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

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5669991694

PHYSICS **9702/36**

Advanced Practical Skills 2 **October/November 2010**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed 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.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **both** questions.
You will be allowed to work with the apparatus for a maximum of one hour for each 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.
You may lose marks if you do not show your working or if you do not use appropriate units.

Additional answer paper and graph paper should be used 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.
All questions in this paper carry equal marks.

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1	
2	
Total	

This document consists of **10** printed pages and **2** blank pages.

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1 In this experiment, you will investigate the equilibrium position of a flat board.

(a) The board is suspended from a nail as in Fig. 1.1. Check that the board can swing freely.

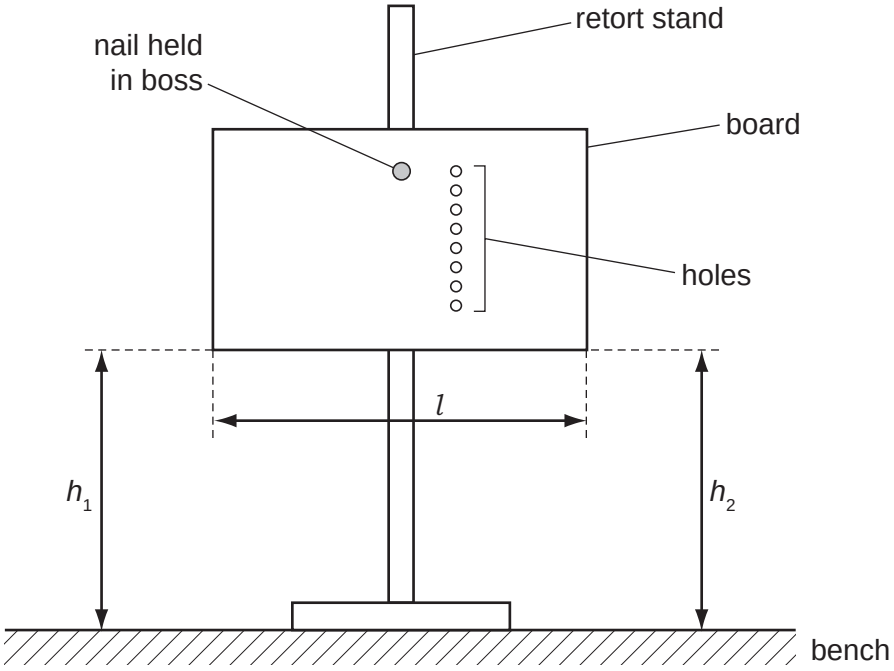


Fig. 1.1

(b) Measure the heights h_1 and h_2 of the two lower corners of the board above the bench.

If necessary, add a small amount of Blu-Tack to the top edge of the board so that the two heights are the same (i.e. so that the lower edge of the board is parallel to the bench).

(c) Measure and record the length l of the lower edge of the board.

l = ... cm

(d) Using the wire hook, attach the 150 g mass to the top hole in the board, as shown in Fig. 1.2.

