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

October/November 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.

For Examiner's Use

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.

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

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1 In this experiment you will investigate the oscillations of a pendulum. A rod reduces the length of the pendulum by a distance *d* for half of each oscillation.

(a) Clamp the thread using a split cork so that the length of the pendulum is about 70 cm.

(b) Mount the wooden rod horizontally so that it is halfway down the length of the pendulum. The rod should just touch the string when the pendulum rests in a vertical position, as shown in Fig. 1.1.

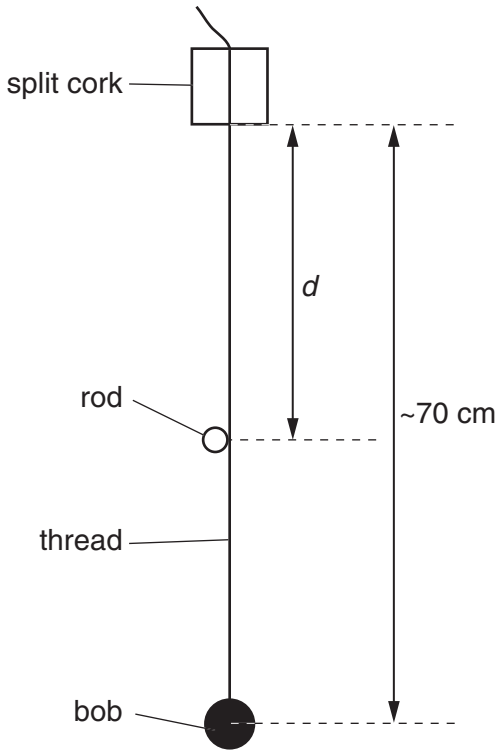

Fig. 1.1

(c) **(i)** Measure and record the value of *d*.

d = ...

(ii) Estimate the percentage uncertainty in this value of *d*, showing your working.

% uncertainty in *d* = ...

(d) (i) Gently displace the pendulum so that it performs small oscillations in a vertical plane perpendicular to the rod, as shown in Fig. 1.2.

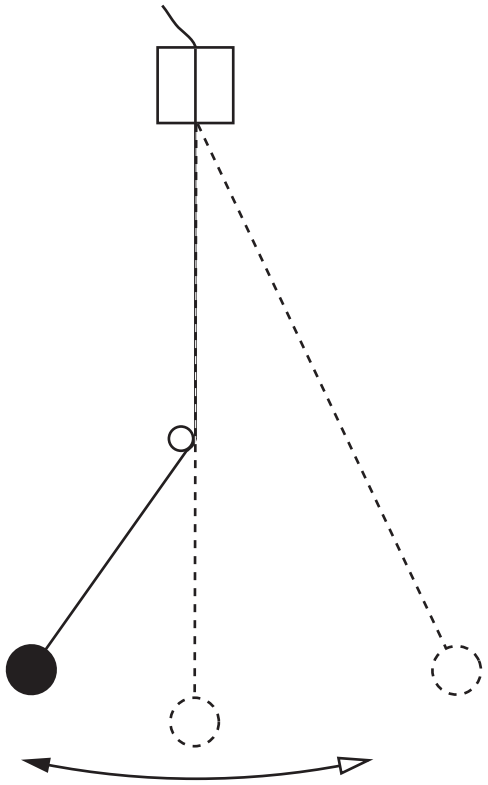

Fig. 1.2

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

T = ...

For Examiner's Use

(e) (i) Adjust the position of the rod to give a new value of d and repeat **(d)** until you have five more sets of readings for d and T where $20.0\,\text{cm} \leq d \leq 60.0\,\text{cm}$. Include all six values of $\frac{d}{T}$ in your table of results below.

(ii) Justify the number of significant figures that you have given for $\frac{d}{T}$.

