Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

7852599699

PHYSICS **9702/36**

Paper 3 Advanced Practical Skills 2 **October/November 2016**

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 the current in an electrical circuit.

(a) Connect the circuit shown in Fig. 1.1.

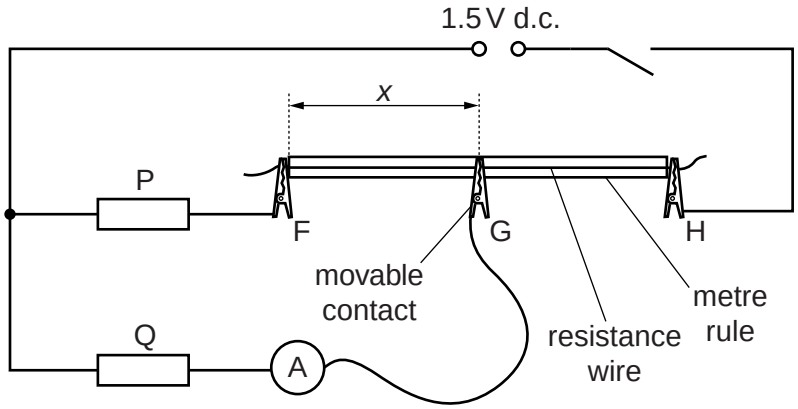


Fig. 1.1

F, G and H are crocodile clips. The crocodile clip G is used as a movable contact. Position G approximately half-way along the resistance wire.