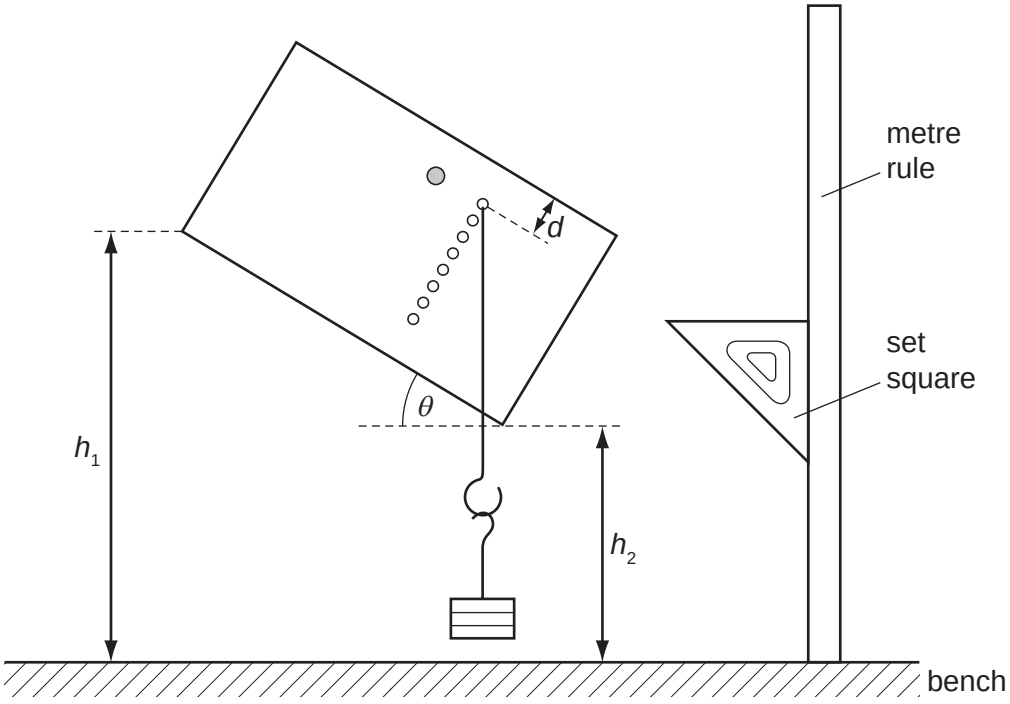


Fig. 1.2

The distance *d* is measured from the top edge of the board to the hole with the hook in it. The angle θ is the angle between the lower edge of the board and the horizontal.

(e) **(i)** Measure and record h_1 and h_2. You may find it useful to use a set square as shown in Fig. 1.2.

h_1 = ... cm

h_2 = ... cm

(ii) Using your answer from **(c)**, calculate θ (in degrees) using the relationship

$$\sin\theta = \frac{h_1 - h_2}{l}.$$

θ = ... °

(iii) Measure and record *d*.

d = ...

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(f) Increase d by moving the hook and 150 g mass to a lower hole in the board, and repeat **(e)** until you have five sets of readings of h_1, h_2 and d.

Include in your table values for θ and $\frac{1}{\tan\theta}$.

(g) **(i)** Plot a graph of $\frac{1}{\tan\theta}$ on the y-axis against d on the x-axis.