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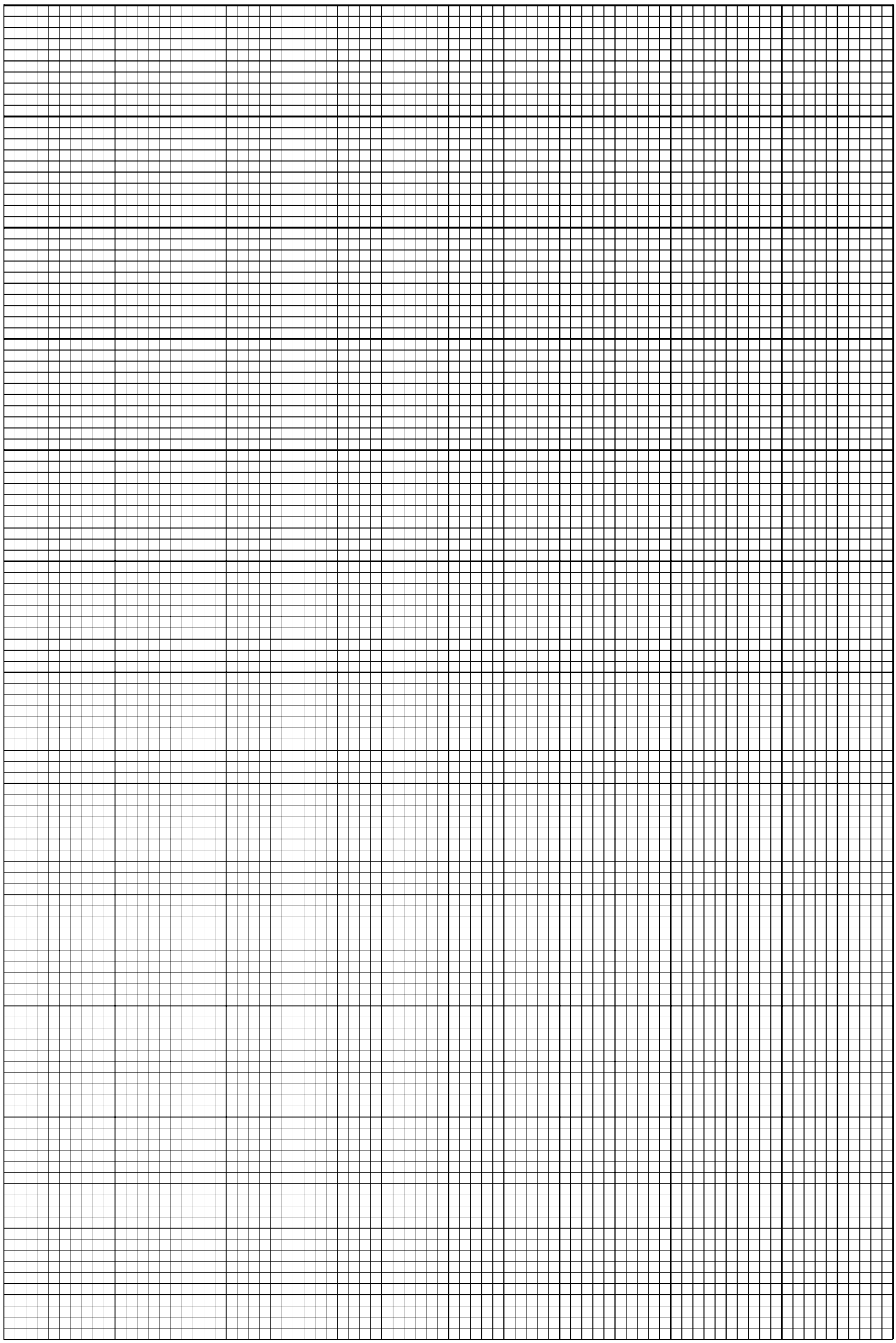
(f) (i) Plot a graph of T (y-axis) against $\frac{d}{T}$ (x-axis).

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

gradient = ...

y-intercept = ...



(g) T and d are related by the formula

$$T = -\frac{\pi^2}{g}\left(\frac{d}{T}\right) + T_O$$

where g is the acceleration of free fall and T_o is a constant.

Use your answers from **(f)(ii)** to find the values for g and T_o. Include appropriate units in each case.

g = ...

T_o = ...

(h) Suggest **one** possible improvement to your experiment.

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