Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

PHYSICS **9702/05**

Paper 5 Practical Test

May/June 2006

1 hour 30 minutes

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.

Answer **both** questions.

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. The working of the answers is to be handed in.
Marks are mainly given for a clear record of the observations actually made, for their suitability and accuracy, and for the use made of them.
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.

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1	
2	
Total	

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

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It is recommended that you spend about 60 minutes on this question.
You may not need to use all of the materials provided.

1 In this experiment you will investigate how the current in a wire depends on the length of the wire. You will use the results of your experiment to determine a value for the resistivity of the material of the wire.

(a) Set up the circuit shown in Fig. 1.1. Use a crocodile clip to attach a connecting lead to the bare wire at the zero end of the metre rule. The crocodile clip should be attached as close as possible to the zero mark on the rule.

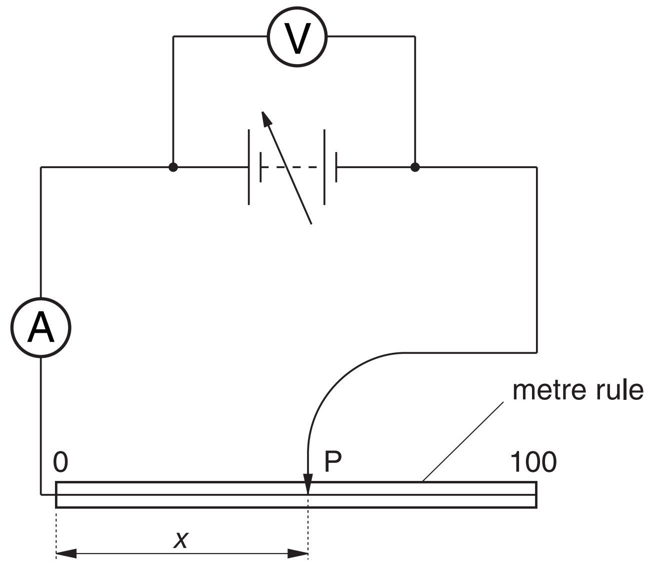

Fig. 1.1

(b) (i) Adjust the power supply to give an output voltage of 3.0 V. Place the connecting lead P onto the wire near the centre. Measure and record the length x and the current I.

x = ... m

I = ... A

(ii) State one way of improving the precision in the measurement of x.

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(c) Change the value of x and repeat **(b) (i)** until you have six sets of readings of length x and current I for values of x in the range $0.400\,\text{m} \le x \le 0.900\,\text{m}$. You may need to adjust the setting on the power supply to maintain a constant output potential difference of 3.0 V. Include in your table of results values for lg (x/m) and lg (I/A).

(d) **(i)** Plot a graph of lg (x/m) (y-axis) against lg (I/A) (x-axis).

(ii) Draw the line of best fit.

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

gradient = ...

y-intercept = ...

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(e) x and I are related by a simple power law of the form

$$x = kI^n$$

where n and k are constants.

Use your answers from **(d) (iii)** to find the values of k and n. You need not be concerned with the units of these quantities.

k = ...

n = ...

(f) A simple theoretical treatment of this circuit gives

$$k = \frac{VA}{\rho}$$

where V is the potential difference across the wire, A is the cross-sectional area of the wire and ρ is the resistivity of the material of the wire.

(i) Remove the crocodile clip from the wire. Use a micrometer screw gauge to measure the diameter of the wire.

diameter of wire = ... mm

(ii) Determine the cross-sectional area A of the wire.

A = ... m^2

(iii) Determine the percentage uncertainty in A.

percentage uncertainty in A = ... %

(g) Using your answers from **(e)** and **(f)**, determine a value for ρ.

ρ = ... Ω m

(h) The experiment is repeated with a wire of the same material but twice the diameter. Suggest what value of k would be obtained.

k = ...

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It is recommended that you spend about 30 minutes on this question.

2 A fine wire mesh has individual wires that are spaced very close together. See Fig. 2.1.

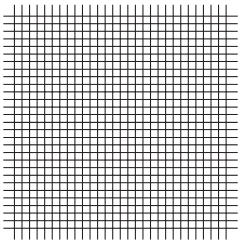

Fig. 2.1

The mesh behaves like two diffraction gratings placed at right angles to each other. The diffraction grating formula is $d \sin\theta = n\lambda$.

The spacing between the wires of the mesh is to be found accurately. Design a laboratory experiment using light of a single wavelength to determine the spacing between the wires. You may assume that the wavelength of the light is known.

You should draw a detailed labelled diagram showing the arrangement of your apparatus. In your account you should pay particular attention to

(a) the type of light source to be used, giving a reason for your choice,

(b) the procedure to be followed and the measurements that would be taken,

(c) how the measurements would be used to find values of θ,

(d) how the spacing between the wires would be deduced,

(e) any safety precautions you may take.

Diagram

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