Centre Number	Candidate Number	Name

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

PHYSICS **9702/03**

Paper 3 Practical Test

May/June 2003

1 hour 15 minutes

Candidates answer on the Question Paper.
Additional Materials: As specified 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 in the spaces provided on the Question Paper.
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 the **one** 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. 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.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

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This document consists of **6** printed pages and **2** blank pages.

SP (SM) S45889/2

University of Cambridge
Local Examinations Syndicate

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1 In this question you will investigate how the period of oscillation of a bent metal wire varies with the angle between the straight parts of the wire.

(a) (i) Secure the cork in the clamp so that the pin is mounted horizontally.

(ii) Make a sharp bend in the wire at its centre so that the angle θ between the straight parts of the wire is about 160° as shown in Fig. 1.1.

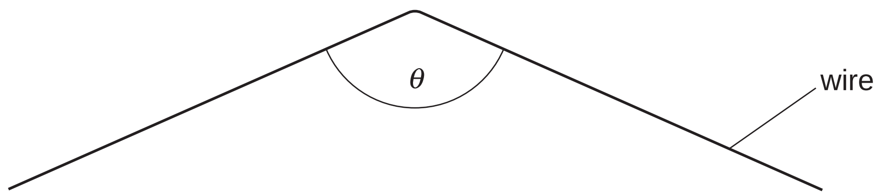

Fig. 1.1

(iii) Measure and record the angle θ.

θ = ...

(iv) Estimate the percentage uncertainty in this measurement of θ, showing your working.

% uncertainty in θ = ...

(b) (i) Suspend the wire from the pin so that the arrangement is as shown in Fig. 1.2.

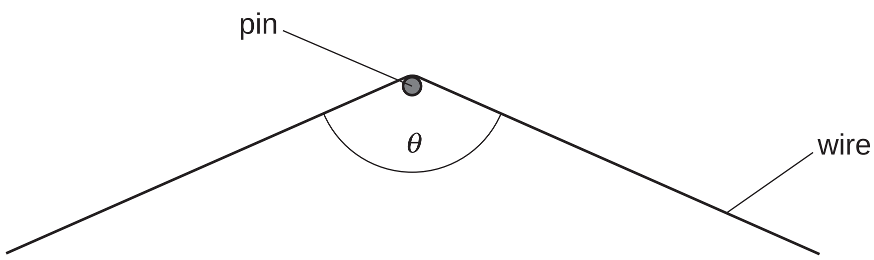

Fig. 1.2

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(ii) Displace the wire from its equilibrium position and release it so that it performs small oscillations in a vertical plane, as shown in Fig. 1.3.

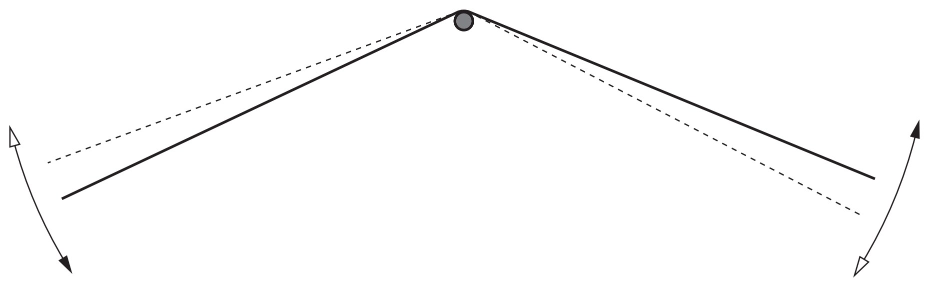

Fig. 1.3

(iii) Make and record measurements to determine the period T of these oscillations.

T = ...

(c) Remove the wire from the pin. Change the value of θ by gently bending the wire. The new value of θ should be in the range $160° \geq \theta \geq 30°$. Measure and record the new value of θ.

θ = ...

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(d) **(i)** Repeat **(b)** and **(c)** until you have six sets of readings for T and θ. Include values of $\frac{1}{T^4}$ and $\cos\theta$ in your table of results.

(ii) Justify the number of significant figures which you have given for $\cos\theta$.

....

....

....

(e) **(i)** Plot a graph of $\frac{1}{T^4}$ (y-axis) against $\cos\theta$ (x-axis).

(ii) Determine the gradient and y-intercept of the line of best fit.

gradient = ...

y-intercept = ...

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(f) T and θ are related by an expression of the form

$$\frac{1}{T^4} = A\cos\theta + B$$

where A and B are constants.

Use your answers from **(e)(ii)** to state the values of A and B. Include appropriate units in each case.

A = ...

B = ...

(g) A theoretical treatment of this oscillator shows that

$$A = \frac{1}{2}\left(\frac{3g}{4\pi^2 L}\right)^2$$

where L is the total length of the wire.

By making one further measurement, and using the results of your experiment, calculate a value for g, the acceleration of free fall.

g = ...

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