Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5669755955 96

PHYSICS **9702/31**

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 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	

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[Turn over

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

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

(a) (i) You have been provided with a length of bare wire and two crocodile clips which have small screws on them. Connect the wire between the crocodile clips using the screws as shown in Fig. 1.1.

The length *w* of wire between the screws should be approximately 50 cm. The screws should be tightened using the screwdriver.

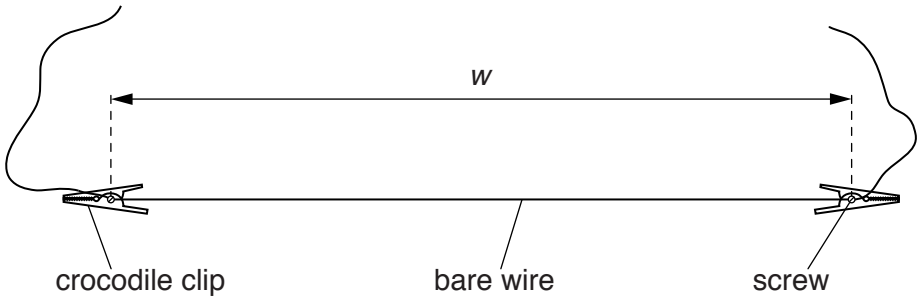

Fig. 1.1

(ii) Measure and record *w*.

w = ... [1]

(b) (i) Set up the circuit as shown in Fig. 1.2.

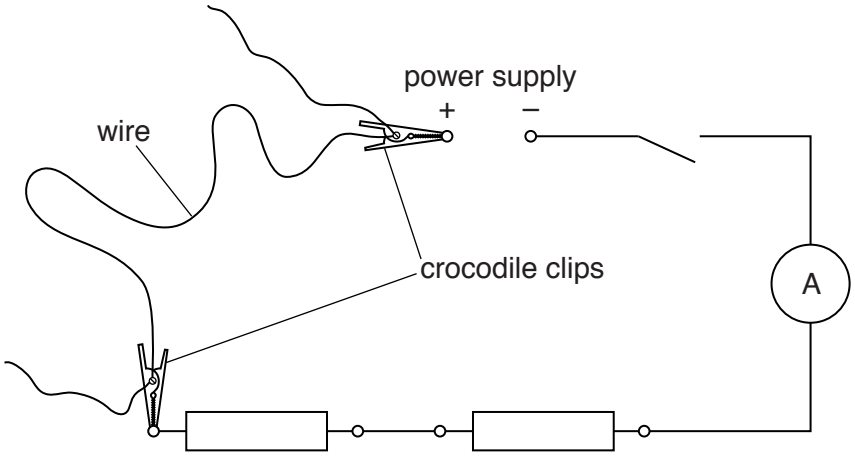

Fig. 1.2

(ii) Close the switch.

(iii) Record the ammeter reading I_A.

I_A = ...

(iv) Open the switch.

(c) (i) Move the crocodile clip to set up the circuit as shown in Fig. 1.3.

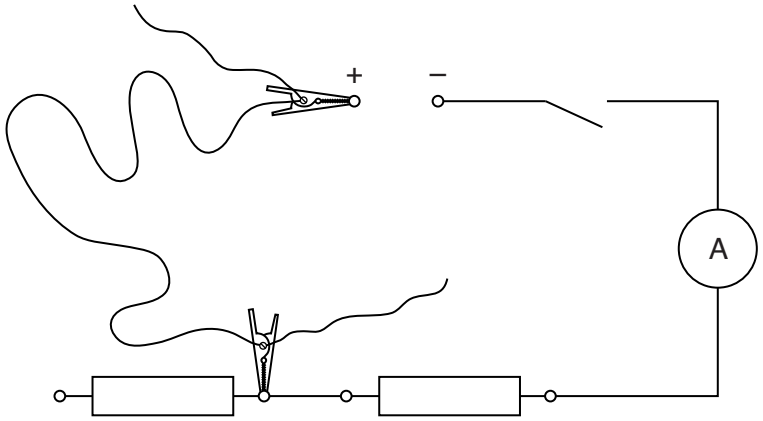

Fig. 1.3

(ii) Close the switch.

(iii) Record the ammeter reading I_B.

I_B = ... [1]

(iv) Open the switch.

(d) Change *w* and repeat **(a)(ii)**, **(b)** and **(c)** until you have six sets of values of *w*, I_A and I_B.

Include values of $\frac{(I_A + I_B)}{I_A I_B}$ in your table.

