OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

PHYSICS A 2823/03/TEST

Practical Test (Part B)

Thursday **15 MAY 2003** Morning 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
Electronic Calculator
Candidate's Plan (Part A of the Practical Test)

Candidate Name	Centre Number	Candidate Number

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces on the question paper.

INFORMATION FOR CANDIDATES

- In this part of the Practical Test you will be assessed on the Experimental and Investigative Skills:
  Skill I Implementing
  Skill A Analysing evidence and drawing conclusions
  Skill E Evaluating
- You are advised to spend the first few minutes reading through the whole paper before starting to answer any questions.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- You will be awarded marks for the quality of written communication where this is indicated in the question.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
Planning	**16**	
1	**28**	
2	**16**	
TOTAL	**60**	

This question paper consists of 11 printed pages and 1 blank page.

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It is recommended that you spend about 1 hour on this question.

1 An ideal voltmeter has infinite resistance. In practice, voltmeters have a high but not infinite resistance, and therefore it is sometimes necessary to take account of this resistance in circuits. In this experiment you will measure the resistance of a voltmeter.

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

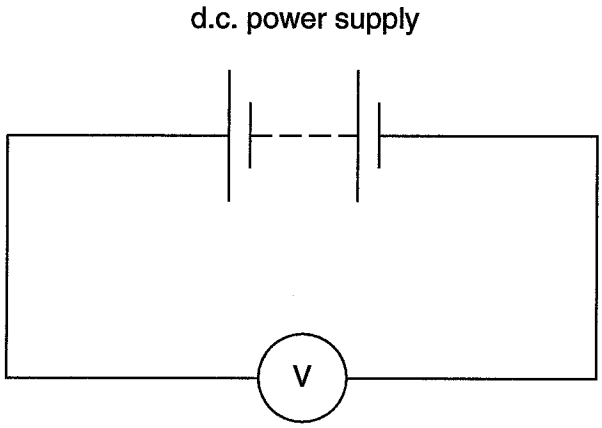

Fig. 1.1

(ii) Measure and record the voltage shown by the voltmeter. For this experiment take this voltage as being equal to the e.m.f. E of the power supply.

E = ... V

(b) Construct the circuit shown in Fig. 1.2 using one of the six resistors in the chain. Connections may be made using crocodile clips. The resistance of each of the resistors in the chain is written on a card.

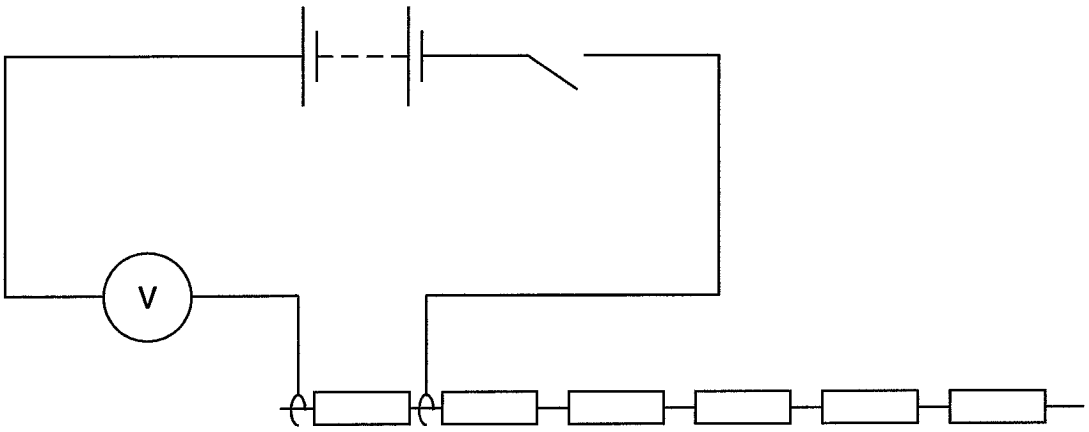

Fig. 1.2

(c) **(i)** Close the switch.

(ii) Record the reading of potential difference *V* from the voltmeter.

V = ... V

(iii) Open the switch.

For Examiner's Use

(d) Change the resistance R between the crocodile clips by including more resistors from the chain. Repeat **(c)** until you have six sets of readings for R and V, where $R \neq 0$. Include values of $\frac{1}{V}$ in your table of results.

(e) Justify the number of significant figures which you have given for $\frac{1}{V}$.