(b) **(i)** The distance between F and G is *x*, as shown in Fig. 1.1.
Measure and record *x*.

x = ... cm [1]

(ii) Close the switch.

(iii) Record the ammeter reading *I*.

I = ... [1]

(iv) Open the switch.

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(c) Vary x and repeat **(b)** until you have six sets of values for x and I.

[8]

(d) (i) Plot a graph of I on the y-axis against x on the x-axis. [3]

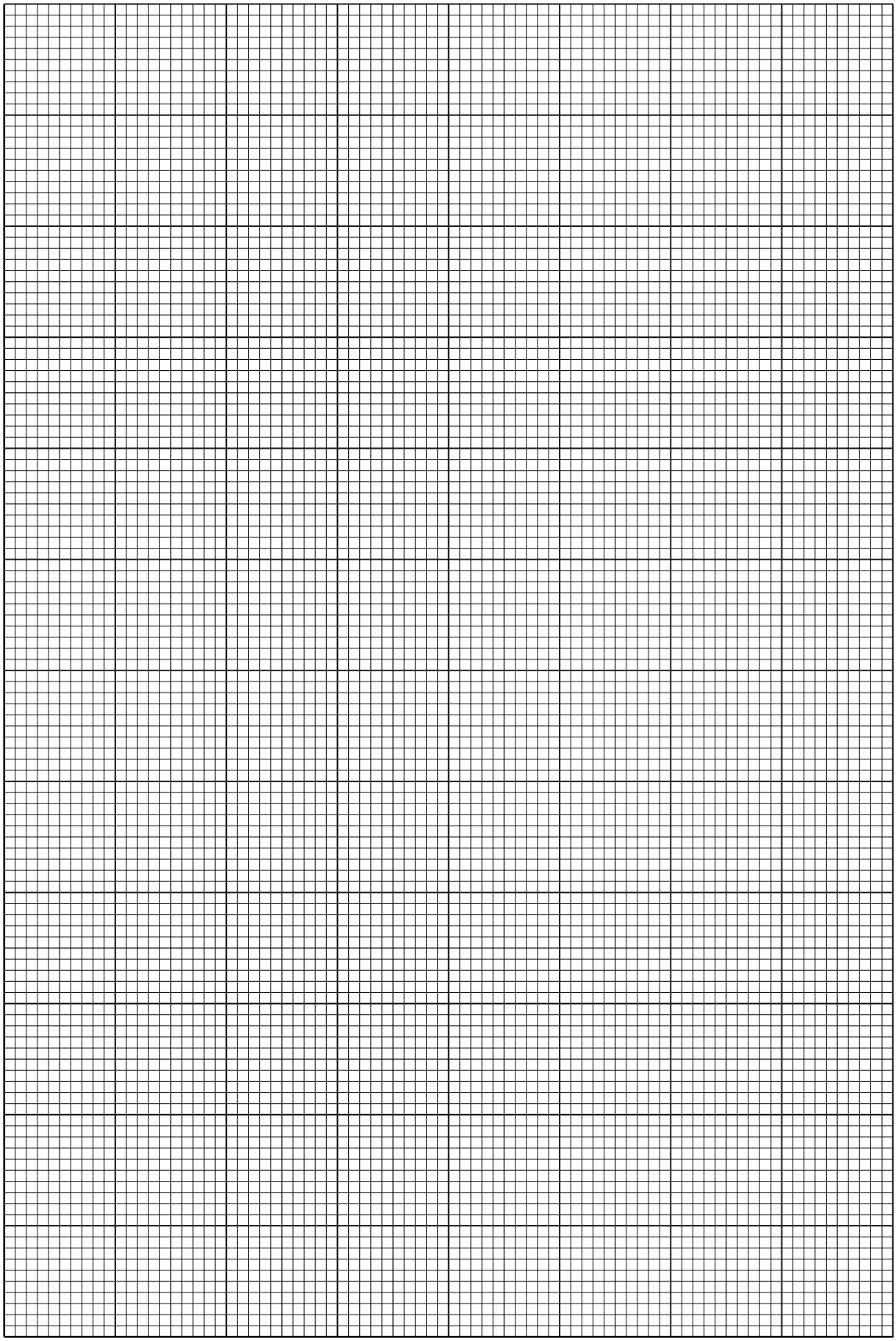
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...

