Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1378165508

PHYSICS **9702/31**

Paper 3 Advanced Practical Skills 1 **October/November 2015**

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 **14** printed pages and **2** blank pages.

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CAMBRIDGE International Examinations

[Turn over

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

1 In this experiment, you will investigate the effect of air resistance on the motion of a circular card.

(a) (i) Use the compasses to draw a circle of approximate diameter 20 cm on the card.

(ii) Use the scissors to cut out the circle.

(iii) Make a hole in the centre of the circle with the compasses. The hole should be big enough for the hook of the mass hanger to pass through.

(iv) Measure and record the diameter *d* of the card as shown in Fig. 1.1.

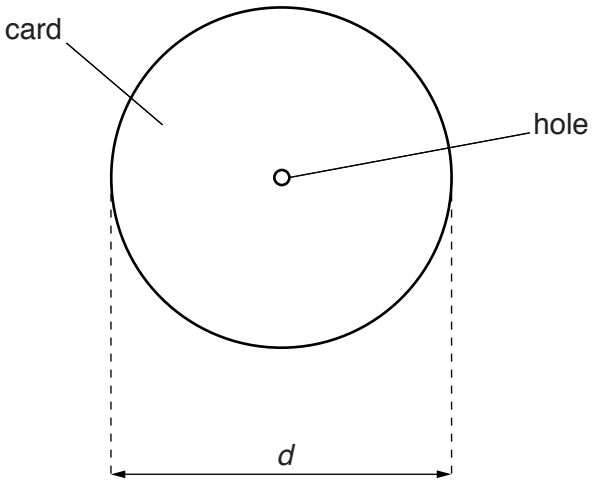


Fig. 1.1

d = ... [1]

(b) (i) Set up the apparatus as shown in Fig. 1.2.
The rule should have a 0 cm mark at the bottom and a 100 cm mark at the top.

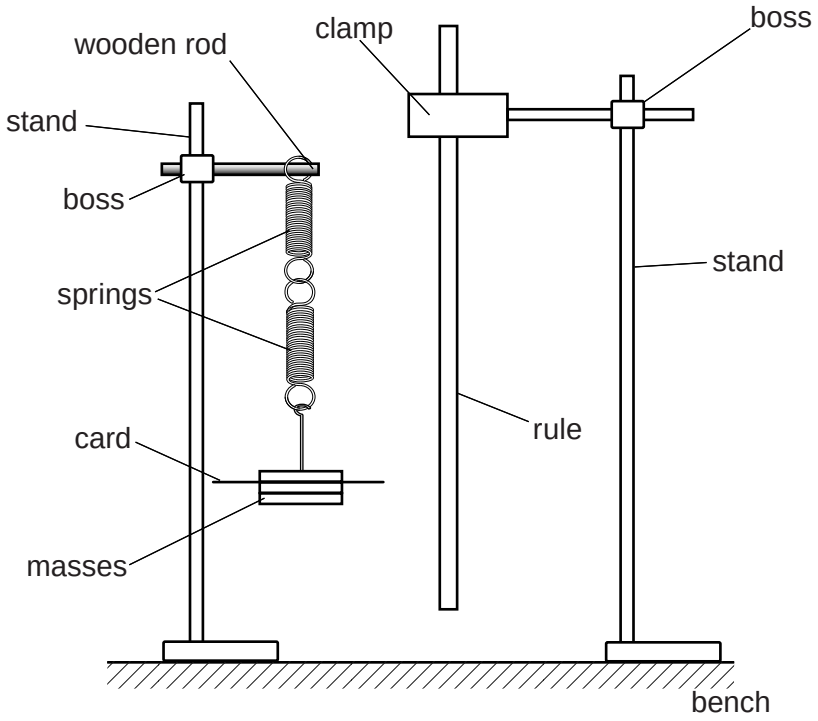


Fig. 1.2

(ii) Adjust the rule until the 5.0 cm mark is level with the card as shown in Fig. 1.3.