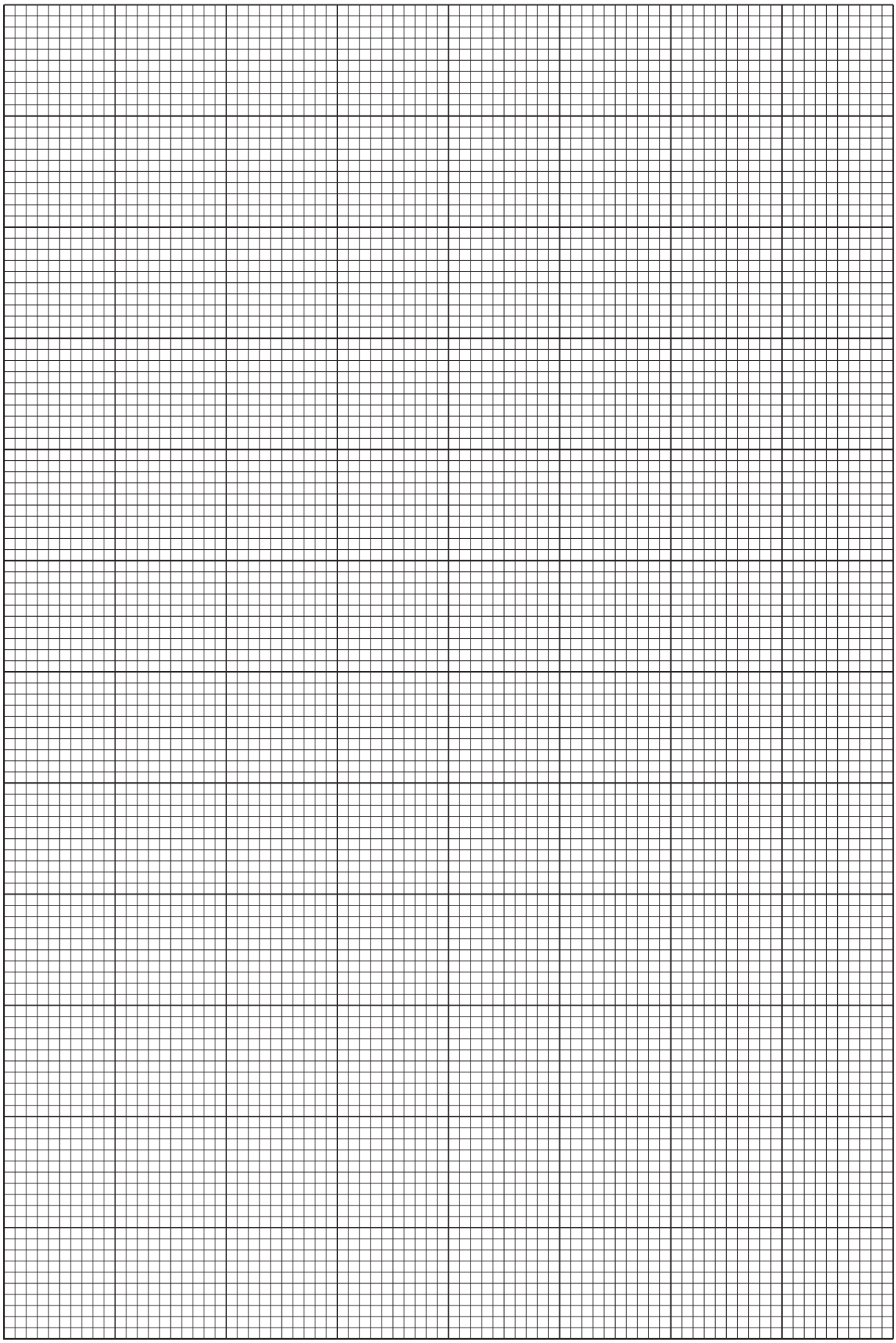
(ii) Draw the straight line of best fit.

(iii) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...

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(h) The quantities θ and d are related by the equation

$$\frac{1}{\tan\theta} = ad + b$$

where a and b are constants.

Using your answers from **(g)(iii)**, determine the values of a and b. Give units where appropriate.

a = ...

b = ...

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Please turn over for Question 2.

You may not need to use all of the materials provided.

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2 In this experiment, you will investigate the frictional force between strips of paper.

(a) You have been provided with three strips of paper, one of which is shaped, and a wire hook.
Attach the wire hook to the end of the shaped strip by folding and glueing, as shown in Fig. 2.1.
Glue together the other two strips over a 4 cm length at one end and clamp this glued end to the bench.
Position the strips as shown in Fig. 2.1.

