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Centre Number	Candidate Number

Candidate Name _____

CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Advanced Subsidiary Level and Advanced Level

PHYSICS 9702/3

PAPER 3 AS Practical

OCTOBER/NOVEMBER SESSION 2002

1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
As specified in Instructions to Supervisors
Graph paper

TIME 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and on any separate answer paper used.

Answer the **one** question.

Write your answers in the spaces provided on the question paper.

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.

INFORMATION FOR CANDIDATES

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.

FOR EXAMINER'S USE

This question paper consists of 5 printed pages and 3 blank pages.

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1 In this question you will investigate how the period of torsional oscillations of a bar magnet suspended above a fixed bar magnet changes with the separation between the two magnets.

(a) (i) Fix one of the magnets to the bench top using tape or Blu-tack.

(ii) Suspend a second magnet using a cradle and thread so that it lies in a horizontal plane about 50 cm below the point of suspension. The distance *d* between the bottom of the suspended magnet and the top of the fixed magnet should initially be about 5 cm. The base of the stand should be as far as possible from the fixed bar magnet. The arrangement is shown in Fig. 1.1.

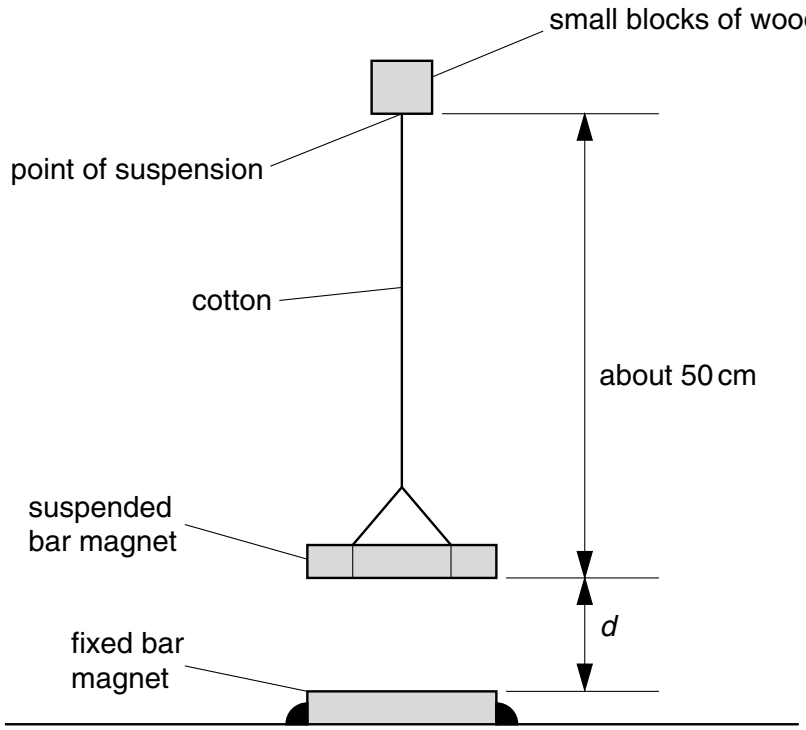

Fig. 1.1

(b) (i) Measure and record the distance *d*.

(ii) Gently rotate the suspended magnet and release it so that it performs small torsional oscillations in a horizontal plane, as shown in Fig. 1.2.

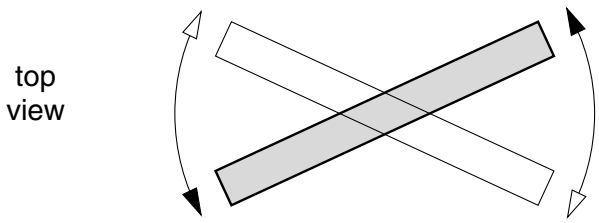

Fig. 1.2

Make and record measurements to determine the period *T* of these oscillations.

(iii) Change the value of *d* and repeat **(i)** and **(ii)** until you have six sets of readings for *T* and *d* where 10 cm ≥ *d* ≥ 3 cm.

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(c) It is suggested that T and d are related by an expression of the form

$$T = kd + c$$

where k and c are constants.

(i) Plot a graph of T (y-axis) against d (x-axis).

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

(iii) Use your answers from **(ii)** to find values for k and c. Include appropriate units in each case.

(d) A student suggests that T is directly proportional to d. Explain whether or not the results of your experiment would support this suggestion.