[2]



(e) The quantities I and x are related by the equation

$$I = Sx + T$$

where S and T are constants.

Use your answers from **(d)(iii)** to determine the values of S and T.
Give appropriate units.

S = ...

T = ...
[2]

(f) The resistance per unit length r of the resistance wire can be found from

$$r = \frac{PS}{T}$$

where $P = 15\,\Omega$ (the resistance of resistor P).

Calculate r in $\Omega\,\text{cm}^{-1}$.
Give your answer to a suitable number of significant figures.

r = ... $\Omega\,\text{cm}^{-1}$ [2]

[Total: 20]

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

2 In this experiment, you will investigate a balanced metre rule.

(a) (i) Set up the apparatus as shown in Fig. 2.1.
Use some of the Blu-Tack to fix the pivot to the empty beaker.

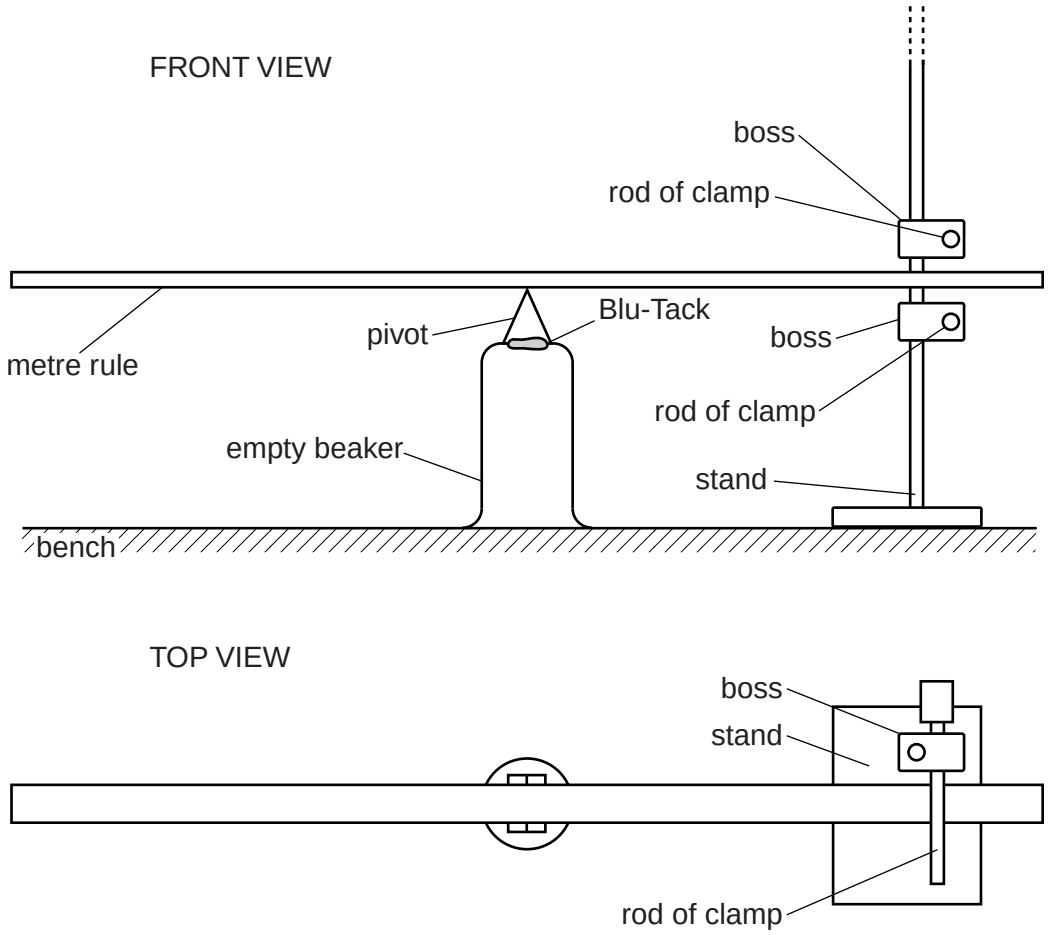


Fig. 2.1

(ii) The rods of the clamps act as stops to prevent the metre rule tilting too far.
Adjust them so that one is approximately 3 cm higher than the pivot and the other is approximately 3 cm lower than the pivot.

(iii) Position the metre rule with its 50.0 cm mark at the pivot. If necessary, add Blu-Tack to one end of the rule to balance it.

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(b) You are provided with two glass spheres fixed to string loops.

(i) Suspend the larger sphere from the metre rule at a distance of 10.0 cm from the pivot. Balance the rule by suspending the other sphere a distance x_1 from the pivot, as shown in Fig. 2.2.

