

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Advanced GCE**

**PHYSICS A**

**2826/03/TEST**

**Practical Examination 2 (Part B – Practical Test)**

Tuesday **1 FEBRUARY 2005** Afternoon 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												
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**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 provided on the question paper.
- Read the instructions and questions carefully.

**INFORMATION FOR CANDIDATES**

- In this 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 evidence and procedures.
- 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.

<b>FOR EXAMINER'S USE</b>		
<b>Qu.</b>	<b>Max.</b>	<b>Mark</b>
<b>Planning</b>	<b>16</b>	
<b>1</b>	<b>28</b>	
<b>2</b>	<b>16</b>	
<b>TOTAL</b>	<b>60</b>	

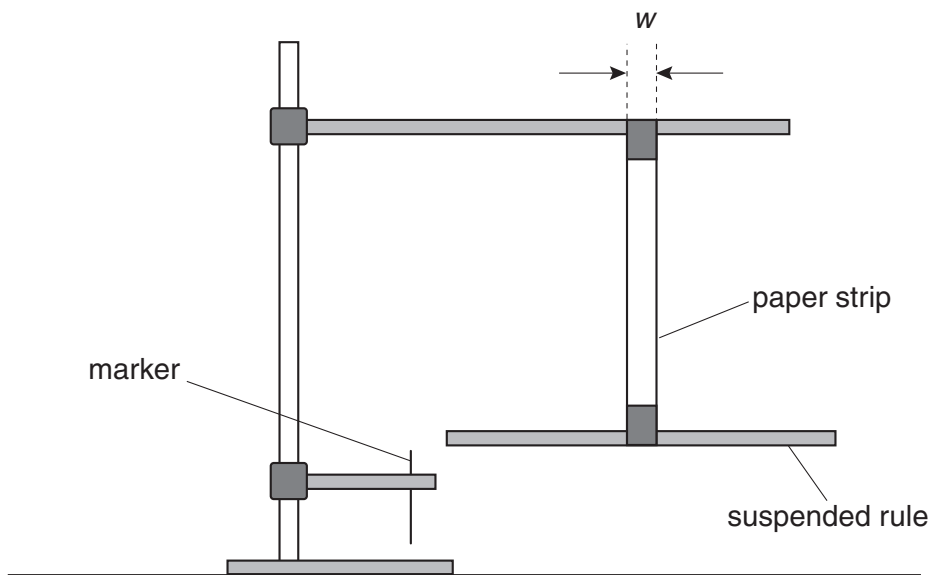
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**This question paper consists of 11 printed pages and 1 blank page.**

Answer **all** the questions.

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

- 1 In this experiment, you will investigate how the period of torsional oscillations of a paper strip carrying a half-metre rule depends on the width of the paper strip. The paper strip has a loop at each end.
- (a) (i) Support one of the 50 cm rules horizontally by clamping it near one of its ends with its largest face vertical. Slide one of the loops in the paper strip onto this rule. Place the second rule through the bottom loop so that its largest face is vertical. The centre of the suspended rule should be in the middle of the lower loop. Position a marker near to one end of the rule to aid the timing of oscillations. See Fig. 1.1.



**Fig. 1.1**

- (ii) Measure the width  $w$  of the paper strip.

$w = \dots\dots\dots$  cm



- (iii) Twist the lower rule through an angle of about  $45^\circ$  and release the rule so that it performs torsional oscillations in a horizontal plane as shown in Fig. 1.2.