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(e) **(i)** Use the results of your experiment to calculate the period of oscillation of the suspended magnet for a separation $d = 5$ mm.

period of oscillation = ...

(ii) Give two reasons why, in practice, it would not be possible to measure this time directly.

1 .....

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2 .....

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For Examiner's Use

Measurements and calculations

M

R

A

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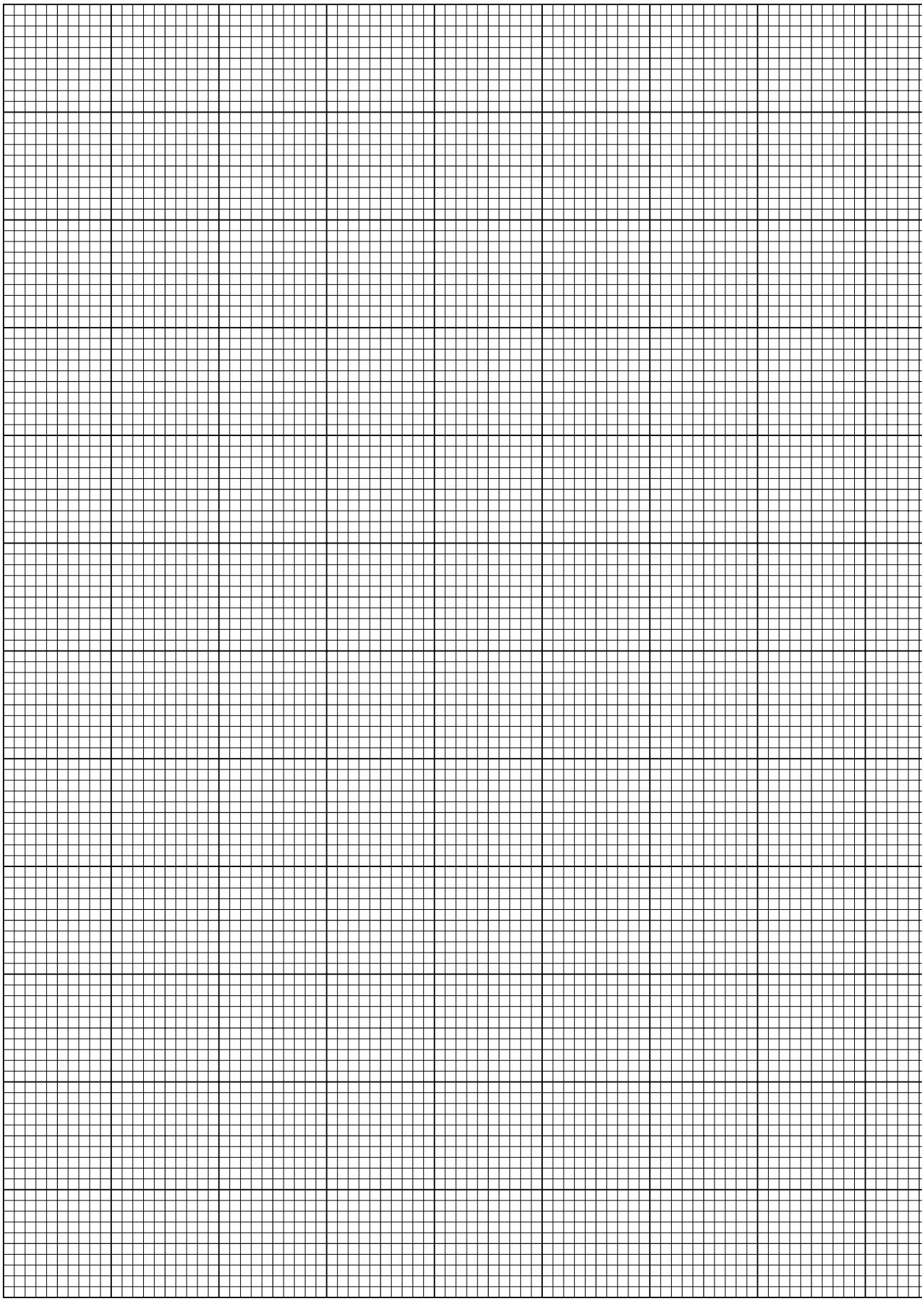
For Examiner's Use

G

Graph grid



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