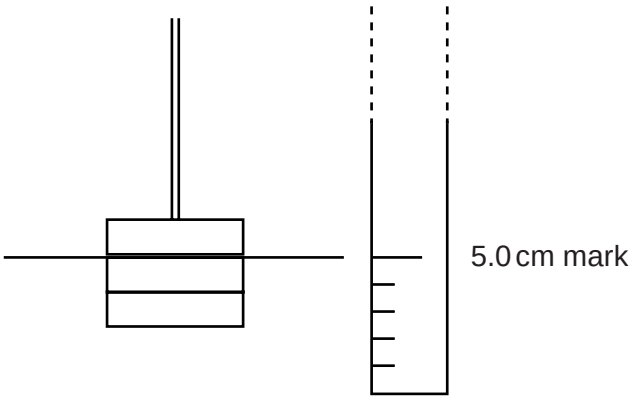


Fig. 1.3

(c) (i) Pull the masses down so that the card is level with the 0 cm mark as shown in Fig. 1.4.

Release the masses and watch the movement of the masses and card. They will move up and down.

When the card returns to its lowest point for the first time, it has completed one cycle as shown in Fig. 1.4.
Gradually the card moves less and less and does not move down as far as the 0 cm mark.

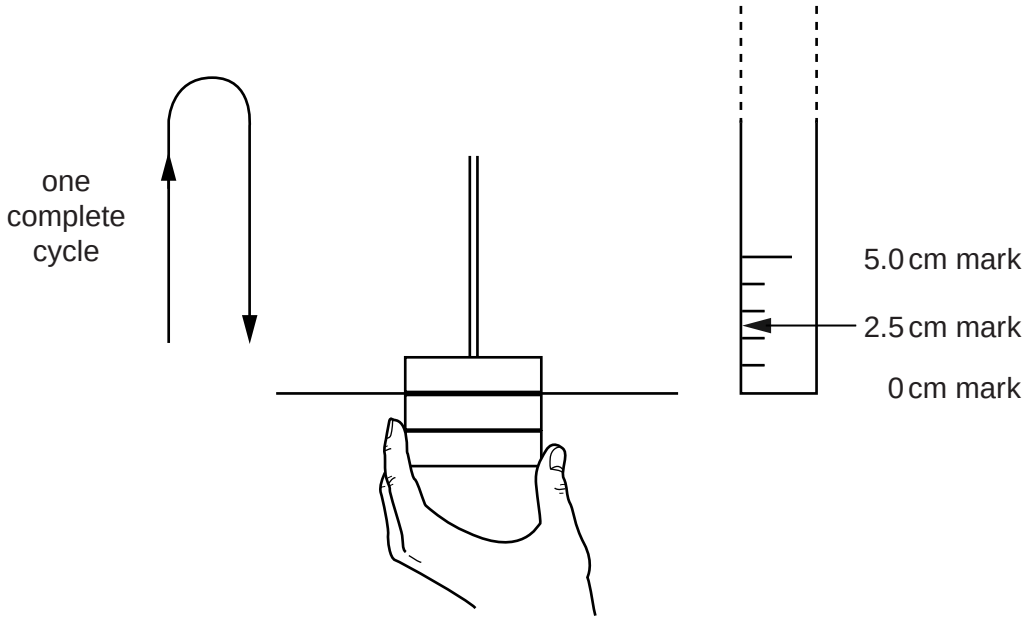


Fig. 1.4

(ii) Pull the masses down so that the card is again level with the 0 cm mark. Release the masses and count the number *N* of cycles for the card to reach the 2.5 cm mark at its lowest point.

N = ...[1]

(d) (i) Remove the card from the mass hanger.

Use the compasses to draw a circle of approximate diameter 18 cm on the card.

Use the scissors to cut out the circle.

Measure and record the diameter d of the card.

d = ...

(ii) Repeat **(b)** and **(c)**.

N = ...

(e) Cut smaller circles and repeat **(b)** and **(c)** until you have six sets of values of d and N. Include in your table the two sets of values already taken.

Also include values of $\frac{1}{d}$ and $\sqrt{N}$ in your table.