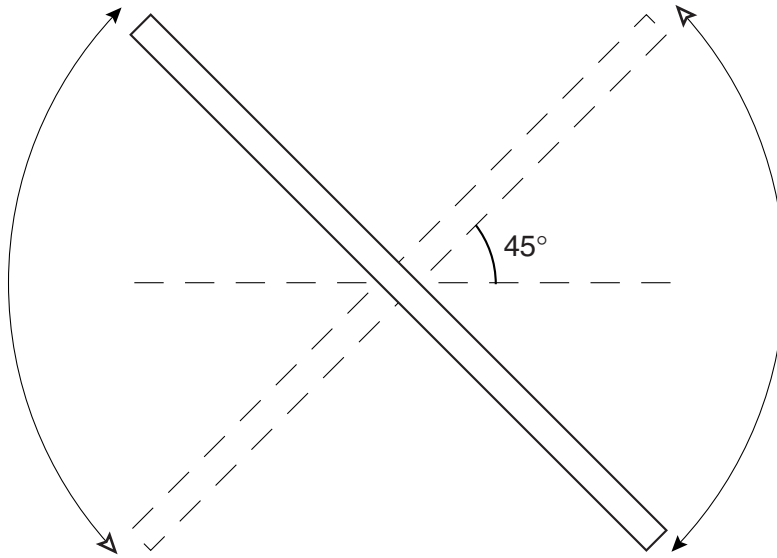


Fig. 1.2

- (iv) Make and record measurements to determine the period  $T$  of the oscillations of the rule. It will not be necessary to time a large number of oscillations.

$T = \dots\dots\dots$  s

- (b) (i) Estimate the percentage uncertainty in  $w$ .

percentage uncertainty in  $w = \dots\dots\dots$

- (ii) Give the name of an instrument that you could use to increase the precision of the measurement of  $w$ .

$\dots\dots\dots$

(iii) What is the smallest number of torsional oscillations that must be timed to make the percentage uncertainty in  $T$  the same as the percentage uncertainty in  $w$ ?

number of oscillations = .....

(iv) Explain why the best position for the marker is at the centre of oscillation of the rule.

.....  
.....  
.....

(v) The amplitude of oscillation of the rule decreases with time, preventing the timing of a large number of oscillations. What is the name given to this effect?

.....

(c) Remove the paper strip. Using scissors, cut along a line on the strip so that the width of the strip is reduced by about 1 cm. Measure the new width  $w$ , replace the strip and suspend the rule as in (a)(i). Make and record measurements to determine the new period  $T$  of the oscillations of the rule.

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**Question 1 continued over the page**

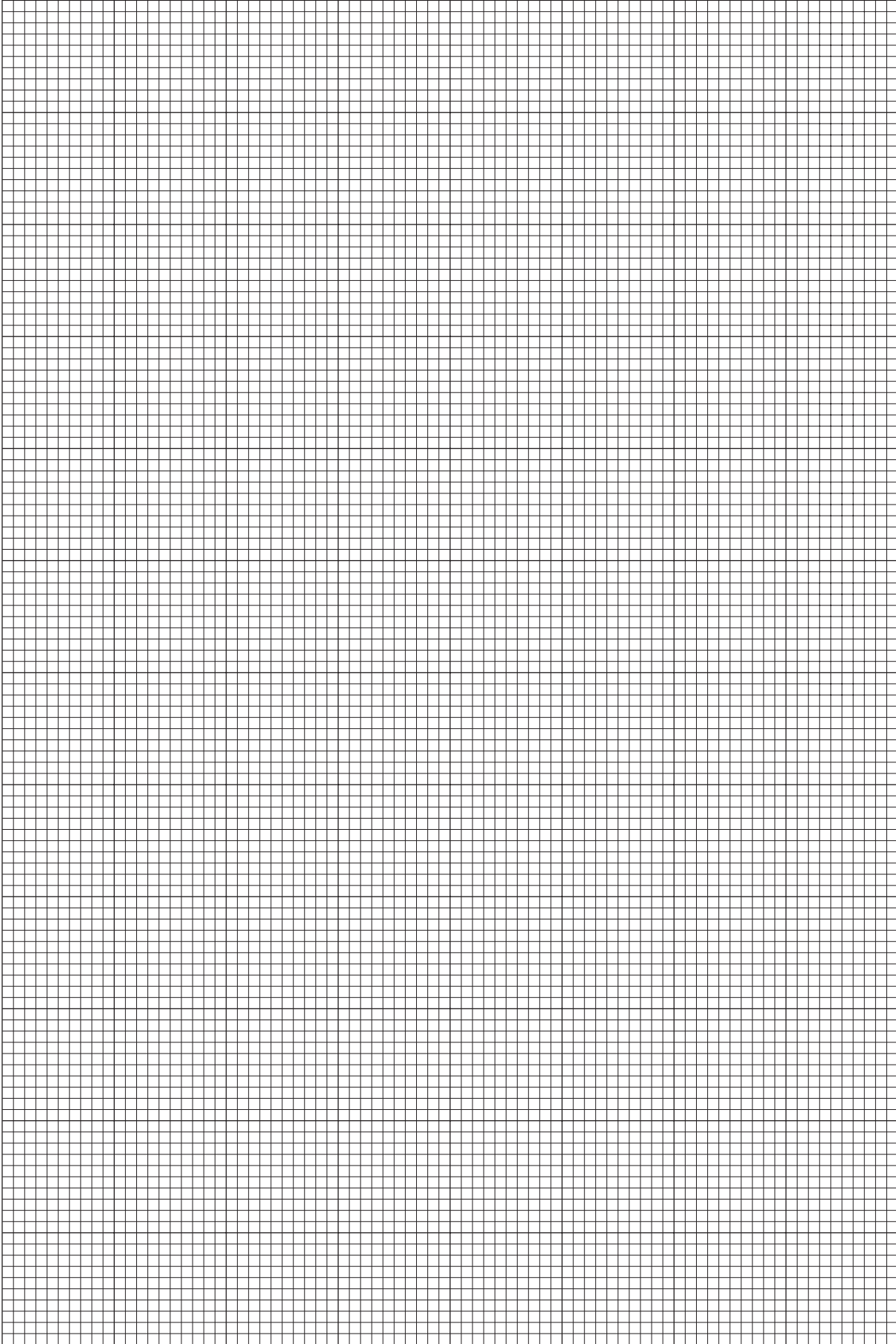
- (d) Repeat (c) until you have six sets of readings for  $T$  and  $w$ . Include values of  $\lg (T/s)$  and  $\lg (w/cm)$  in your table of results.

