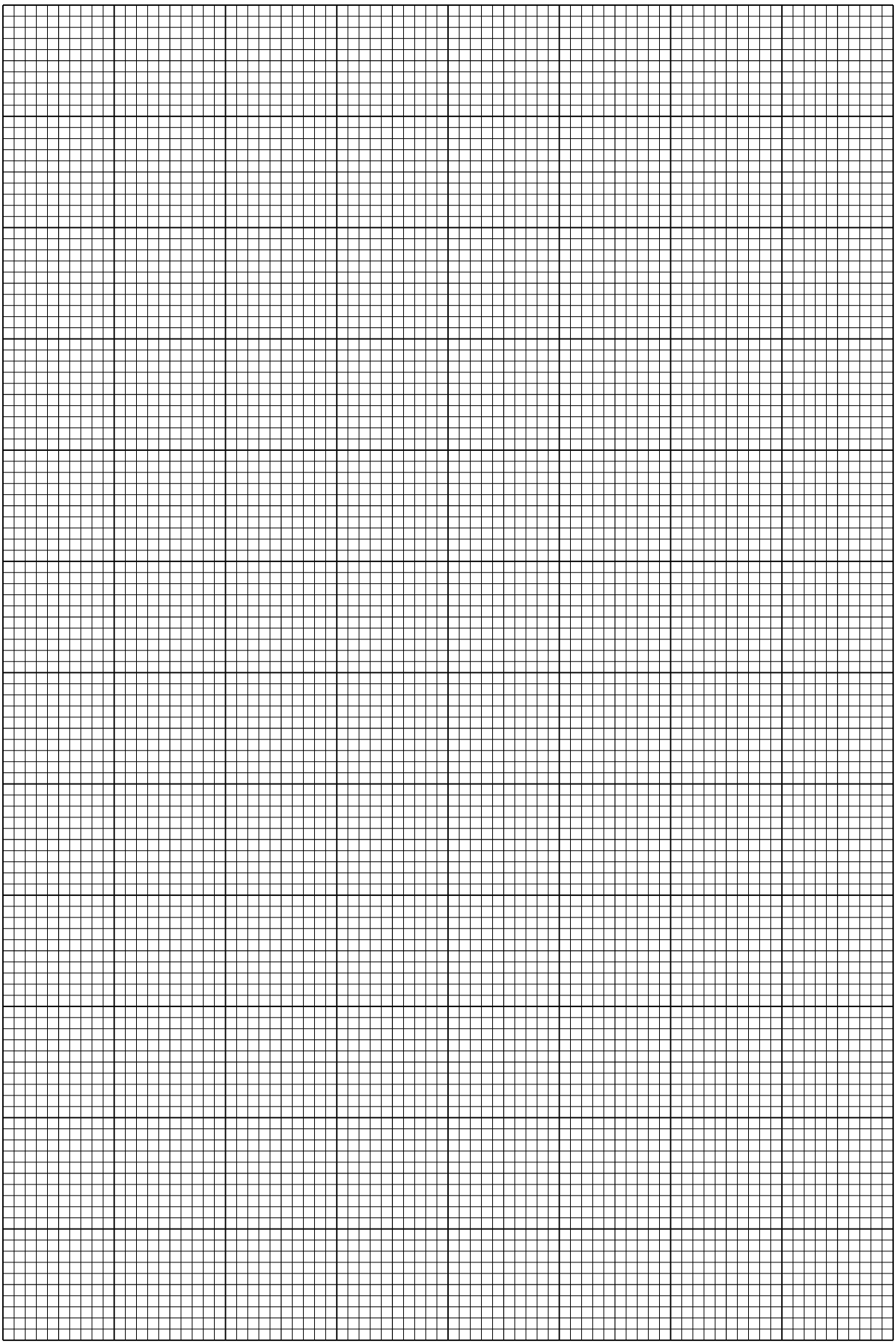
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...

[2]



(e) The quantities V_2, V_1 and x are related by the equation

$$\frac{V_2}{V_1} = \frac{Ax}{P} + \frac{Q}{B}$$

where $P = 15\,\Omega$, $Q = 10\,\Omega$ and A and B are constants.

Use your answers in **(d)(iii)** to determine values for A and B.
Give appropriate units.