[10]

(e) **(i)** Plot a graph of $\frac{(I_A + I_B)}{I_A I_B}$ on the *y*-axis against *w* 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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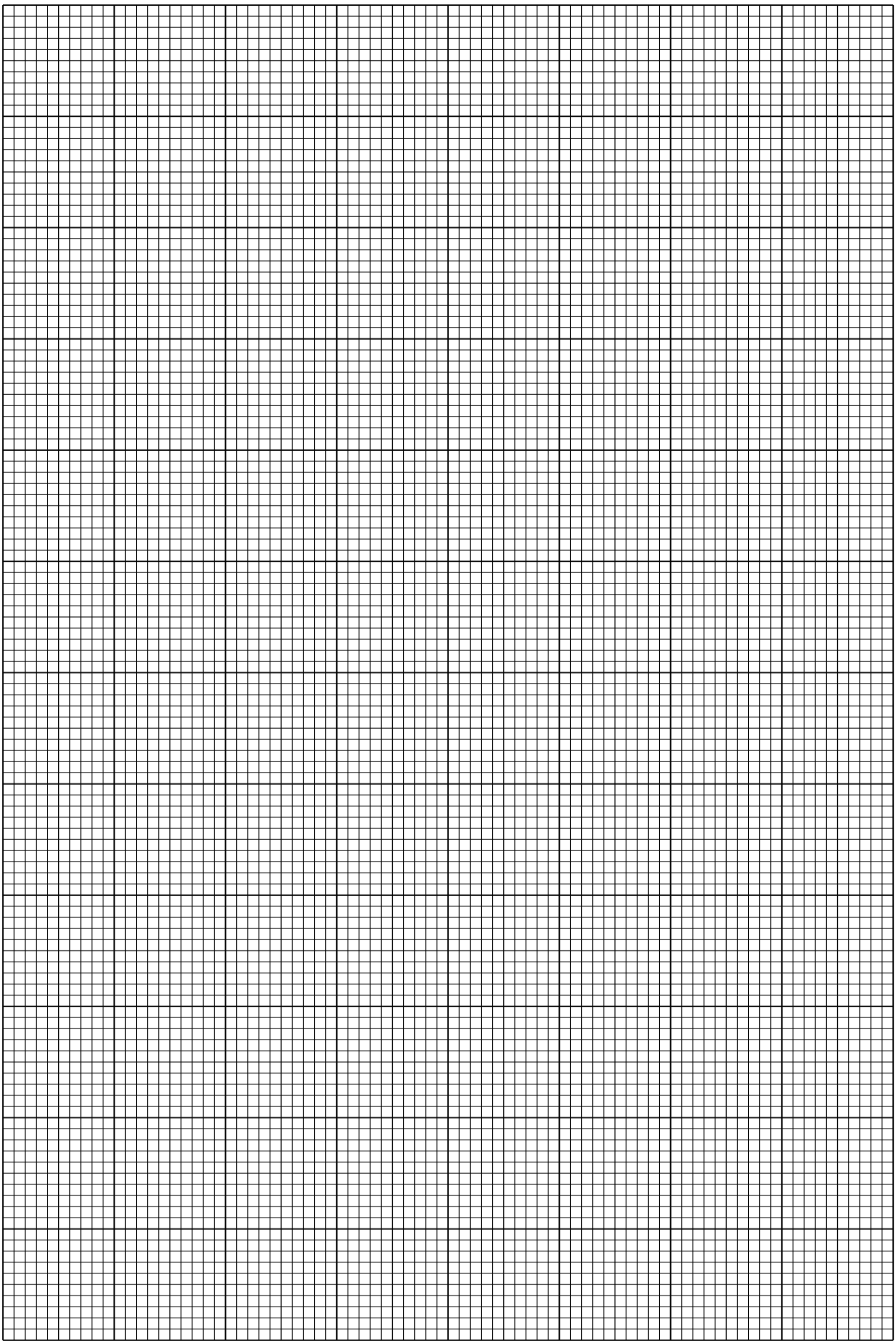

(f) The quantities I_A, I_B and w are related by the equation

$$\frac{(I_A + I_B)}{I_A I_B} = Mw + N$$

where M and N are constants.

Using your answers in **(e)(iii)**, determine values for M and N.
Give appropriate units.

M = ...

N = ...

[2]

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

2 In this experiment, you will investigate the balance of a wooden strip.

(a) (i) Measure and record the length L of the **longer** wooden strip as shown in Fig. 2.1.