[10]

(f) **(i)** Plot a graph of $\sqrt{N}$ on the y-axis against $\frac{1}{d}$ on the x-axis. [3]

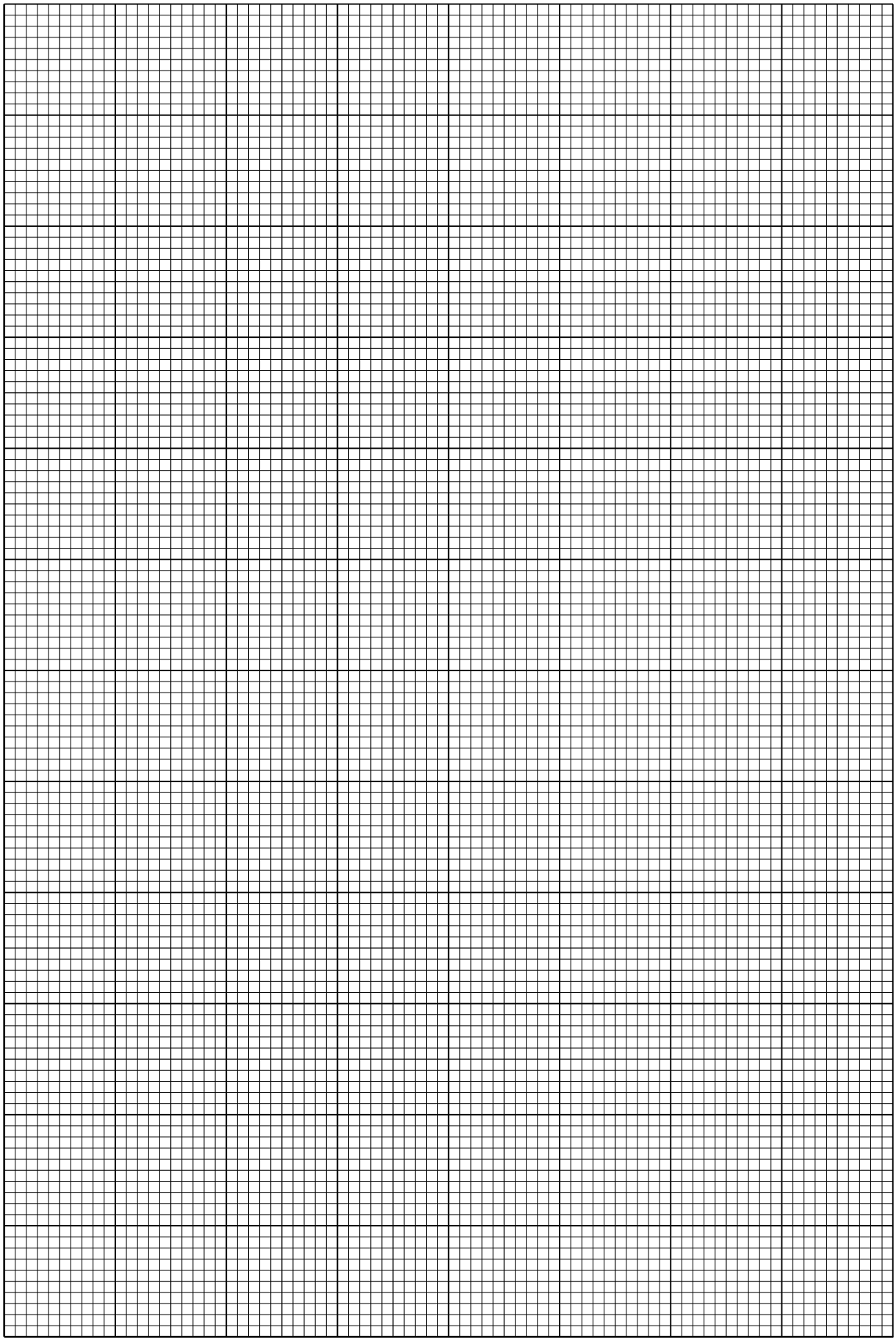
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...

[2]



(g) It is suggested that the quantities N and d are related by the equation

$$\sqrt{N} = \frac{A}{d} + B$$

where A and B are constants.