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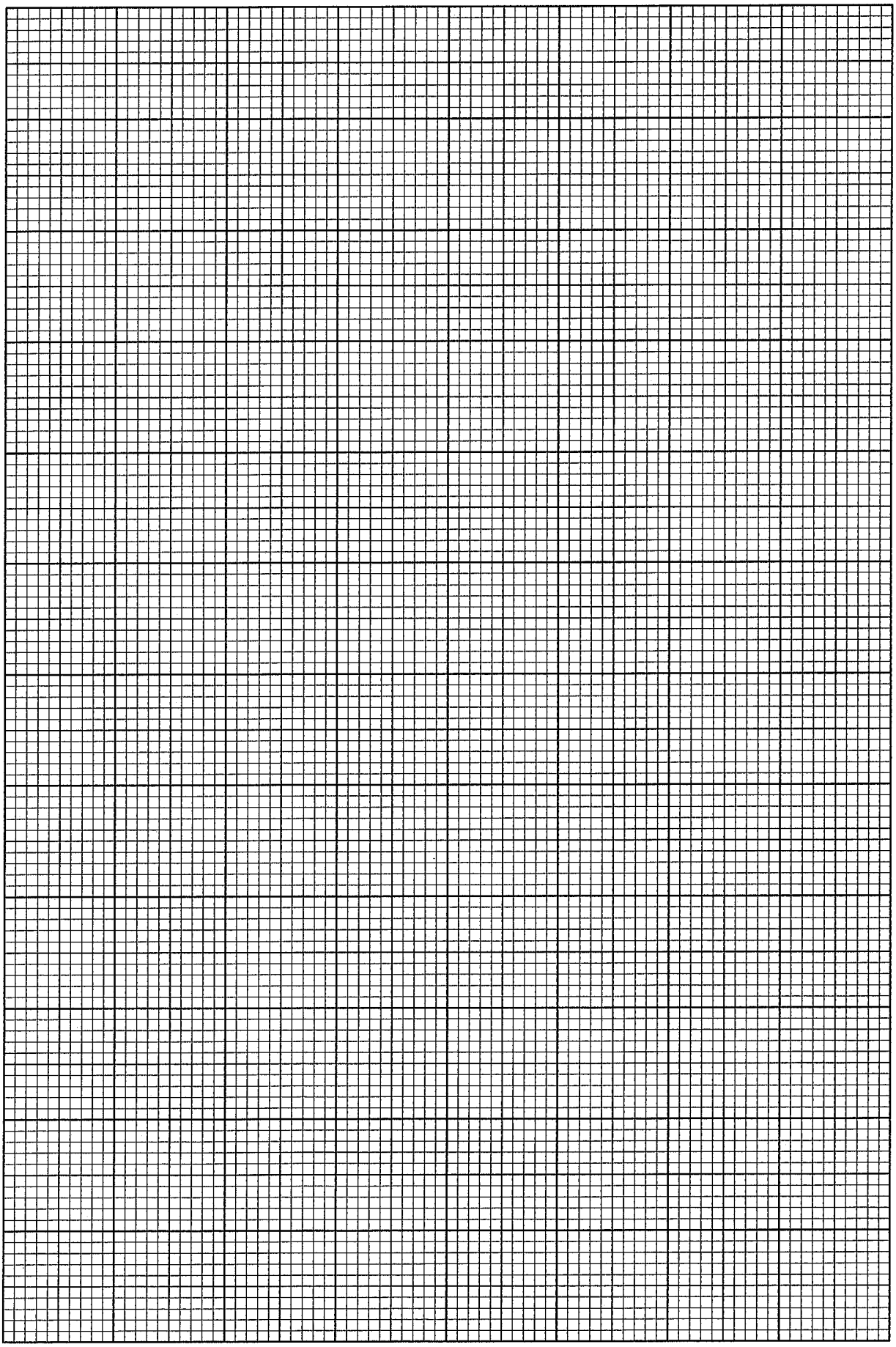
(f) Plot a graph of $\frac{1}{V}$ (y-axis) against R (x-axis) and draw the best straight line through the points.

(g) Determine the gradient of this line.

gradient = ...

For Examiner's Use



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(h) Theory shows that the relation between V and R is

$$\frac{1}{V} = \left(\frac{1}{ER_V}\right)R + \frac{1}{E}$$

where E is the e.m.f. of the power supply and R_V is the resistance of the voltmeter.

Use your answers from **(a)** and **(g)** to determine a value for the resistance of the voltmeter.

resistance of voltmeter = ... Ω

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

Approximately half of this time should be spent on the evaluation exercise in part (d).

2 In this question you will measure the density of wood by submerging part of it in water in a container.

(a) (i) Attach a length of cotton to the wood using the small hook at the end of the wood. Suspend the wood above a container of water using a stand and clamp as shown in Fig. 2.1.

