OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

PHYSICS A 2823/03/TEST

Practical Test (Part B)

Thursday **24 JANUARY 2002** Afternoon 1 hour 30 minutes

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

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** 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.

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 In this experiment you will measure the Young modulus of wood by attaching a load to a strip of the wood and measuring the depression of the end of the strip as the length of the strip is changed.

(a) (i) Clamp a wooden strip to the edge of the bench with its largest face horizontal. The length l of the strip which protrudes over the edge of the bench should be approximately 50 cm.

(ii) Attach a pin horizontally to the end of the strip so that the pin just overlaps the end of the strip and may be used as a pointer.

(iii) Mount a metre rule vertically using a stand, boss, clamp and set square. Place this rule close to the pin.

(iv) Thread a short length of twine through the hole at the end of the strip and tie the ends together to make a loop. The arrangement should now be as shown in Fig. 1.1.

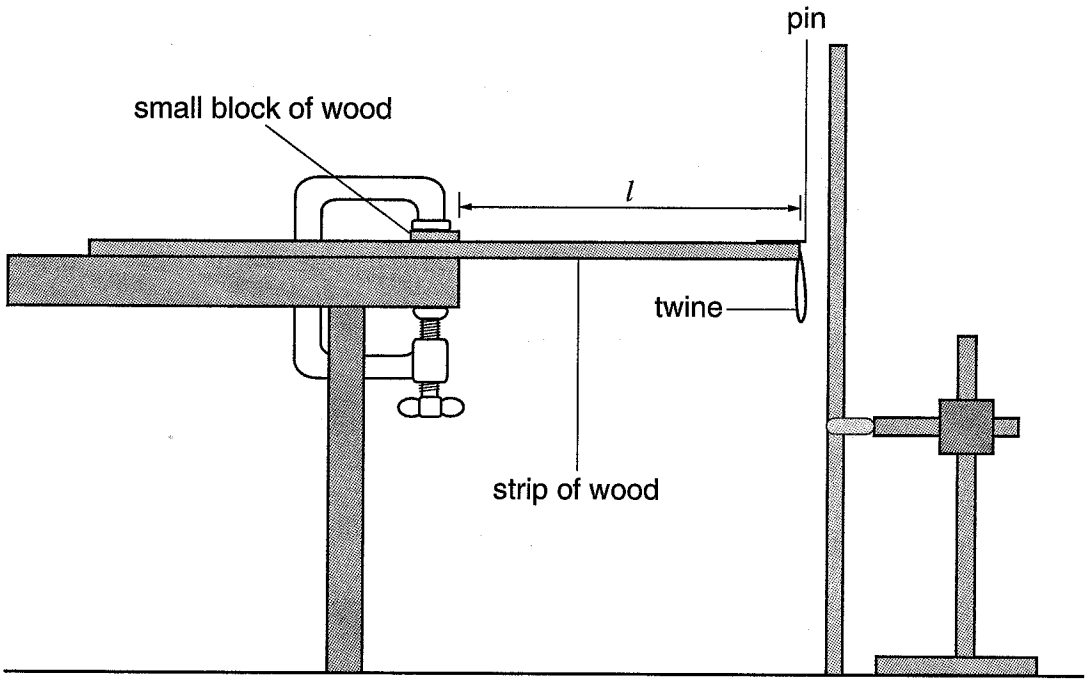

Fig. 1.1

(b) (i) Record the reading indicated by the pin on the vertical rule.

.....

(ii) Suspend a 300 g mass from the loop of twine and record the new reading indicated by the pin on the rule.

.....

(iii) Calculate the depression *d* of the end of the strip as shown in Fig. 1.2.

d = ...