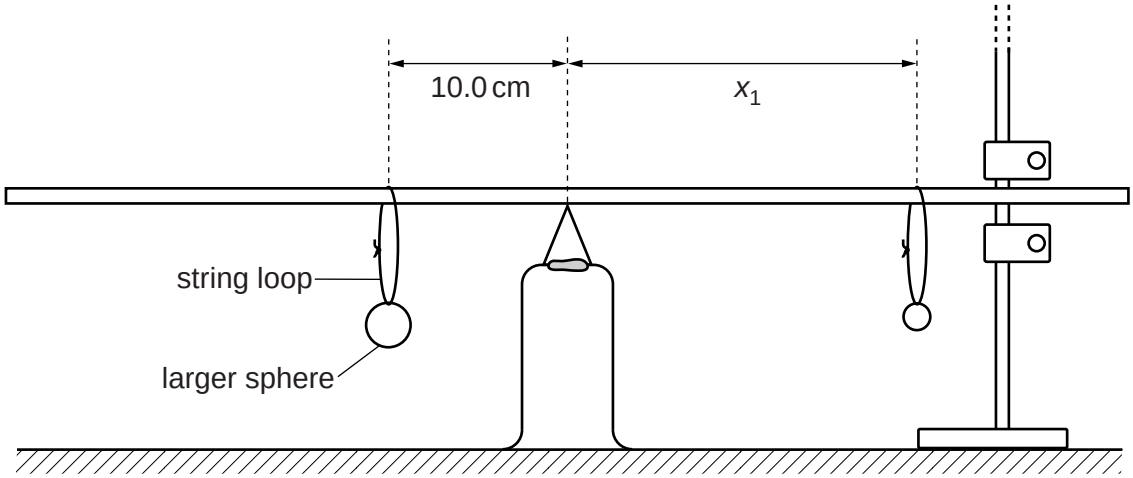


Fig. 2.2

(ii) Measure and record x_1.

x_1 = ... cm [1]

(c) Immerse the larger sphere in water at a distance of 10.0 cm from the pivot, as shown in Fig. 2.3.
Balance the rule by moving the smaller sphere.
Measure and record the distance x_2.

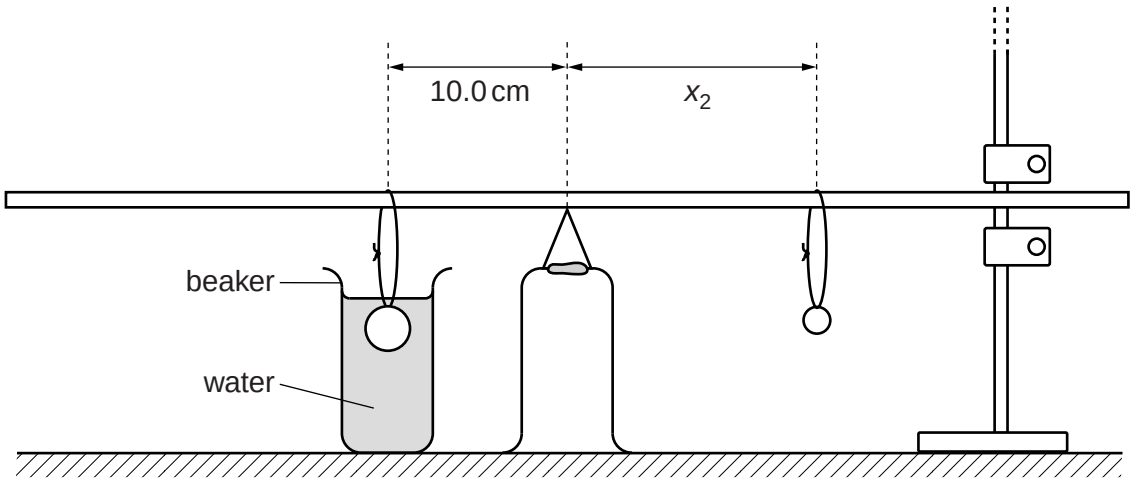


Fig. 2.3

x_2 = ... cm [1]

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(d) (i) Repeat **(b)** with the spheres changed around, with the smaller sphere suspended at a distance of 40.0 cm from the pivot, as shown in Fig. 2.4.