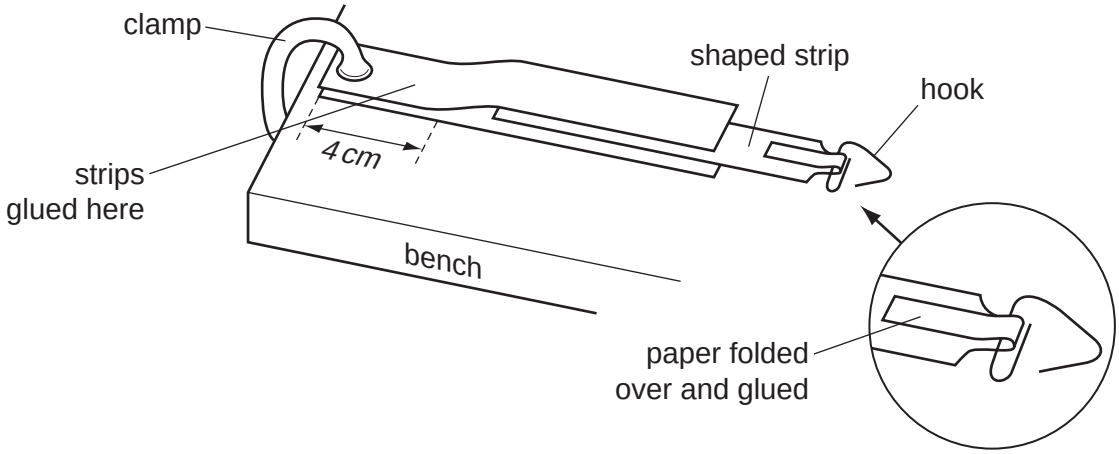


Fig. 2.1

(b) (i) You have also been provided with two rubber pencil erasers. Measure the length and width of the larger eraser and use these to calculate the area *A* of the largest face as shown in Fig. 2.2.

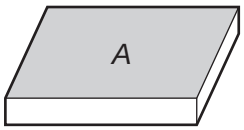


Fig. 2.2

length = ...

width = ...

A = ...

(ii) Justify the number of significant figures that you have given for your value of *A*.

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(c) (i) Place the larger rubber pencil eraser on top of the paper strips and balance the 500 g mass on top of the eraser, as shown in Fig. 2.3.

(ii) Attach the newton-meter to the hook and lay it horizontally on the bench as shown in Fig. 2.3. Check that it reads zero (adjust the zero if necessary).

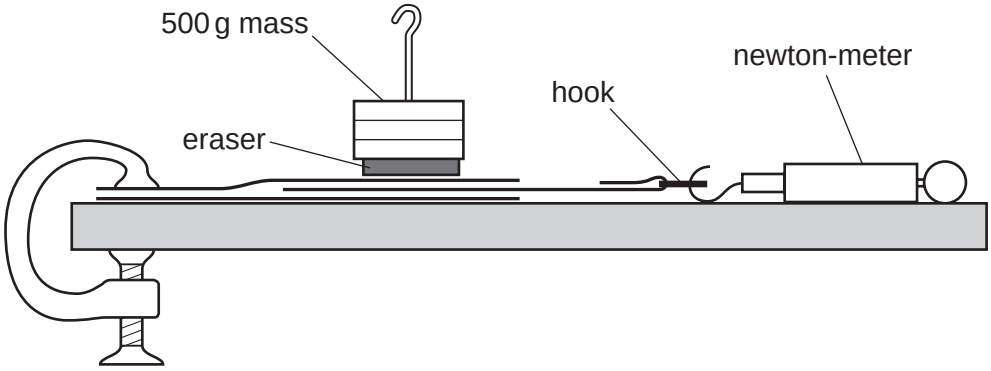


Fig. 2.3

(d) (i) Pull the newton-meter until the middle paper strip starts to slide. Take measurements to determine the average force *F* that just makes the strip slide. Show your working.

F = ...

(ii) By considering the measurements that you took in **(i)**, estimate the uncertainty in your value of *F*.

uncertainty = ... N

(e) Repeat **(b)(i)**, **(c)** and **(d)(i)** but using the smaller piece of rubber eraser.

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length = ...

width = ...

A = ...

F = ...

(f) It is suggested that F remains constant when A is changed.
Using your answer in **(d)(ii)**, explain whether your results support the suggested relationship.

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(g) (i) Describe four sources of uncertainty or limitations of the procedure in this experiment.

1. .....

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2. .....

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3. .....

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4. .....

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(ii) Describe four improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

1. .....

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2. .....

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3. .....

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4. .....

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