UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

4874129683

PHYSICS **9702/36**

Paper 3 Advanced Practical Skills 2 **October/November 2012**

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 a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, 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 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 submitted only if it becomes necessary to do so.
You are reminded of the need for good English and clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] after each question or part question.

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1	
2	
Total	

This document consists of **10** printed pages and **2** blank pages.

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1 In this experiment, you will investigate how the light intensity incident on a light sensor varies with distance from the light source.

(a) You are provided with a lamp mounted inside one end of a black paper tube, together with a light sensor in the form of a light-dependent resistor (LDR) mounted on a half-metre rule, as shown in Fig. 1.1.

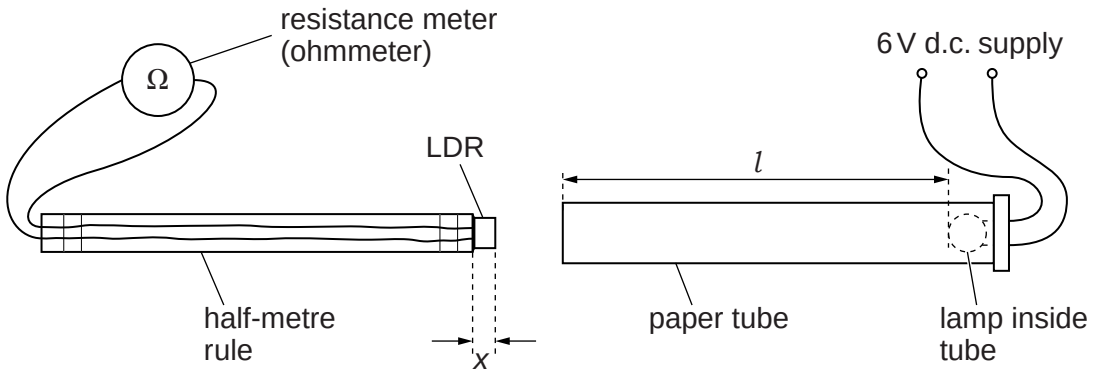


Fig. 1.1

(b) **(i)** Measure and record the distance l from the lamp to the open end of the tube, as shown in Fig. 1.1.

l = ...

(ii) Measure and record the distance x from the front of the LDR to the end of the half-metre rule, as shown in Fig. 1.1.

x = ... [1]

(c) (i) Push the rule into the tube until the LDR is approximately half way along the tube, as shown in Fig. 1.2.

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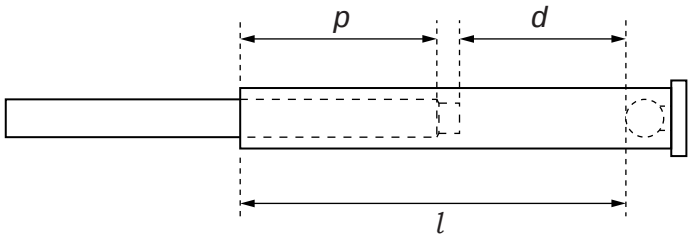


Fig. 1.2

(ii) Record the length *p* of the half-metre rule inside the tube.

p = ...

(iii) Calculate the distance *d* of the LDR from the lamp using $d = l - (x + p)$.

d = ...

(iv) Switch on the lamp and record the resistance reading *R* on the resistance meter.

R = ... kΩ [1]

(d) Repeat **(c)** using different values of p until you have six sets of values of p and R for $p \leqslant 20\,\text{cm}$.
In your table of results include values for d and $d^{1.5}$ ($d^{1.5} = \sqrt{d^3}$).

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[10]

(e) **(i)** Plot a graph of R on the y-axis against $d^{1.5}$ on the x-axis. [3]

