Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

1786294920

PHYSICS **9702/34**

Paper 3 Advanced Practical Skills 2 **October/November 2014**

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 an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, 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 are reminded of the need for good English and clear presentation in your answers.

Electronic calculators may be used.
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.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **11** printed pages and **1** blank page.

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

1 In this experiment, you will investigate the refraction of light by a transparent block.

(a) You are provided with a sheet of paper with lines marked as shown in Fig. 1.1.
The sheet is attached to a board.

Stick a pin vertically into the board on the line AB approximately 3 cm to the right of A. Stick another pin vertically into the board at C.

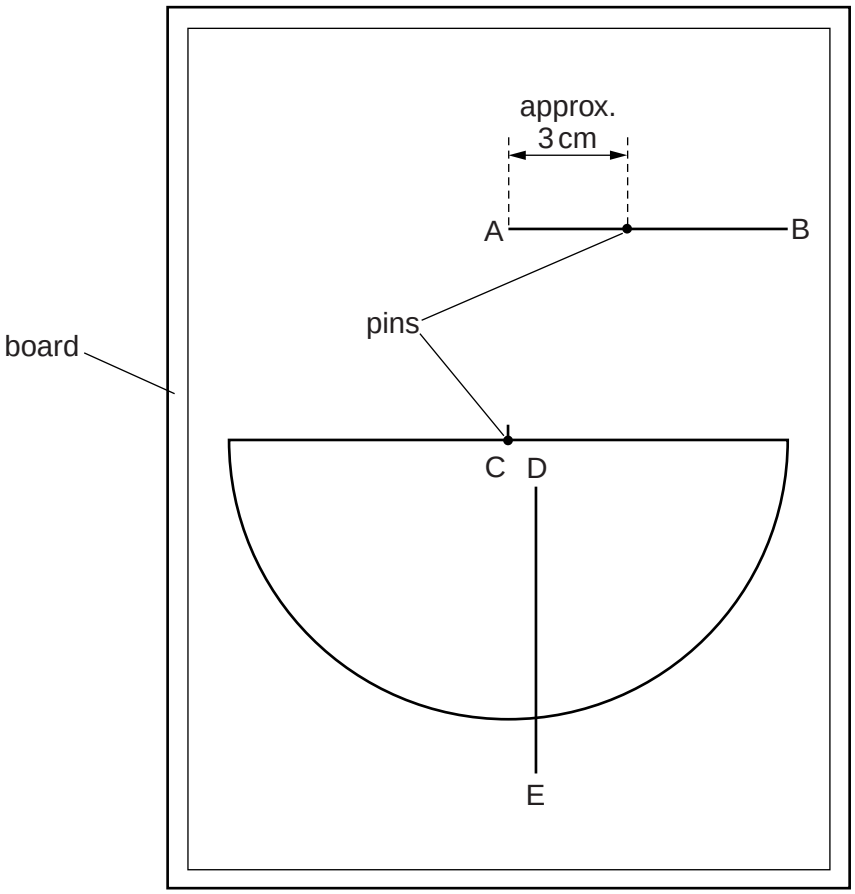


Fig. 1.1 (not to scale)

(b) (i) View the two pins horizontally from the direction shown in Fig. 1.2. Stick the third pin into the board on the curved line so that it is in line with the first two pins.