A = ...

B = ...

[2]

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

2 In this experiment, you will investigate the motion of a metal bar.

(a) Use the loops on one piece of string to arrange the string on a wooden rod as shown in Fig. 2.1.
The loops of the string on the rod should be approximately 18 cm apart.
Repeat for the other rod and string.

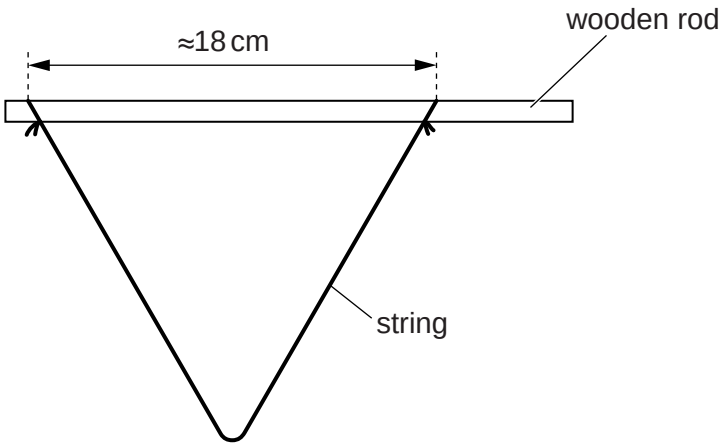


Fig. 2.1

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

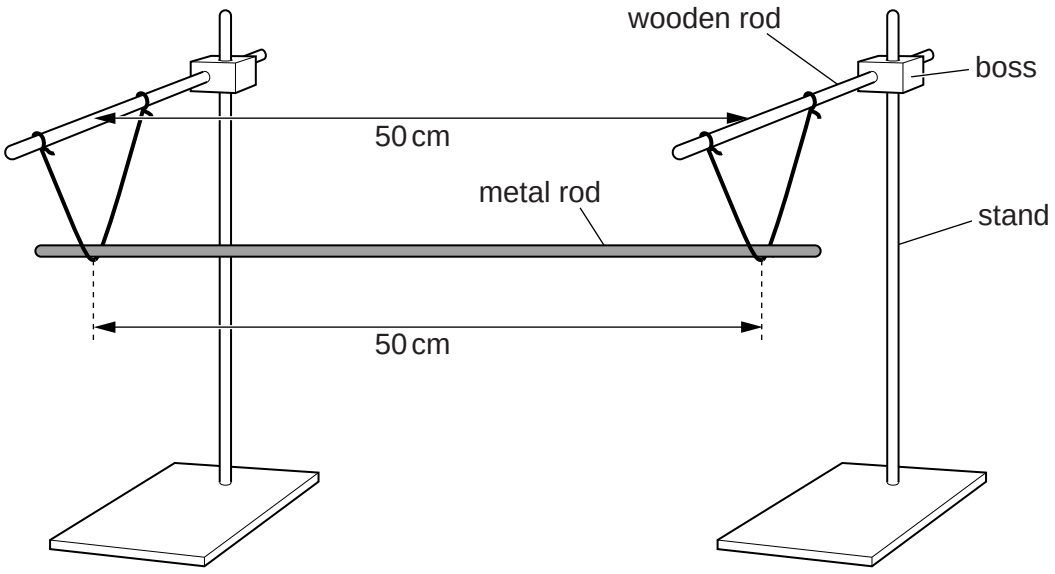


Fig. 2.2

The two wooden rods should be parallel, equal heights above the bench and 50 cm apart.

The two strings supporting the metal rod should be 50 cm apart.

(c) (i) Measure and record the angle θ as shown in Fig. 2.3.

