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

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

3072520809

PHYSICS **9702/34**

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 **9** printed pages and **3** blank pages.

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1 In this experiment, you will investigate the equilibrium position of a metre rule that is balanced on a curved surface.

(a) Mount the cylinder provided on its side on the board, wedging it with modelling clay, as shown in Fig. 1.1. If the cylinder has a lip, this should hang over the edge of the board, as shown.

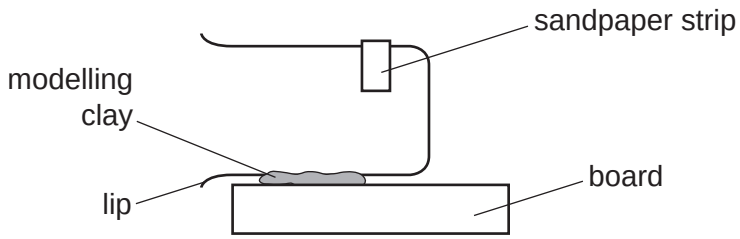


Fig. 1.1 (side view)

Note that the sandpaper strip is on the top of the cylinder.

(b) One of the metre rules has a cotton loop, fixed at the 65 cm mark. Balance this metre rule on the sandpaper strip so that it is parallel to the bench, as shown in Fig. 1.2.

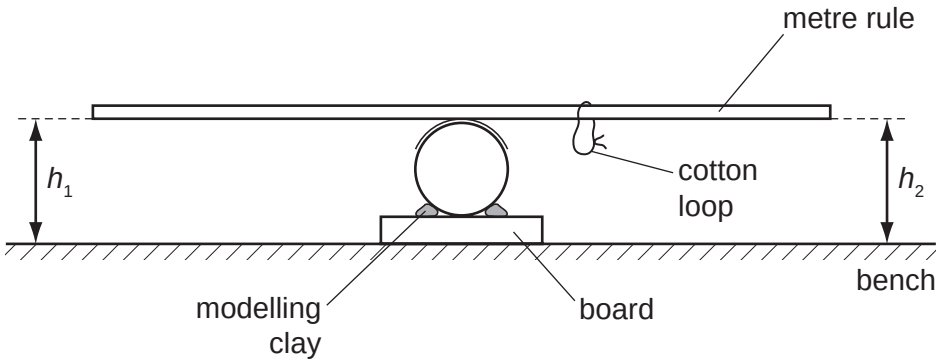


Fig. 1.2 (end view)

(c) Measure and record the heights h_1 and h_2 from the bench to the bottom of each end of the metre rule (see Fig. 1.2).

h_1 = ... cm

h_2 = ... cm

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(d) (i) Open out three paperclips as shown in Fig. 1.3.

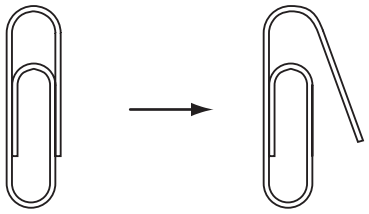


Fig. 1.3

(ii) Hang the three paperclips from the cotton loop and measure and record h_1 and h_2.

h_1 = ... cm

h_2 = ... cm

(iii) In **(ii)**, the number n of paperclips was 3.
Now increase n and measure h_1 and h_2 again until you have six sets of values for n, h_1 and h_2.
Include in your table of results values for $\frac{1}{(h_1 - h_2)}$ and $\frac{1}{n}$.

(e) (i) Plot a graph of $\frac{1}{(h_1 - h_2)}$ on the y-axis against $\frac{1}{n}$ on the x-axis.