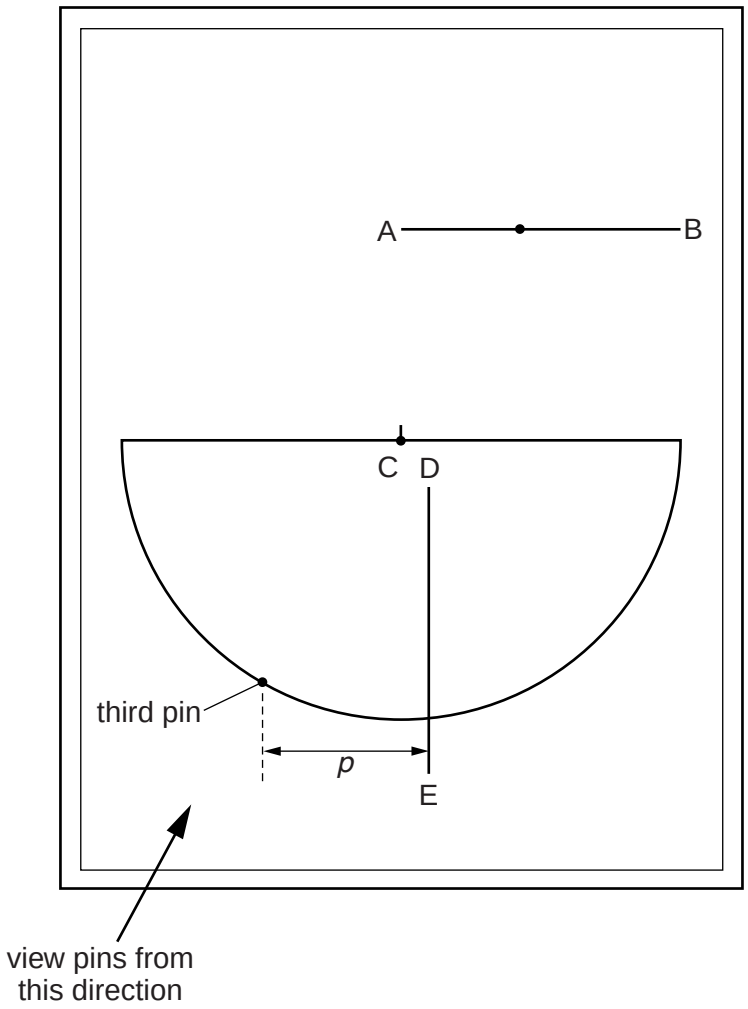


Fig. 1.2 (not to scale)

(ii) Measure and record the perpendicular distance *p* from the third pin to the line DE, as shown in Fig. 1.2.

p = ... cm [1]

(iii) Remove the third pin from the board.

(c) (i) Place the semicircular block on the board with its centre mark next to the pin at C, as shown in Fig. 1.3.

(ii) View the first two pins horizontally from the direction shown in Fig. 1.3. Look at the bottom of the first pin **through** the block. Stick the third pin in the board on the curved line so that it appears to be in line with the first two pins.

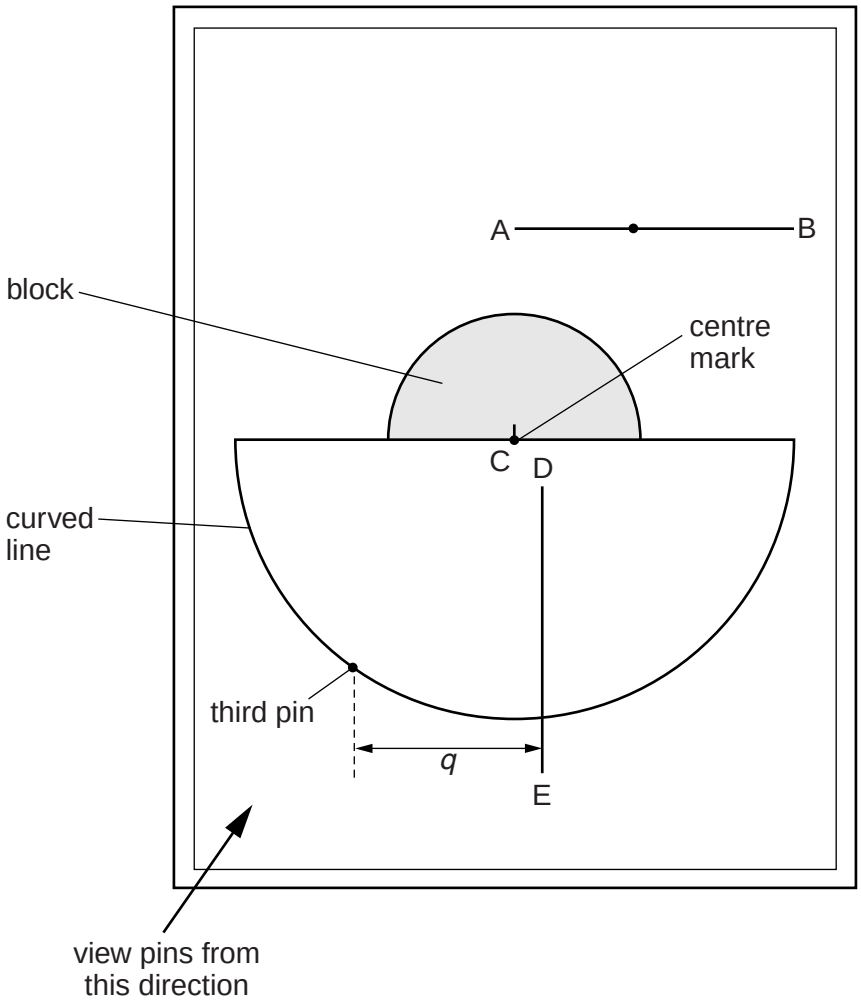


Fig. 1.3 (not to scale)

(iii) Measure and record the perpendicular distance *q* from the third pin to the line DE, as shown in Fig. 1.3.

q = ... cm [1]

(iv) Remove the third pin and the block from the board.