- (e) (i) Plot a graph of  $\lg (T/s)$  ( $y$ -axis) against  $\lg (w/cm)$  ( $x$ -axis).  
(ii) Draw the line of best fit through the points.  
(iii) Determine the gradient and  $y$ -intercept of the line of best fit.

gradient = .....

$y$ -intercept = .....



(f)  $T$  and  $w$  are related by a power law of the form

$$T = kw^n$$

where  $k$  and  $n$  are constants.

(i) Use your answers from (e)(iii) to calculate numerical values for  $k$  and  $n$ .

You need not be concerned with the units of these quantities.

$n =$  .....

$k =$  .....

(ii) 1 Calculate a value for the width of the strip that would give a period of oscillation of the rule of 120 seconds.

$w =$  ..... mm

2 Give **one** reason why it may not be possible to verify this experimentally.

.....  
.....  
.....



**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 determine the specific heat capacity of a metal by adding a hot piece of this metal to some cold water. A 100 g mass of metal at a temperature of about 100 °C is available.

**(a) (i)** Add cold water to the plastic cup until it is about half full. Use a top pan balance to measure the mass of water.

mass of water = ..... g

**(ii)** Measure and record the initial temperature of the water.

initial temperature of water = ..... °C

**(iii)** Transfer the 100 g mass of metal from the beaker of boiling water into the water in the plastic cup. Gently stir the water using the thermometer. Measure and record the maximum final temperature reached by the water.

final temperature of water = ..... °C

**(b)** Calculate a value for the thermal energy given to the water by the metal.

You may assume that the specific heat capacity of water is  $4200 \text{ J kg}^{-1} \text{ K}^{-1}$ .

thermal energy given to the water = ..... unit .....

- (c) Use the results of your experiment to determine a value for the specific heat capacity of the metal.

specific heat capacity = ..... J kg<sup>-1</sup> K<sup>-1</sup>

- (d) In this section, two marks are available for the quality of written communication.

Write an evaluation of the procedure which you have followed to determine a value for the specific heat capacity of the metal. You should include some of the limitations of this procedure and suggest ways in which the experiment may be improved, giving reasons for your suggestions.

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Quality of Written Communication

**END OF QUESTION PAPER**

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