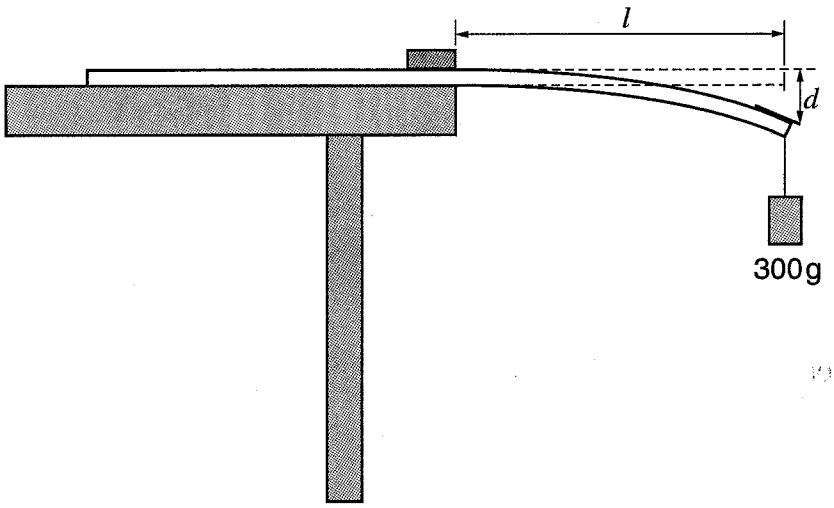

Fig. 1.2

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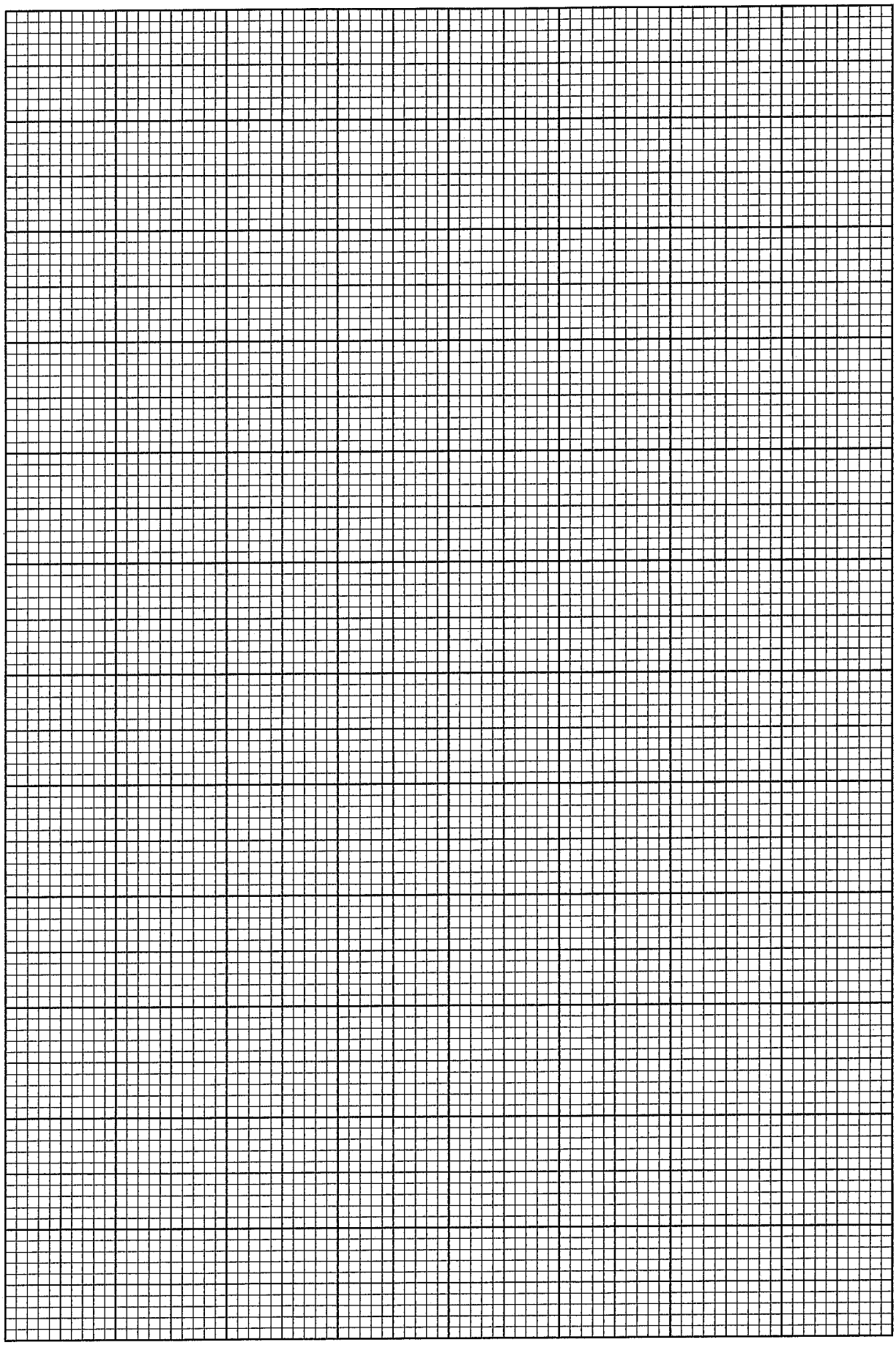
(c) **(i)** Repeat **(b)** for different values of l in the range 30 cm $\leq l \leq$ 80 cm until you have six sets of readings of d and l. Include values of l^3 in your table of results.