(d) Move the first pin to a different position on the line AB. Repeat **(b)** and **(c)** until you have six sets of values of p and q.

Include values for $\frac{q}{p}$ and $\frac{1}{p}$ in your table.

[10]

(e) **(i)** Plot a graph of $\frac{q}{p}$ on the y-axis against $\frac{1}{p}$ on the x-axis. [2]

(ii) Draw the straight line of best fit. [1]

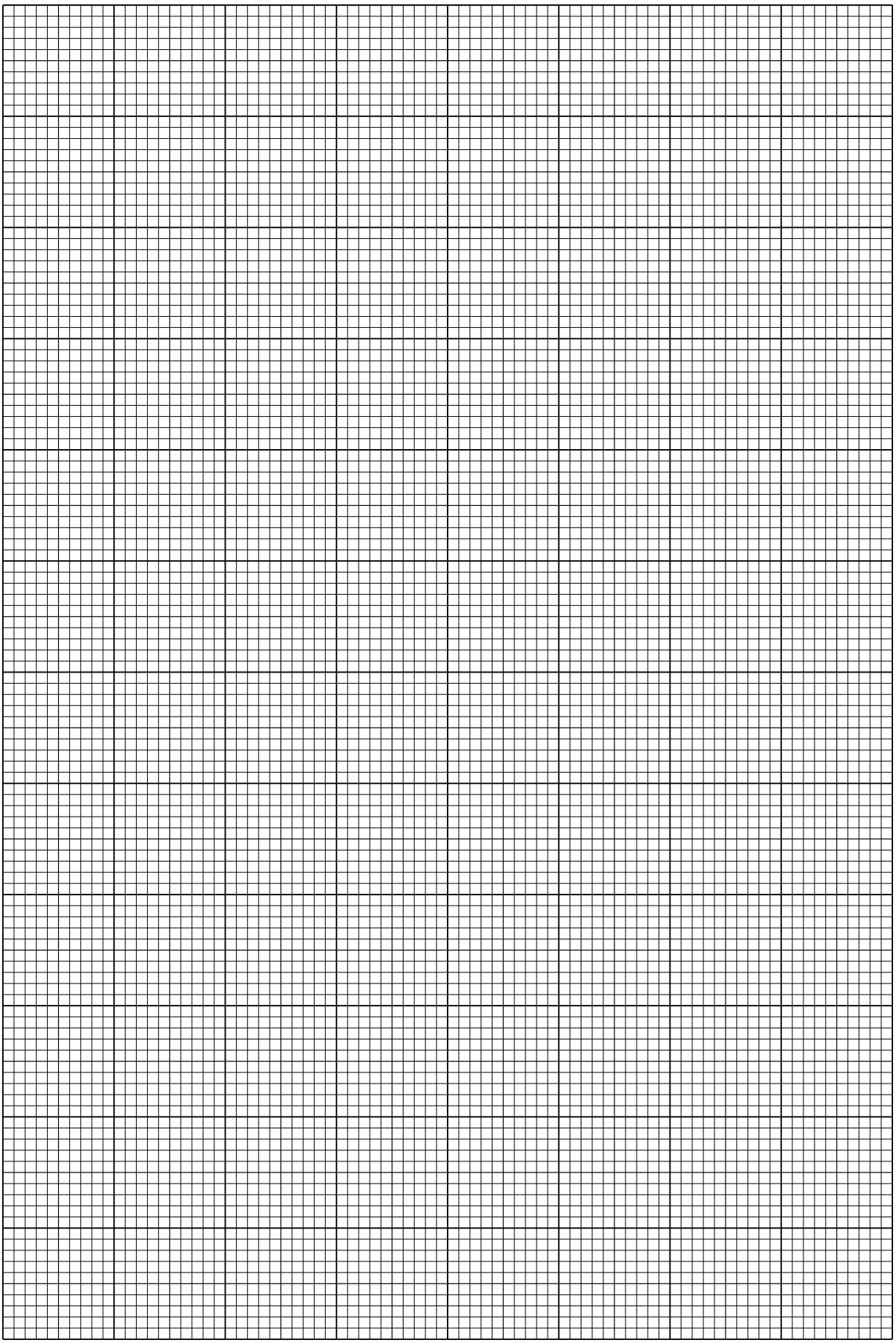
(iii) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...

[2]

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(f) The quantities q and p are related by the equation

$$\frac{q}{p} = \frac{a(1-b)}{p} + b$$

where a and b are constants.

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

a = ...

b = ...

[3]

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

2 In this experiment, you will investigate the relationship between surface area and friction as a rod is hammered into a container of rice.

(a) You are provided with two pencils labelled P and Q.

(i) Measure and record the distance *d* between the opposite flat faces of pencil P, as shown in Fig. 2.1.

