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

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

3390035990675

PHYSICS **9702/35**

Paper 31 Advanced Practical Skills 1 **May/June 2010**

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 used 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.
All questions in this paper carry equal marks.

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1	
2	
Total	

This document consists of **9** printed pages and **3** blank pages.

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

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1 In this experiment, you will investigate the relationship between the power dissipated in a filament lamp and the resistance of the lamp.

(a) Assemble the circuit of Fig. 1.1.

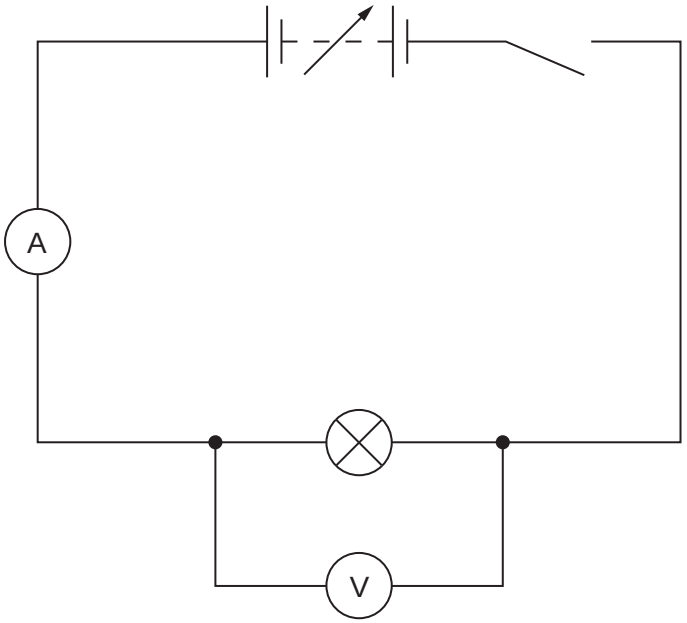


Fig. 1.1

(b) Set the power supply voltage to 12V and close the switch so that the lamp lights. Record the voltmeter reading V and the ammeter reading I.

V = ... V

I = ... A

(c) Reduce the power supply voltage, recording V and I until you have six sets of readings.

Open the switch when you have finished your measurements.

Include in your table of results values of P, R and R^4, where P is the power dissipated in the lamp and R is the resistance of the lamp.

($P = VI$ and $R = \frac{V}{I}$)

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(d) **(i)** Plot a graph of P on the y-axis against R^4 on the x-axis.

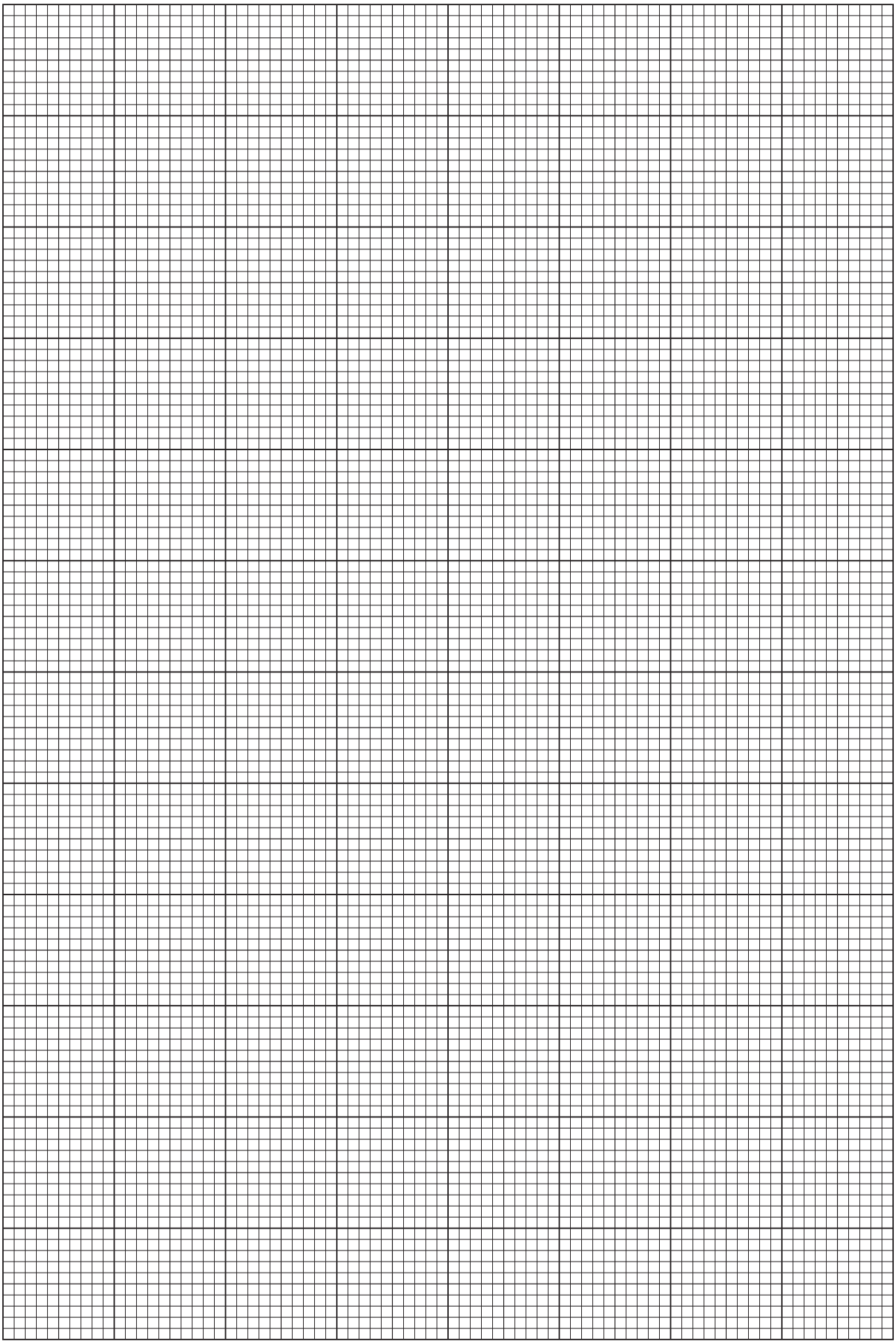
(ii) Draw the straight line of best fit.