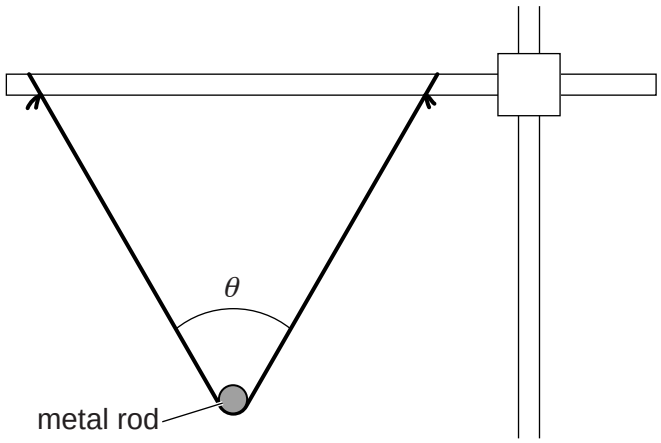


Fig. 2.3

θ = ... [1]

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

percentage uncertainty = ... [1]

(iii) Calculate the value of $\cos\left(\frac{\theta}{2}\right)$.

$\cos\left(\frac{\theta}{2}\right)$ = ... [1]

(d) (i) Move the metal rod to the left.

Release the metal rod and watch the movement.

The metal rod will move to the right and then to the left again, completing a cycle as shown in Fig. 2.4.



Fig. 2.4

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(ii) The time taken for one complete cycle is T_1.
By timing several of these complete cycles, determine an accurate value for T_1.

T_1 = ... [2]

(e) (i) Move the centre of the metal rod towards you through a small distance.

Release the metal rod and watch the movement.

The metal rod will move away from you and then back towards you completing a cycle as shown in Fig. 2.5.

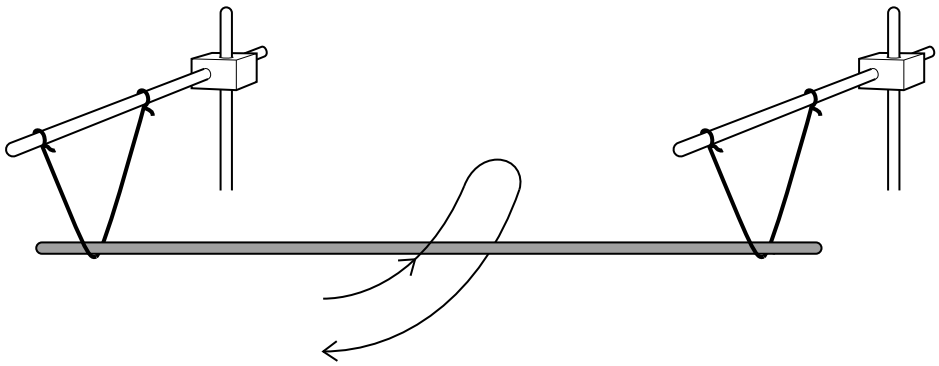


Fig. 2.5

(ii) The time taken for one complete cycle is T_2.
By timing several of these complete cycles, determine an accurate value for T_2.

T_2 = ... [1]

(f) **(i)** Reduce the distance between the loops of string on each wooden rod to approximately 9 cm as shown in Fig. 2.6.

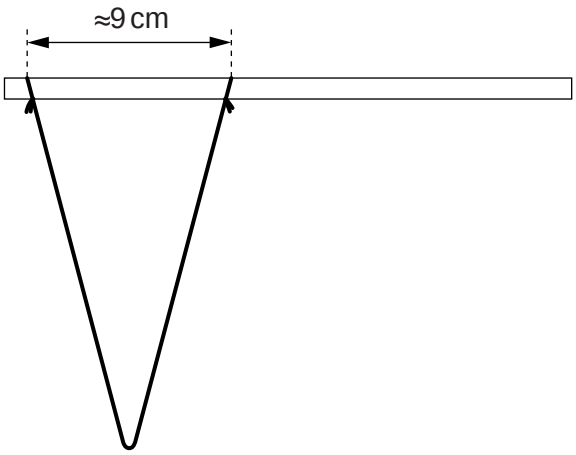


Fig. 2.6

(ii) Repeat **(b)**, **(c)(i)**, **(c)(iii)**, **(d)** and **(e)**.

θ = ...

$\cos\left(\frac{\theta}{2}\right)$ = ...

T_1 = ...

T_2 = ...

[3]

(g) It is suggested that the relationship between T_1, T_2 and θ is

$$\frac{T_1}{T_2} = k \cos\left(\frac{\theta}{2}\right)$$

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]

(iii) Explain whether your results in **(g)(i)** support the suggested relationship.

.....

.....

.....

..... [1]

(h) (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]

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