Note that the initial position indicated by the pin before the mass is attached will change with l.

(ii) Determine the percentage uncertainty in one of your values of l^3.

(iii) Plot a graph of d (y-axis) against l^3 (x-axis).

(iv) Determine the gradient of the line of best fit.



G

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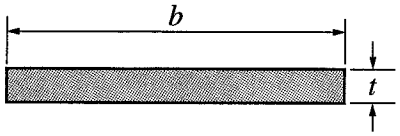
The strip has breadth b and thickness t (see Fig. 1.3).



end view

Fig. 1.3

(d) Measure b and t. Your Supervisor may tell you when to do this.

b = ... cm,

t = ... mm.

Theory suggests that d and l are related by the formula

$$d = \left(\frac{4mg}{Ebt^3}\right) l^3$$

where m is the mass attached to the end of the strip, g is the acceleration of free fall and E is the Young modulus of the material of the strip.

(e) Use your answers from **(c)(iv)** and **(d)** to calculate a value for E.

Include an appropriate unit with your value.

(Note: the acceleration of free fall $g = 9.8\,\text{m}\,\text{s}^{-2}$)

(f) A wooden plank of thickness t = 5.0 cm and breadth b = 30 cm is made of the same wood as the strip used in this experiment. The plank is clamped at one end so a length of 3.5 m protrudes over a fishing boat. The plank is to be used to transfer fish from the boat to the dockside. See Fig. 1.4.

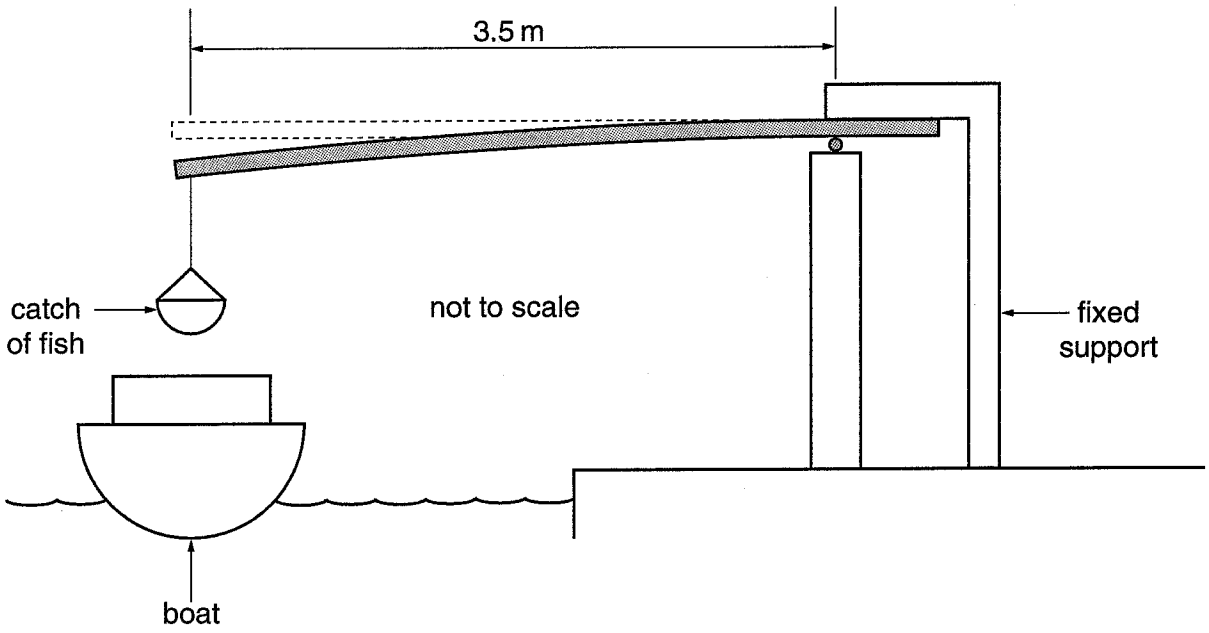


Fig. 1.4

Calculate the mass of a catch of fish suspended from the end of this plank for a depression d = 58 cm.

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 The element of a heater contains a length of wire formed into a coil. An electrician is considering ways in which the diameter of the wire may be measured without removing it from the heater. In this experiment you will determine the diameter of a wire by measuring the diameter of a coil and the resistance of the coil.

You are provided with a coil of constantan wire connected to two crocodile clips. The arrangement has been mounted using two stands and clamps as shown in Fig. 2.1.

