Centre Number	Candidate Number

Candidate Name _____

CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Advanced Subsidiary Level and Advanced Level

PHYSICS 9702/3

PAPER 3 Practical Test

MAY/JUNE 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.

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.

University of Cambridge Local Examinations Syndicate

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1 In this experiment you will be required to investigate the torsional oscillations of a loaded rod suspended by a spring.

(a) The spring has been placed on the cork so that it is positioned in the centre of the rod. Take each piece of plasticine and shape it into a small ball. Carefully push the two balls onto the rod so that their centres are situated at equal distances *d* from the spring. The value of *d* initially should be about 10 cm. Clamp the top of the spring using the small blocks of wood provided so that the rod and the balls are suspended horizontally as shown in Fig. 1.1.

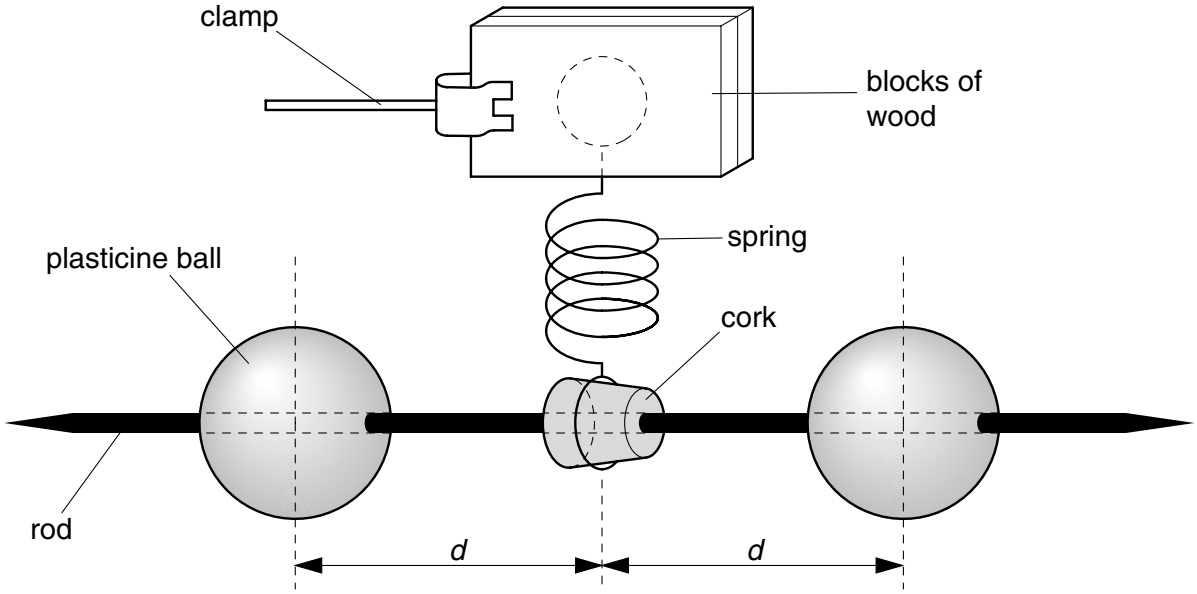
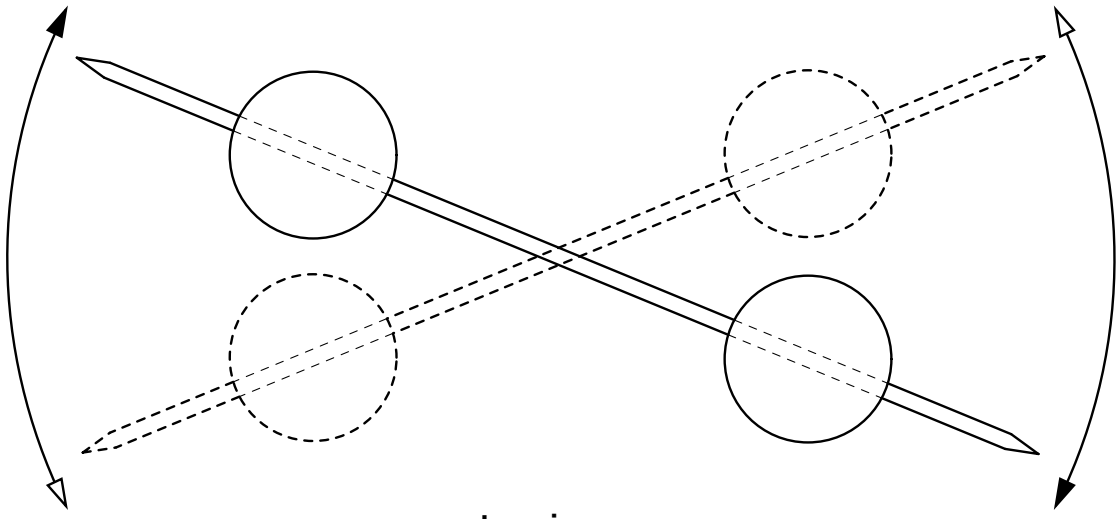


Fig. 1.1

(b) **(i)** Measure and record the distance *d* from the spring to the centre of each ball.

