| Centre Number | Candidate Number | Name |
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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

**PHYSICS** **9702/03**

Paper 3 Practical Test

October/November 2005

**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 they 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.

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1 In this question you will investigate how the force required to maintain equilibrium of a horizontal rule depends on the position of a mass suspended from the rule.

**(a) (i)** Suspend a rule horizontally using two loops of string and a newton-meter, as shown in Fig. 1.1. The strings must be vertical.

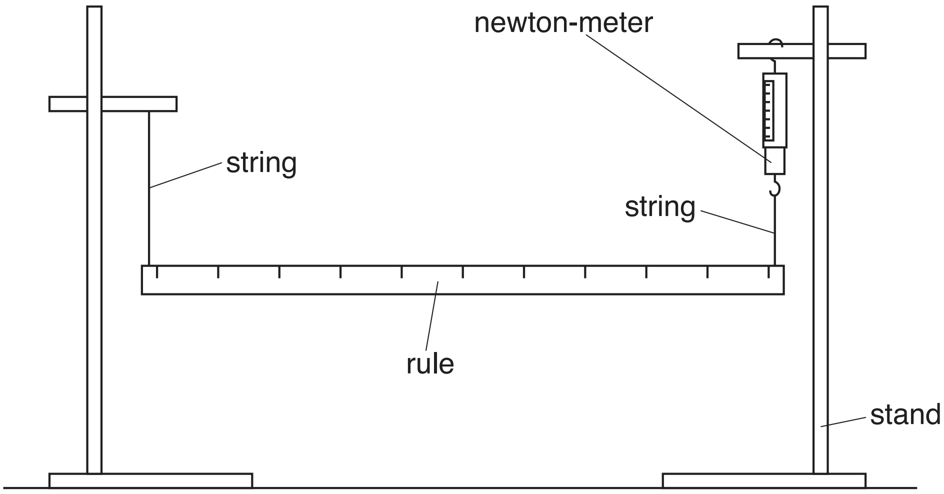


**Fig. 1.1**

**(ii)** Suspend the mass at a distance *d* from the newton-meter using a loop of string. You will need to adjust the position of the clamps to ensure that the rule remains horizontal. The arrangement should now be as shown in Fig. 1.2.

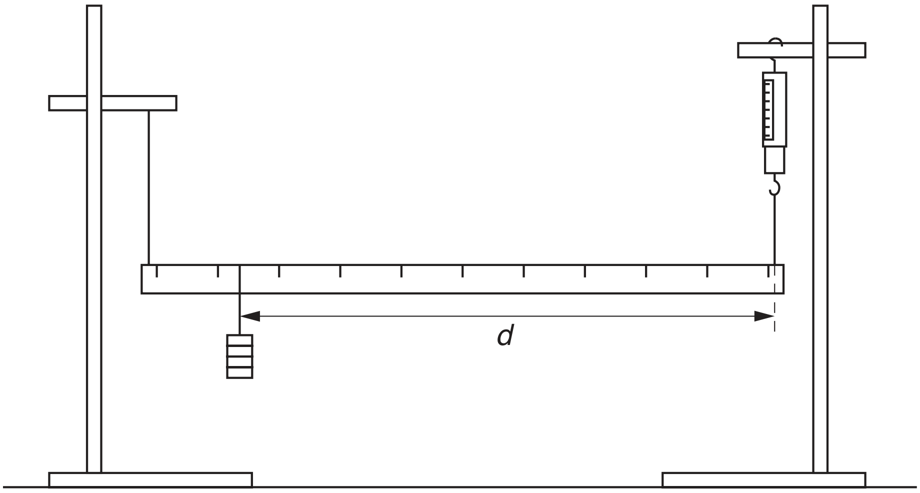


**Fig. 1.2**

**(b)** **(i)** Measure and record the value of *d* and the reading *F* from the newton-meter.

*d* = ..................................

*F* = ..................................

**(ii)** Determine the percentage uncertainty in the value of *d*.

percentage uncertainty in *d* = ..................................

**(iii)** Explain how you ensured that the rule was horizontal when the measurements were taken.

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**(c)** Slide the suspended mass to a new position on the rule and repeat **(b)(i)** until you have six sets of readings for *d* and *F*. You should ensure when you are taking readings that the rule is horizontal and that the newton-meter does not go off scale.

Include all six sets of values of *d* and *F* in your table of results.

**(d)** Plot a graph of *F* (*y*-axis) against *d* (*x*-axis) and draw the best straight line through the points.

**(e)** Determine values for the gradient and *y*-intercept of the line.

gradient = ......................................................

*y*-intercept = ......................................................

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**(f)** The equation that relates $F$ and $d$ is

$$F = \frac{-Wd}{L} + \frac{mg}{2} + W$$

where $W$ is the weight of the suspended mass, $m$ is the mass of the rule, $L = 0.980\,\text{m}$, and $g = 9.81\,\text{m s}^{-2}$.

Use your answers from **(e)** to determine values for $W$ and $m$. Include appropriate units.

$W$ = ..................................

$m$ = ..................................

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