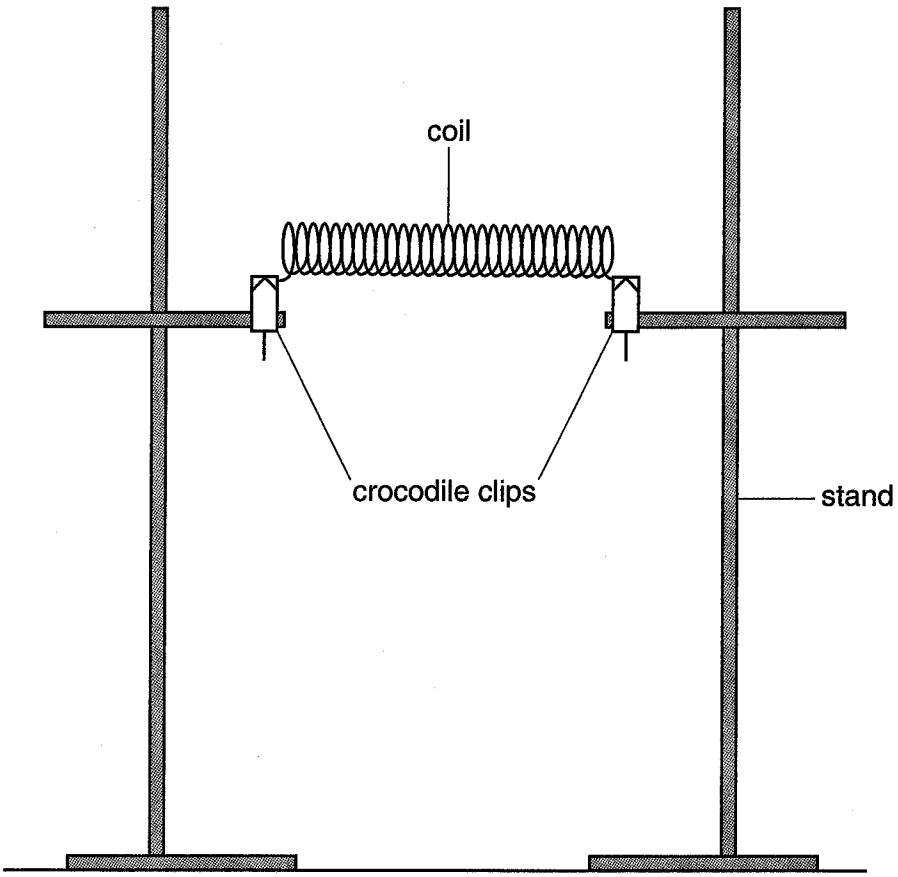


Fig. 2.1

(a) (i) Measure the diameter of one of the loops and hence calculate the length of wire in a loop.

(Note: Take the length of wire in a loop = $\pi \times$ diameter of the loop)

Diameter ..... cm

Length of wire in a loop = ... cm

(ii) Suggest one way of improving the accuracy of this measurement. (other than repeated readings)

.....

.....

.....

(iii) Measure and record the number of turns in the coil.

Number of turns in the coil = ...

(iv) Hence determine the total length of wire in the coil.

(b) (i) Set up the circuit shown in Fig. 2.2, keeping the coil mounted as shown in Fig. 2.1. The output of the supply should be set to about 3V.

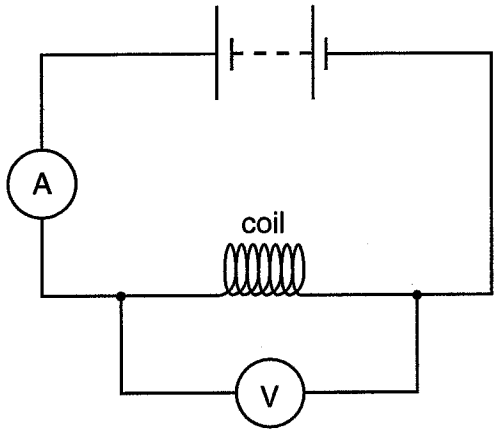


Fig. 2.2

(ii) Measure and record the potential difference V and the current I.

V = ... V

I = ... A

(iii) Calculate the resistance of the coil.

(c) The resistance R of a length l of wire is given by the formula

$$R = \frac{\rho l}{A}$$

where ρ is the resistivity of constantan and A is the cross-sectional area of the wire. Calculate a value for the diameter of the wire. (Note: $\rho = 4.9 \times 10^{-7}\,\Omega\,\text{m}$)

(d) Evaluation exercise. (*In this part question two marks are awarded for quality of written communication*).

Write an evaluation of the procedure which you have followed. You should include some of the limitations of your procedure and suggest ways in which the accuracy of the experiment may be improved, giving reasons for your suggestions.

For Examiner's Use

Evaluation

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