(ii) Displace the rod slightly so that it performs torsional oscillations in the horizontal plane as shown in Fig. 1.2.



top view

Fig. 1.2

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

(iv) Change the value of d and repeat **(i)**, **(ii)** and **(iii)** until you have six sets of readings for T and d where d is in the range 7.0 cm $\leqslant d \leqslant$ 12.0 cm. Include values of T^2 and d^2 in your table of results.

(v) Justify the number of significant figures which you have given for d^2.

(c) It is suggested that T and d are related by the equation

$$T^2 = \left(\frac{8\pi^2 m}{k}\right) d^2 + \left(\frac{4\pi^2 I_0}{k}\right)$$

where m is the mass of one of the balls of plasticine and I_0 and k are constants.

(i) Plot a graph of T^2 (y-axis) against d^2 (x-axis).

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

(iii) Calculate values for k and I_0 given that $m = 20$ g.

Include appropriate units with your values.

(iv) Use the results of your experiment to find a value for T when there are no balls on the rod.

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Measurements and calculations

For Examiner's Use

M

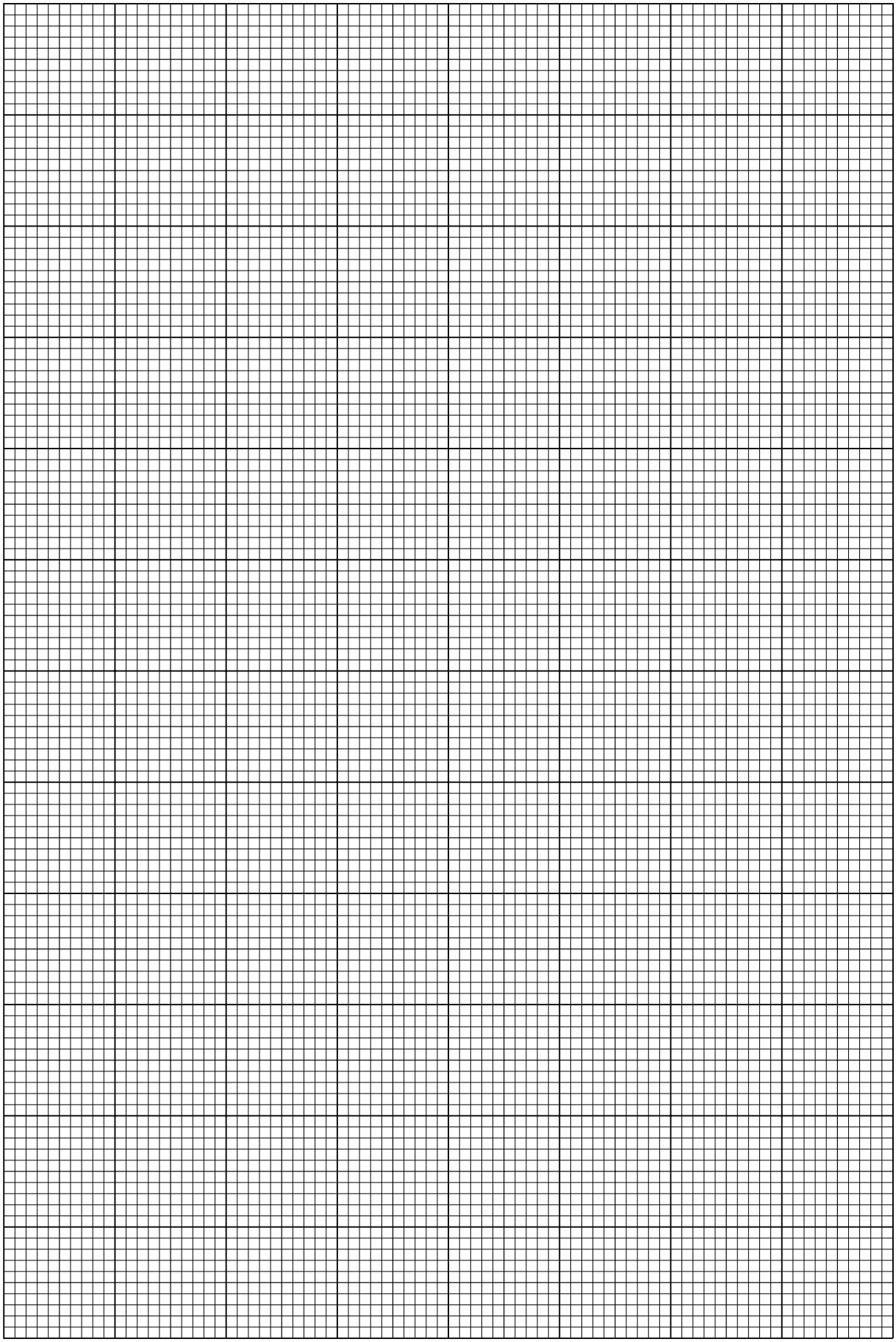
R

A

For Examiner's Use

G

Graph grid



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