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

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

8200109335

PHYSICS **9702/34**

Paper 3 Advanced Practical Skills 2 **May/June 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 [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

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

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1 In this experiment, you will investigate the change in current in a circuit as its resistance is changed.

(a) (i) Assemble the circuit of Fig. 1.1.

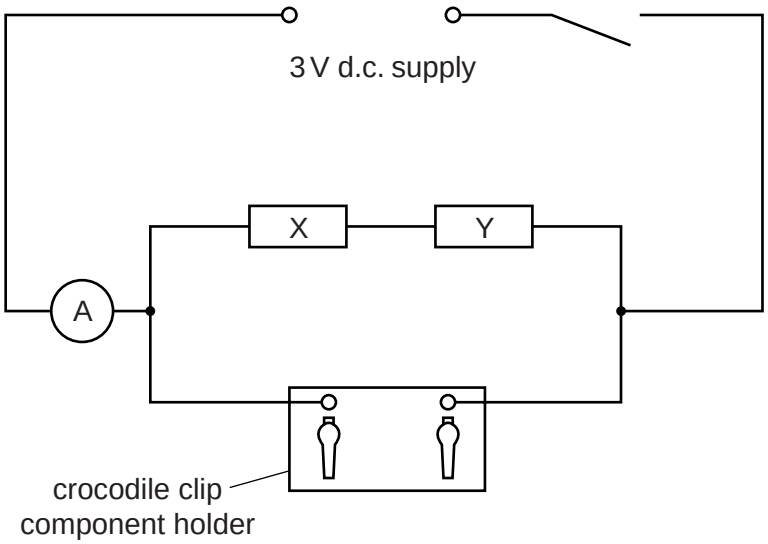


Fig. 1.1

(ii) Close the switch.

(iii) Record the ammeter reading I_0.

I_0 = ... [1]

(iv) Open the switch.

(b) (i) Select one of the resistors labelled with a numerical value and connect it between the crocodile clips on the component holder. Record the resistance R of your selected resistor.

R = ... kΩ

(ii) Close the switch and record the ammeter reading I.
Open the switch.

I = ... [1]

(c) Repeat **(b)** using different labelled resistors until you have six sets of values of R and I. Include values of $\frac{1}{R}$ in your table.

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[10]

(d) **(i)** Plot a graph of I on the y-axis against $\frac{1}{R}$ on the x-axis. [3]