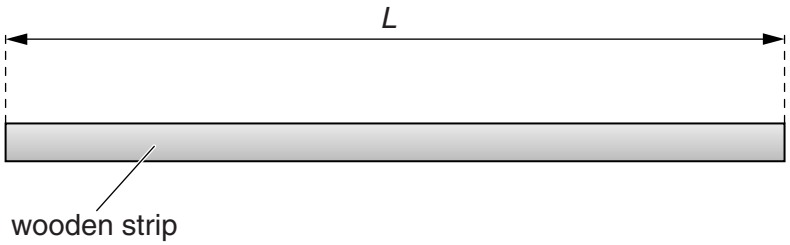

Fig. 2.1

L = ... [1]

(ii) Measure and record the mass m, in grams, of the **longer** wooden strip.

m = ... g [1]

(iii) Calculate the mass per unit length p of the wood, where

$$p = \frac{m}{L}.$$

p = ...

(iv) Justify the number of significant figures that you have given for your value of p.

.....

.....

.....[1]

(b) (i) Measure and record the mass M, in grams, of the slotted mass.

M = ... g [1]

(ii) Use the Blu-Tack to attach the slotted mass to the top of the **longer** wooden strip as shown in Fig. 2.2.

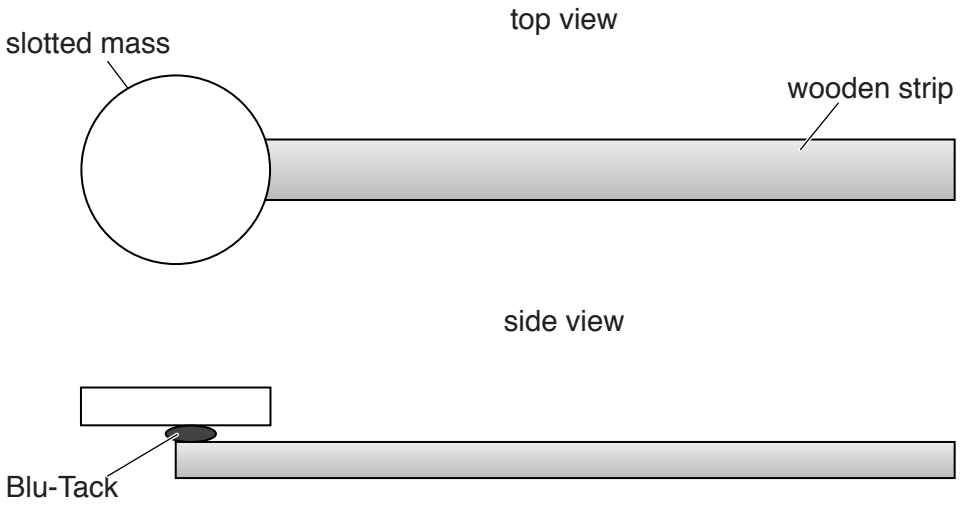

Fig. 2.2

The centre of the slotted mass should be positioned at the end of the wooden strip.

(iii) Calculate C, where

$$C = \frac{L^2}{2(M + Lp)}.$$

C = ... [1]

(c) (i) Balance the wooden strip on the pivot as shown in Fig. 2.3.

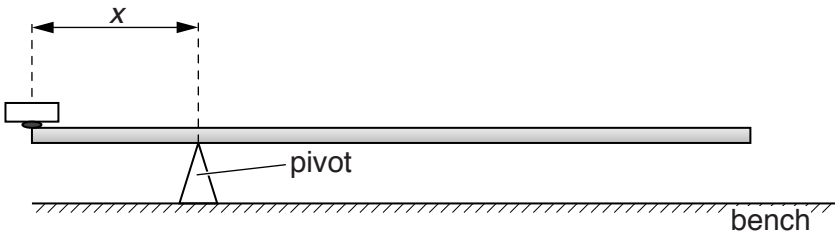

Fig. 2.3

(ii) Measure and record the distance *x* from the pivot to the end of the wooden strip as shown in Fig. 2.3. **Do not mark the wooden strip.**

x = ... [1]

(iii) Estimate the percentage uncertainty in your value of *x*.

percentage uncertainty = ... [1]

(d) Repeat **(a)(i)**, **(b)(ii)**, **(b)(iii)**, **(c)(i)** and **(c)(ii)** for the **shorter** wooden strip.

L = ...

C = ...

x = ...

[3]

(e) It is suggested that the relationship between x and C is

$$x = kC$$

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 in **(e)(i)** support the suggested relationship.

.....

.....

.....

.....[1]

(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]

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