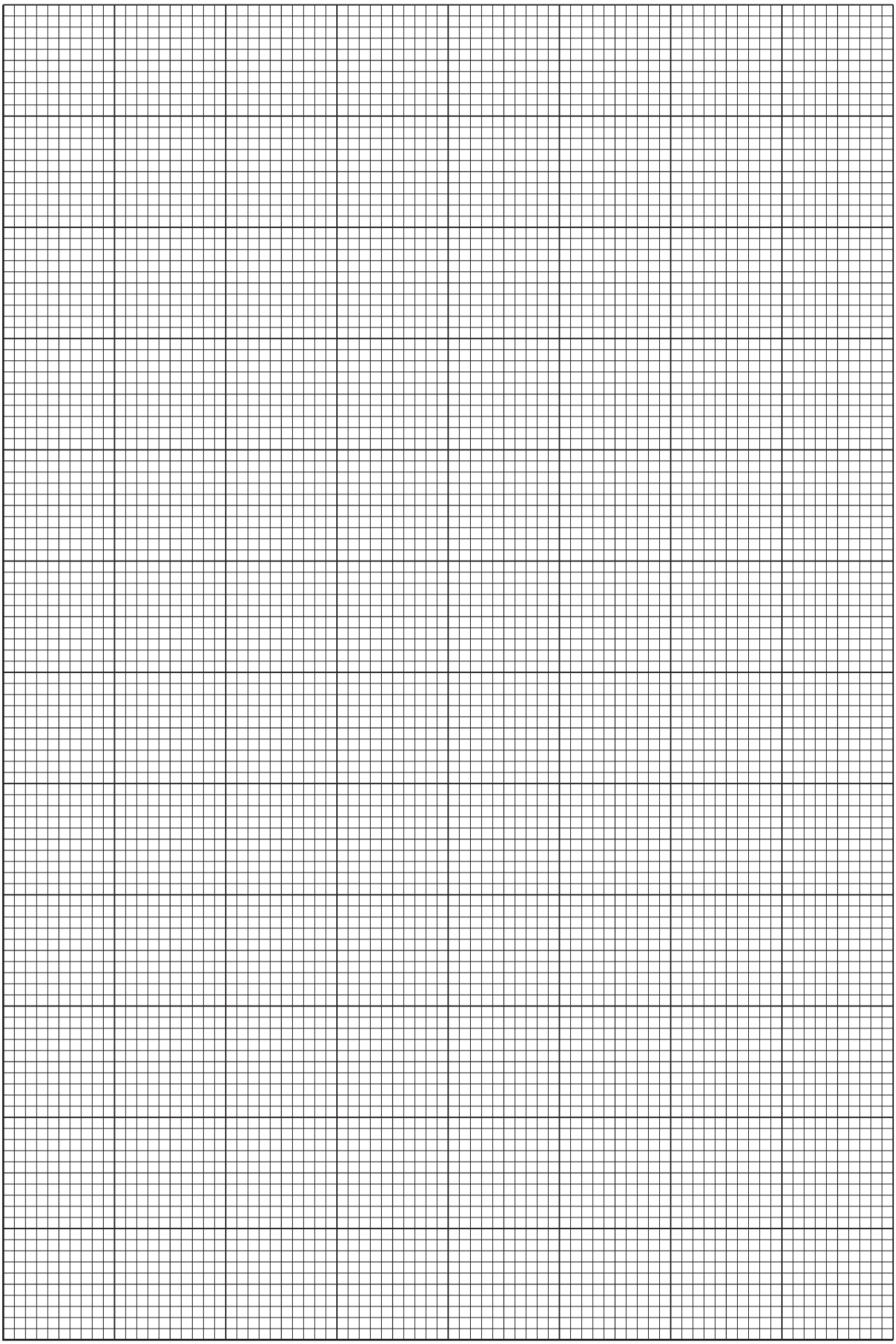
(ii) Draw the straight line of best fit.

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

gradient = ...

y-intercept = ...

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(f) It is suggested that the relationship between h_1, h_2 and n is

$$\frac{1}{(h_1 - h_2)} = \frac{a}{n} + b$$

where a and b are constants.

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

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 water flow through a hole in a container.

You are provided with a transparent plastic bottle with a small hole drilled in its base and with labels marking two positions P and Q.

The apparatus has been set up for you as shown in Fig. 2.1.