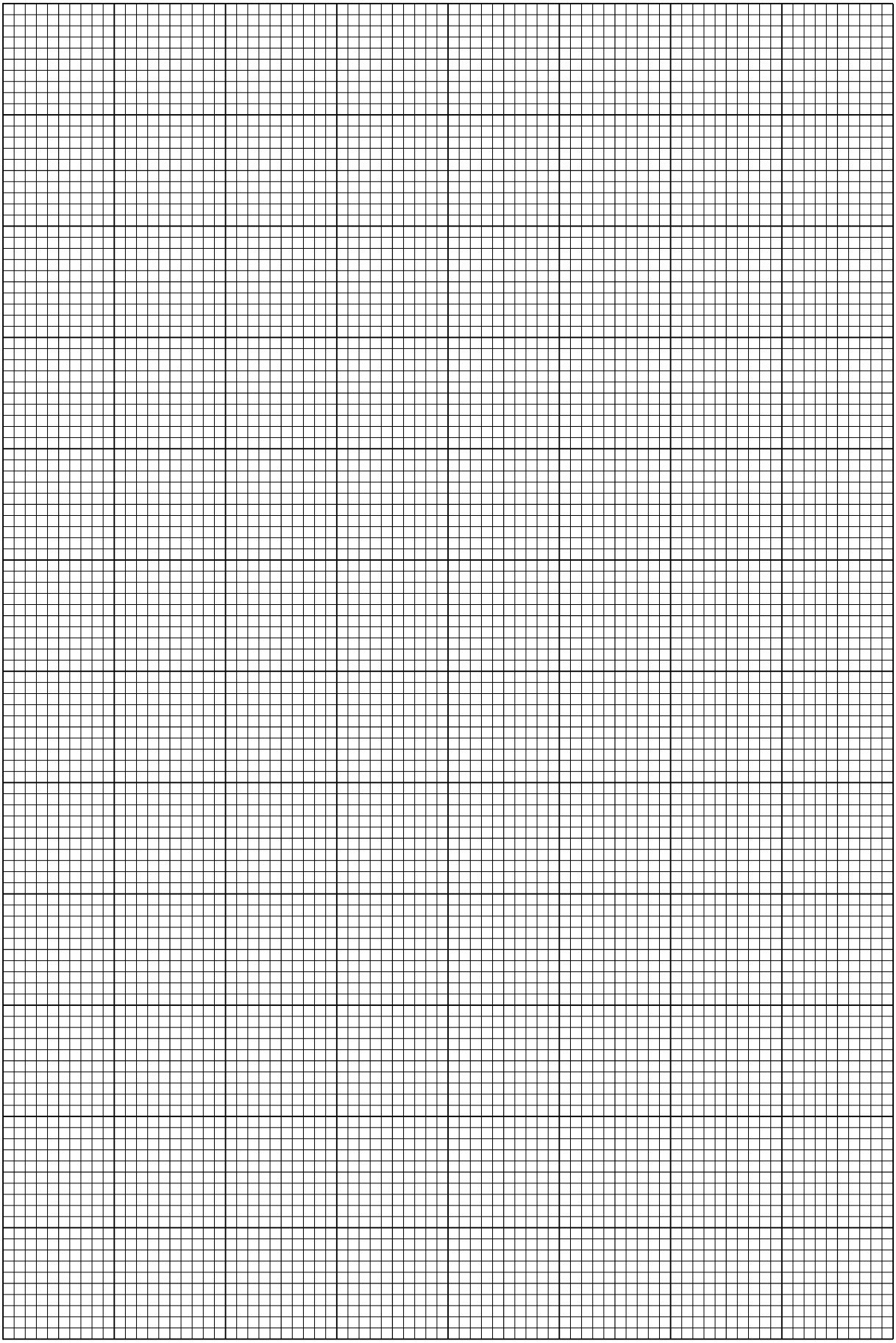
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...
[2]

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(f) The quantities R and d are related by the equation

$$R = a\,d^{1.5} + b$$

where a and b are constants.

Using your answers from **(e)(iii)**, determine the values of a and b.
Give appropriate units.

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a = ...

b = ...

[2]

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

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2 In this experiment, you will investigate the speed of a cylindrical piston moving through water.

(a) (i) You are provided with a container of water and a piece of modelling clay which can be moulded into a cylindrical piston.
You are also provided with a card on which is written the internal diameter d_0 of the container, together with two other values *A* and *B*.

Mould the piece of modelling clay into a cylinder with a diameter approximately equal to value *A*.
Measure and record the diameter *d* of this cylinder.

d = ...[1]

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

percentage uncertainty = ...[1]

(iii) You are also provided with a string running over a pulley. The string has a mass X attached to one end and a paperclip at the other end.

Push the paperclip into the centre of your clay cylinder and lower it into the container of water, as shown in Fig. 2.1, with the clay cylinder axis vertical.

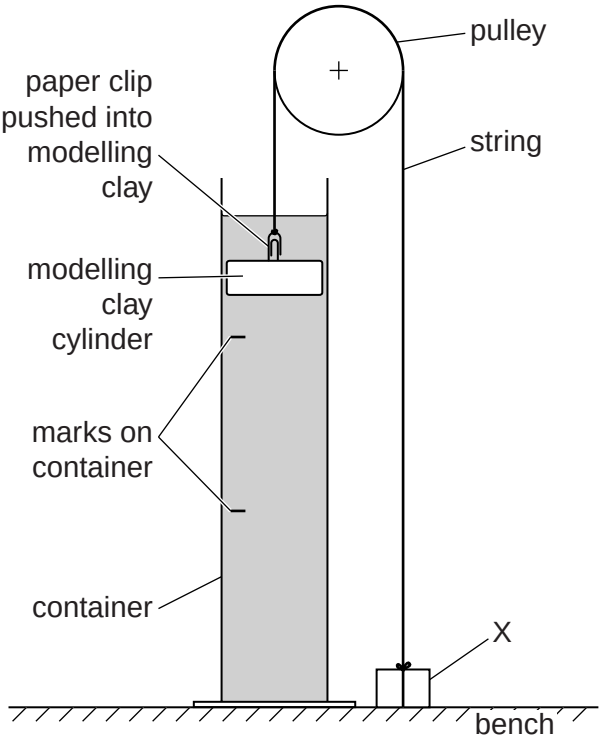


Fig. 2.1

(iv) Measure and record the distance h between the marks on the container of water.

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h = ...[1]

(b) (i) Raise X until the clay cylinder reaches the bottom of the container of water.
Release X and take measurements to determine the time t taken for the clay cylinder to rise from the lower mark to the higher mark.

t = ...[2]

(ii) Calculate the average speed v of the clay cylinder between the marks using $v = \frac{h}{t}$.

v = ...[1]

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

.....

.....

.....[1]

(c) (i) Remove the modelling clay from its paperclip and re-mould it into a cylinder with a diameter approximately equal to value B from the card.
Measure and record the diameter d of the cylinder.

d = ...[1]

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(ii) Push the paperclip into the centre of your clay cylinder again and lower it into the container of water. Repeat **(b)(i)** and **(b)(ii)**.

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t = ...

v = ...
[2]

(d) (i) It is suggested that the relationship between v and d is

$$v = k\,(d_0 - d)$$

where k is a constant and d_0 is given on your card.

Using your data, calculate two values of k.

first value of k = ...

second value of k = ...
[1]

(ii) Explain whether your results support the suggested relationship.

.....

.....

.....

.....[1]

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

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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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