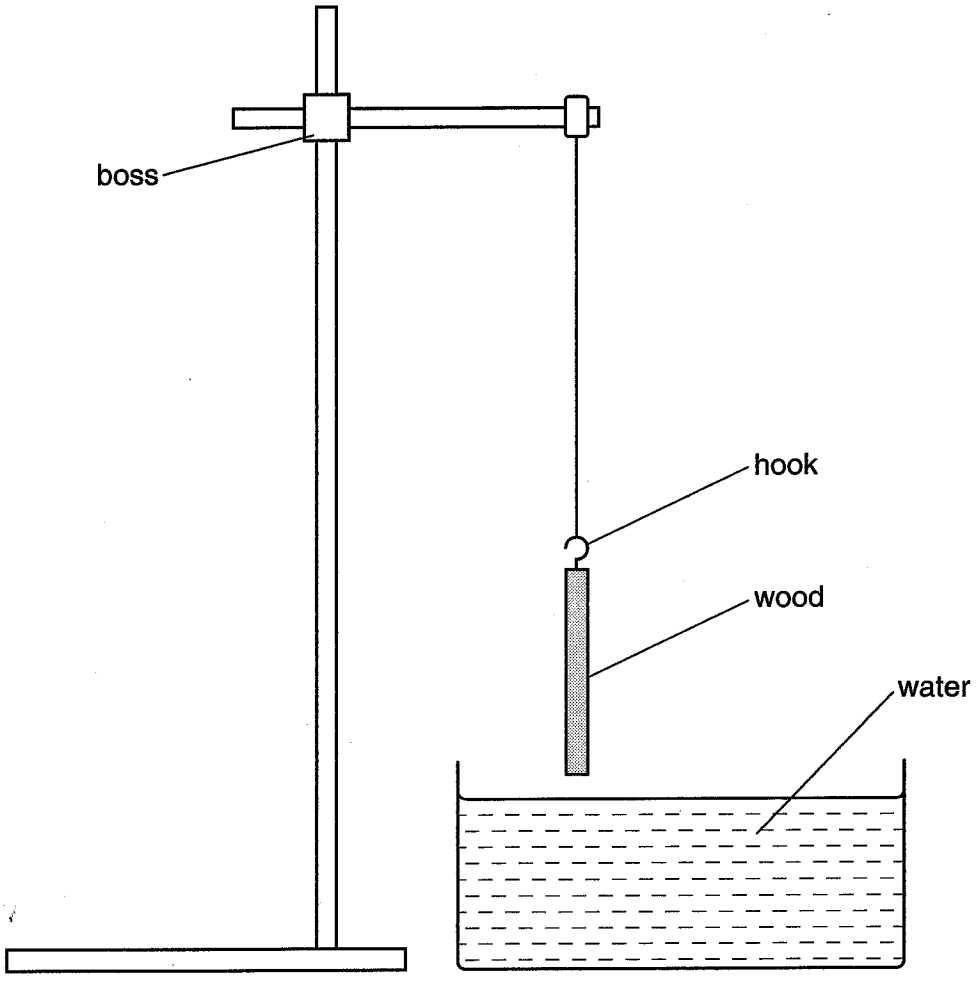

Fig. 2.1

(ii) Gently lower the wood into the water by lowering the clamp until the wood just begins to tilt. Observe that the length of the submerged part of the wood does not change as the clamp is lowered further and the angle of tilt increases.

(iii) Measure the total length and the submerged length of the rod.

total length = ... cm

submerged length = ... cm

(b) Consideration of the turning forces on the wood leads to the expression

$$\rho_{wood} = \rho_{water}\,(2r - r^2)$$

where r is the ratio

$$\frac{\text{submerged length of rod}}{\text{total length of rod}}$$

and ρ_{wood} and ρ_{water} are the densities of the wood and water respectively.

(i) Determine the percentage uncertainty in r.

% uncertainty = ...

(ii) Calculate the ratio r and hence the density of the wood using the given expressions. You may assume that the density of water is 1000 kg m^{-3}.

density of wood = ...

(c) The effect of using a small metal hook to suspend the rod will mean that no matter how many times the experiment is done the result will always be in error, even if the experiment is done very carefully. What is the name of this type of error ?

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In this question, two marks are available for the quality of written communication.

(d) Write an evaluation of the procedures which you have followed to find the density of the wood by this method. You should include some of the limitations of each procedure and suggest ways in which the experiment may be improved, giving reasons for your suggestions.

For Examiner's Use

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