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

gradient = ...

y-intercept = ...

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(e) It is suggested that the relationship between P and R is

$$P = aR^4 + b$$

where a and b are constants.

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

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a = ...

b = ...

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Please turn over for Question 2.

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2 In this experiment, you will investigate how the movement of a tube is affected by fluid friction.

The apparatus has been set up for you as shown in Fig. 2.1. The mass hanger will move up and down if it is pulled down and released.

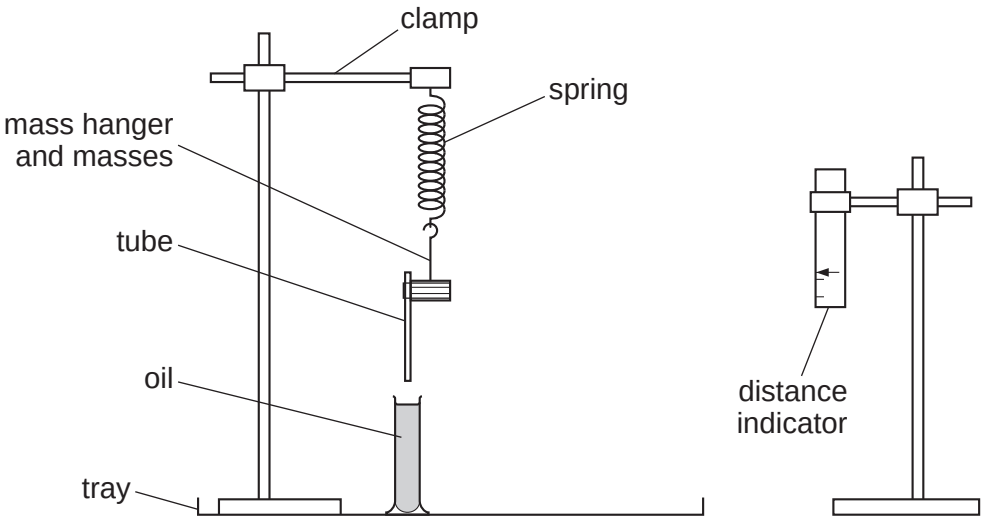


Fig. 2.1

(a) (i) By adjusting the position of the clamp, lower the spring and mass hanger so that the bottom of the tube is immersed centrally in the oil to a depth *d* of about 5 cm, as shown in Fig. 2.2.

(ii) Measure and record *d*.

d = ...

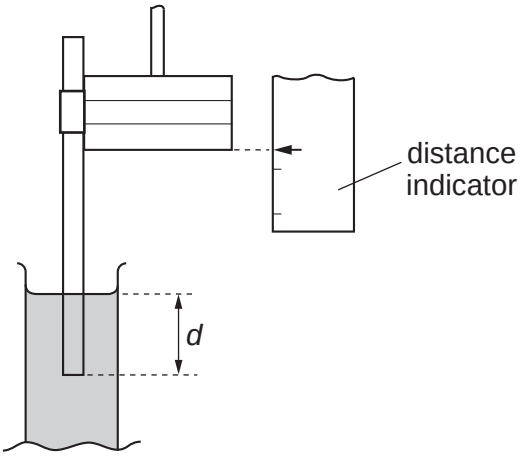


Fig. 2.2

(b) Adjust the distance indicator so that its arrow is level with the bottom of the mass hanger, as shown in Fig. 2.2.

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(c) (i) Pull down the mass hanger about 3 cm and release it so that it moves up and down.
Each time the mass hanger moves down, you will see that the **lowest** position that it reaches changes gradually from 3 cm to 0 cm below the arrow.

(ii) Repeat **(i)** and start the stopwatch when the mass hanger's lowest position is 2.0 cm below the arrow. Stop the stopwatch when the lowest position has become 0.5 cm below the arrow.
Record this time *t*.

t = ...

(d) Estimate the percentage uncertainty in *t*.

percentage uncertainty = ...

(e) (i) By again adjusting the position of the clamp, lower the spring and mass hanger so that *d* is about 10 cm.

(ii) Repeat **(a)(ii)**, **(b)** and **(c)**.

d = ...

t = ...

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[Turn over

(f) **(i)** It is suggested that the relationship between t and d is

$$t^4 = \frac{k}{d^3}$$

where k is a constant.

Using your data, calculate two values of k.

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first value of k = ...

second value of k = ...

(ii) Explain whether your results support the relationship in **(i)**.

.....

.....

.....

(iii) Justify the number of significant figures that you have used for your values of k.

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(g) (i) Describe four sources of uncertainty or limitations of the procedure in this experiment.

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1. .....

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2. .....

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3. .....

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4. .....

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(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. .....

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