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

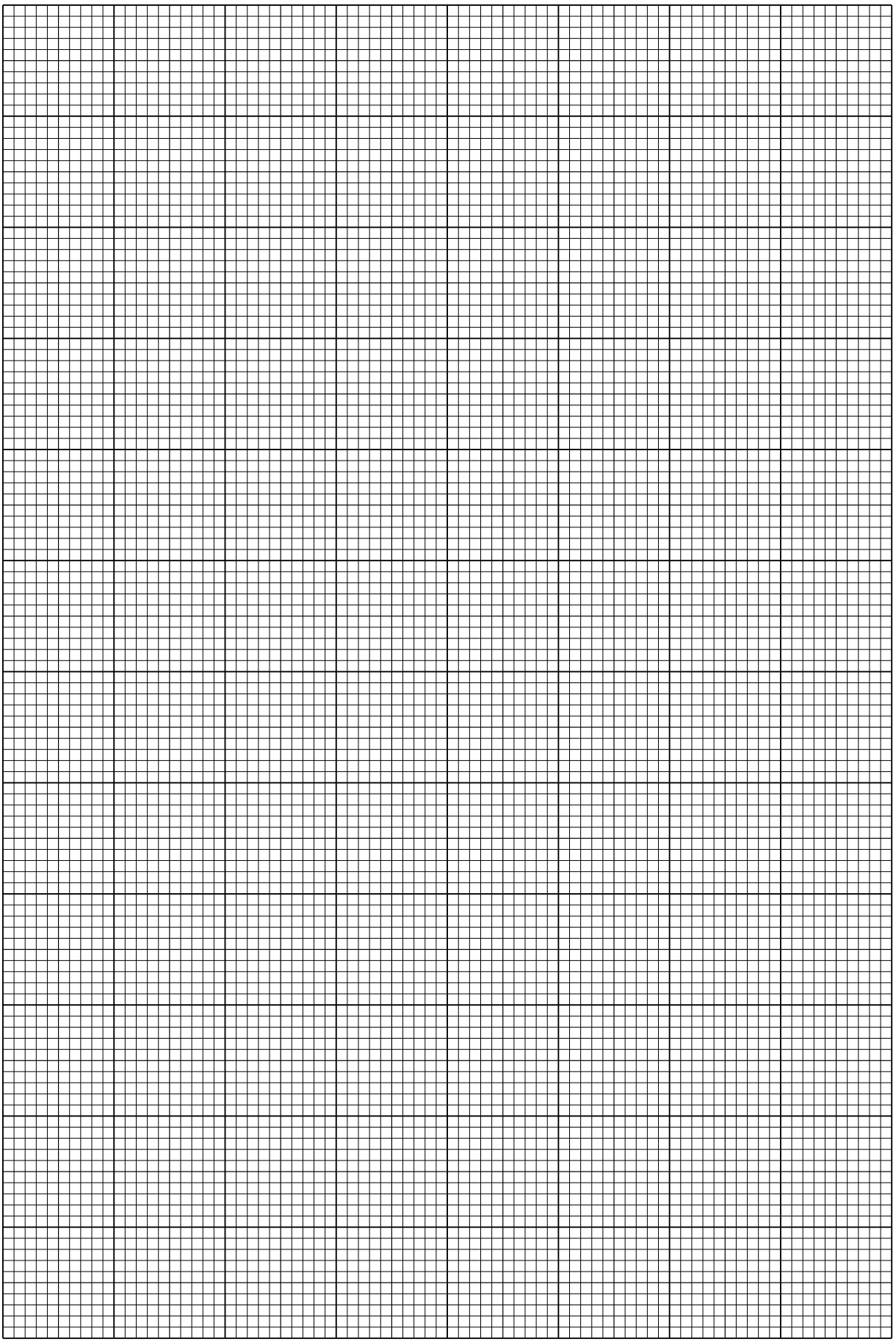
(iii) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...

[2]

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

$$I = \frac{a}{R} + \frac{a}{b}$$

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 = ...

[2]

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2 In this experiment, you will investigate how the amount of energy needed to bend a copper wire depends on its diameter.

(a) You are provided with a pendulum which can be used to hit and bend a wire specimen. Attach the wooden pointer to the pendulum using Blu-Tack. Align the pointer with the 90° position on the protractor when the pendulum is hanging freely, as shown in Fig. 2.1. Check that the pendulum swings freely.