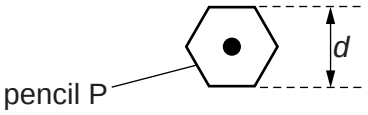


Fig. 2.1

d = ... cm [1]

(ii) Measure and record the length *x* between the two marks on pencil P, as shown in Fig. 2.2.

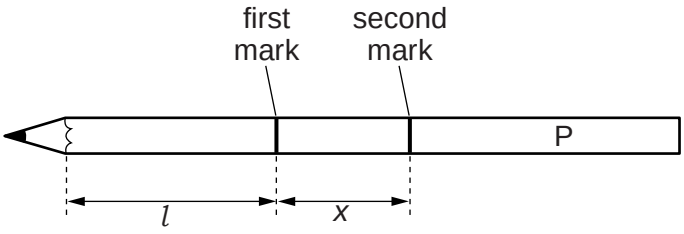


Fig. 2.2

x = ... cm [1]

(iii) Measure and record the length *l* along the flat section of the pencil to the first mark, as shown in Fig. 2.2.

l = ... cm [1]

(b) Estimate the percentage uncertainty in your value of *l*.

percentage uncertainty = ... [1]

(c) Calculate the surface area A of the pencil up to the first mark, using the relationship $A = 2\sqrt{3}dl$.

A = ... [1]

(d) (i) Push the sharp end of the pencil vertically into the centre of the container of rice until the first mark is about 1 cm above the surface of the rice, as shown in Fig. 2.3.

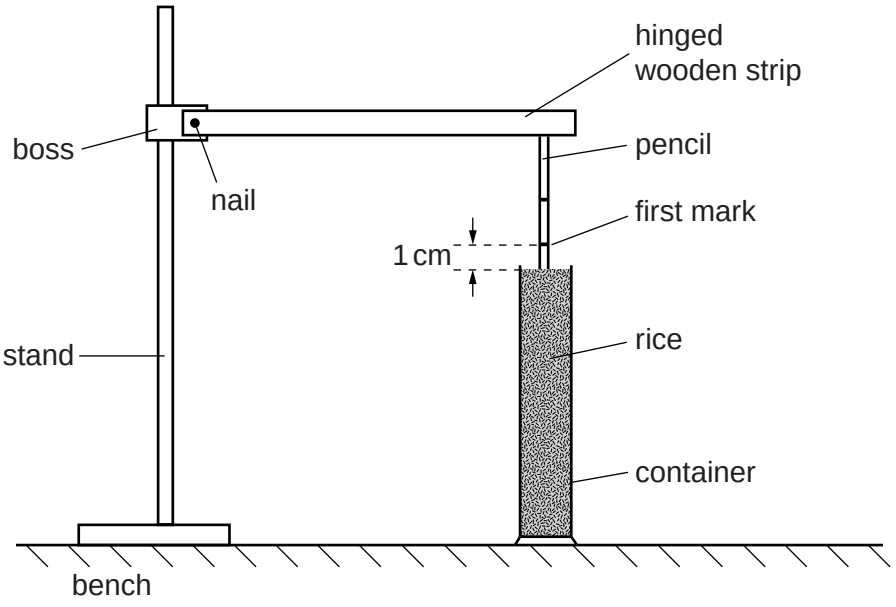


Fig. 2.3

(ii) Position the stand and wooden strip so that the free end of the wooden strip rests on top of the pencil. Adjust the height of the nail so that the wooden strip is horizontal, as shown in Fig. 2.3.

(iii) Raise the free end of the wooden strip by 3 cm and drop it onto the pencil. Repeat until the first mark on the pencil is level with the surface of the rice.

(iv) Adjust the height of the nail so that the wooden strip is horizontal again.

(v) Raise the free end of the wooden strip by 3 cm and drop it onto the pencil. Repeat until the second mark on the pencil is level with the surface of the rice, counting the number n of times the wooden strip is dropped.

n = ... [2]

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(e) Repeat **(a)**, **(c)** and **(d)** using pencil Q.

d = ...

x = ...

l = ...

A = ...

n = ...

[2]

(f) It is suggested that the relationship between n and A is

$$n = kAx$$

where k is a constant.

(i) Using your data, calculate two values of k.

first value of k = ...

second value of k = ...

[1]

(ii) Justify the number of significant figures that you have given for your values of k.

.....

.....

.....[1]

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(iii) Explain whether your results in **(f)(i)** support the suggested relationship.

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.....

.....[1]

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

1. .....

.....

2. .....

.....

3. .....

.....

4. .....

.....

[4]

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

1. .....

.....

2. .....

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3. .....

.....

4. .....

.....

[4]

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