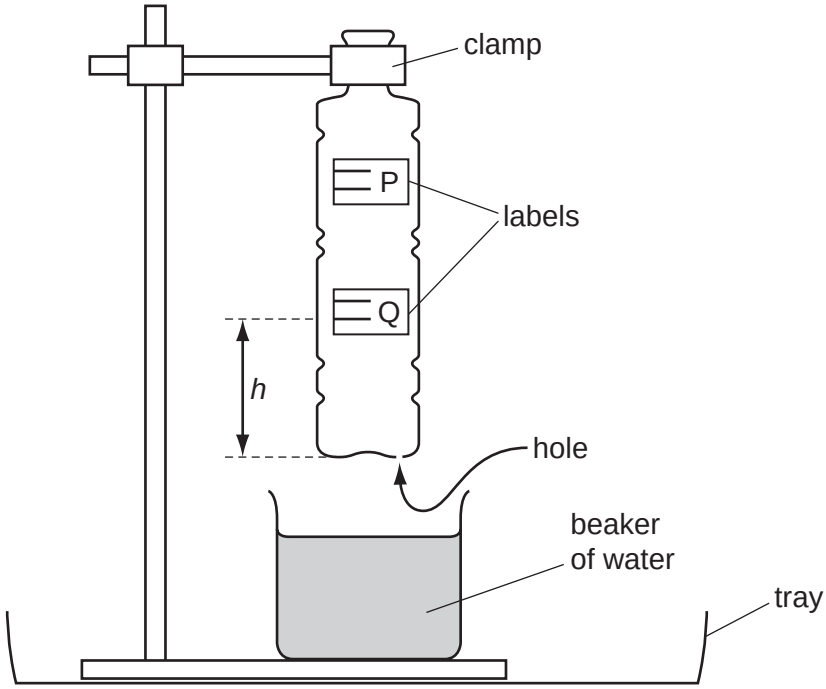


Fig. 2.1

(a) (i) Remove the bottle from the clamp and measure the diameter *d* of the bottle at position Q.

d = ... cm

(ii) Calculate the cross-sectional area *A* of the bottle at position Q, using the relationship

$$A = \frac{\pi d^2}{4}.$$

A = ... cm^2

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(b) On the label at position Q, there are two horizontal lines, as shown in Fig. 2.2.

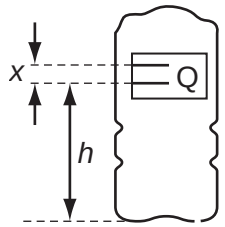


Fig. 2.2

(i) Measure and record the distance *x* between the lines at position Q.

x = ... cm

(ii) Estimate the percentage uncertainty in *x*.

percentage uncertainty = ...

(c) (i) Calculate the volume *V* of the bottle between the lines at position Q using the relationship $V = Ax$.

V = ... cm^3

(ii) Measure and record the distance *h* between the base of the bottle and the lower line at position Q.

h = ... cm

(d) (i) Locate the small hole in the base of the bottle.

(ii) Replace the bottle in the clamp as in Fig. 2.1.
Cover the hole in the base of the bottle with your finger and then add water to the bottle so that the water level is just above the lines at position Q.
Replace the beaker under the bottle.

(iii) Remove your finger so that water flows into the beaker and measure the time it takes for the water level to drop between the two lines at position Q.
Record this time *t*.

t = ... s

(iv) Calculate the flow rate *R*, using the relationship $R = \frac{V}{t}$. Give an appropriate unit.

R = ...

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(e) (i) Remove the bottle from the clamp and repeat **(b)(i)** and **(c)** for the lines at position P, using your value of cross-sectional area from **(a)(ii)**.

x = ... cm

V = ... cm^3

h = ... cm

(ii) Repeat **(d)** for the lines at position P.

t = ... s

R = ...

(f) (i) It is suggested that the relationship between R and h is

$$R = kh$$

where k is a constant.

Using your data, calculate two values of k.

k for position Q = ...

k for position P = ...

(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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