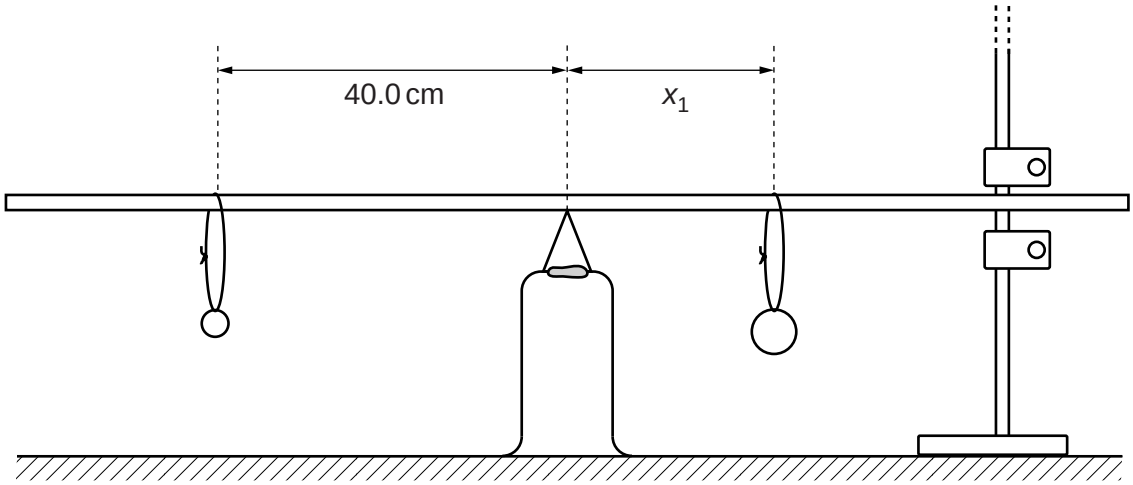


Fig. 2.4

x_1 = ... cm [1]

(ii) Immerse the smaller sphere in water at a distance of 40.0 cm from the pivot, as shown in Fig. 2.5.
Balance the rule by moving the larger sphere.
Measure and record x_2.

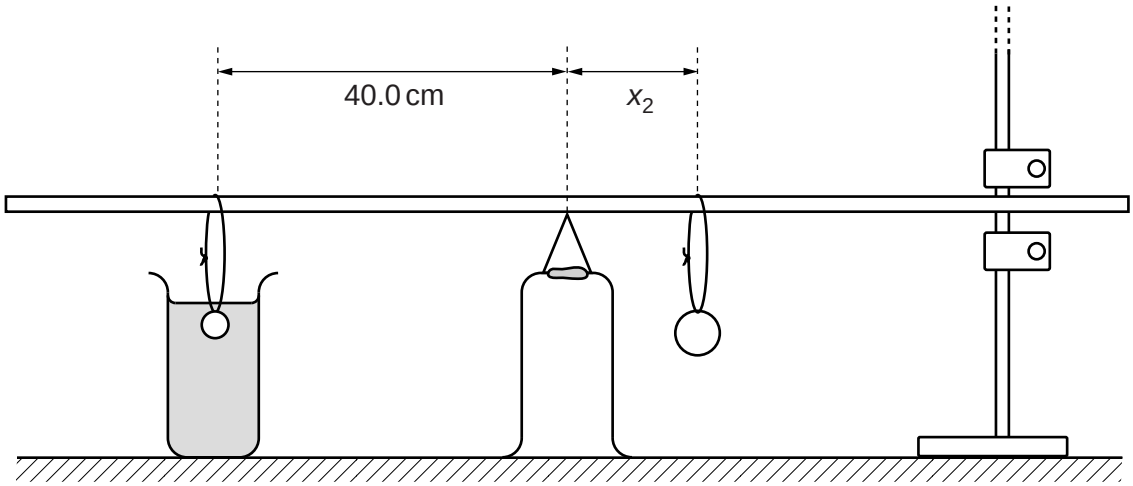


Fig. 2.5

x_2 = ... cm [1]

(e) It is suggested that the relationship between x_1 and x_2 is

$$x_1 = k(x_1 - x_2)$$

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 you have given for your values of k.

.....

.....

.....[1]

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

.....

.....

.....

.....[1]

(f) **(i)** Measure and record the diameter D of the smaller sphere.

D = ... cm [2]

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

percentage uncertainty = ... [1]

(iii) Calculate the volume V of the smaller sphere, where $V = \frac{\pi D^3}{6}$.

V = ...cm^3 [1]

(iv) The mass M of the smaller sphere is given by $M = k\rho V$ where $\rho = 1.0\,g\,cm^{-3}$.
Using one of your values of k, calculate M.

M = ... g [1]

(g) (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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