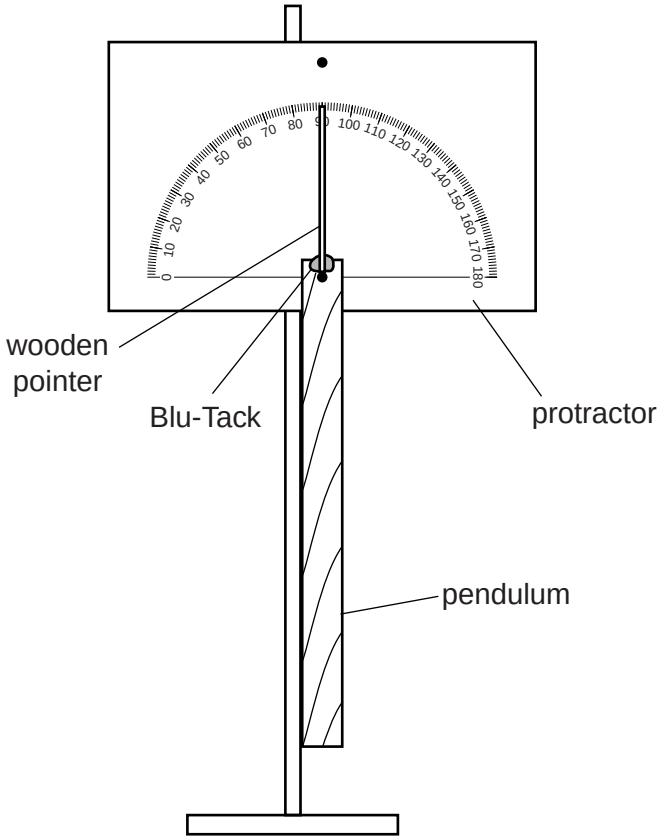


Fig. 2.1

(b) You are provided with copper wire specimens of two different diameters. Using the micrometer, measure and record the diameter *d* of one of the thicker wires.

d = ... [2]

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

percentage uncertainty = ... [1]

(d) (i) Fit the wire fully into the hole in the wooden block. The wire should project about 2 cm above the surface of the block.

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(ii) Position the wooden block so that the wire just touches the edge of the pendulum, as shown in Fig. 2.2.

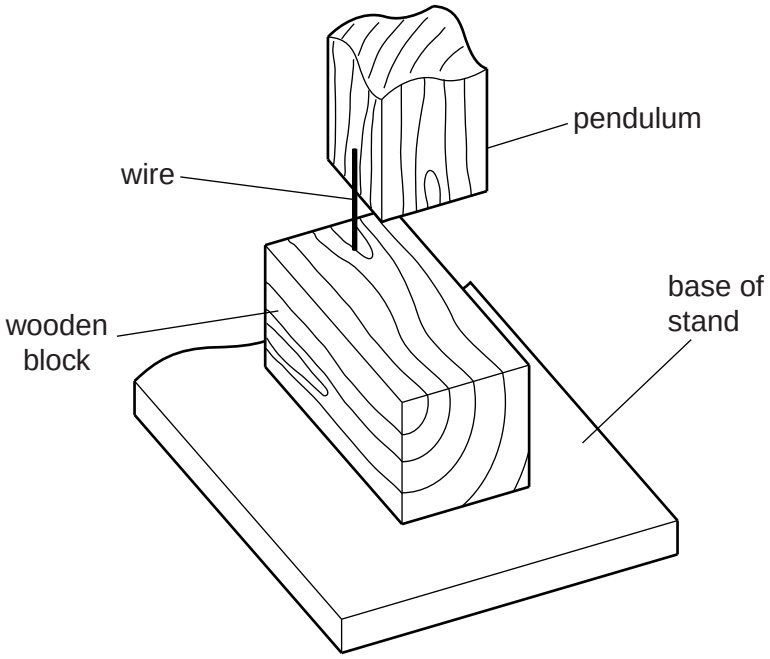


Fig. 2.2

(iii) Lift the pendulum so that the pointer is aligned with the 0° position on the protractor.

(iv) While holding the block in position, release the pendulum and record the maximum angle θ reached by the pointer after the pendulum has bent the wire.

θ = ... [2]

(v) The energy used to bend the wire is proportional to the value of $\sin(180° - \theta)$. Calculate this value, giving your answer to an appropriate number of significant figures.

$\sin(180° - \theta)$ = ... [2]

(e) Repeat **(b)** and **(d)** using the thinner wire specimens.

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d = ...

θ = ...

$\sin(180° - \theta)$ = ...

[3]

(f) It is suggested that the relationship between θ and d is

$$\sin(180° - \theta) = kd^2$$

where k is a constant.

(i) Using your data, calculate two values of k.

first value of k = ...

second value of k = ...

[1]

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

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.....

.....

.....

.....[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. .....

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3. .....

.....

4. .....

.....

[4]

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