Using your answers in **(f)(iii)**, determine the values of A and B.
Give appropriate units.

A = ...

B = ...

[2]

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

2 In this experiment, you will investigate the motion of a marble.

(a) (i) Balance the wooden rod on the pivot as shown in Fig. 2.1.

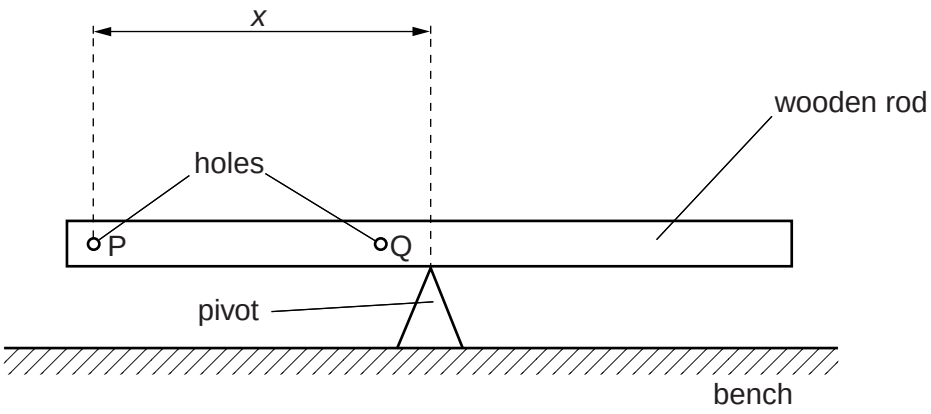


Fig. 2.1

(ii) Measure and record the distance *x* from the hole P to the pivot as shown in Fig. 2.1.
Do not mark the wooden rod.

x = ... m [2]

(b) (i) Calculate *C* using

$$C = \frac{x^2 + h^2}{x}$$

where $h = 0.100\,\text{m}$.

C = ... m [1]

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

.....

.....

.....[1]

(c) (i) Set up the apparatus with the nail through hole P, as shown in Fig. 2.2.

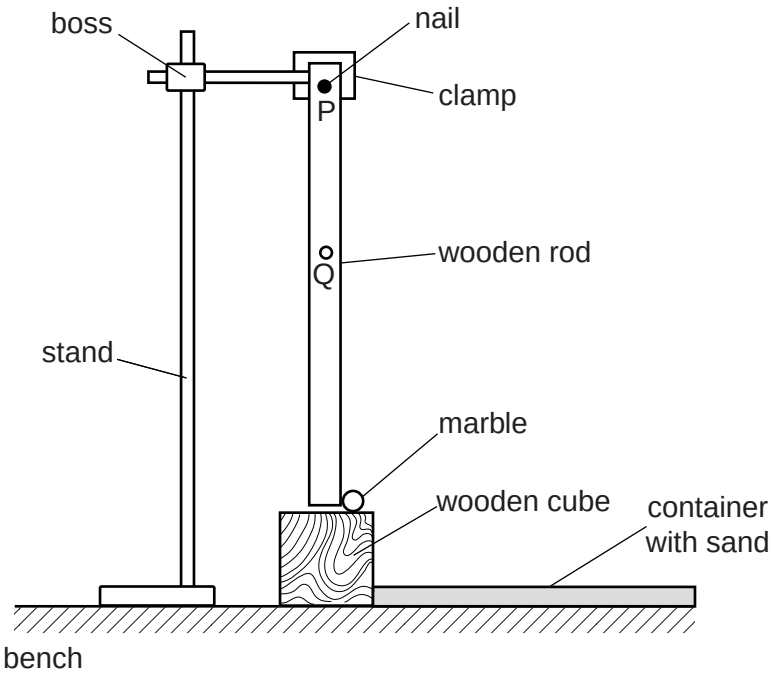


Fig. 2.2

The nail should be held in the clamp. The bottom of the wooden rod should be just above the top of the wooden cube. The marble should be in contact with the wooden rod.

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(ii) Move the wooden rod to the left through a distance of 20 cm as shown in Fig. 2.3. Release the wooden rod. The wooden rod will move to the right and strike the marble.

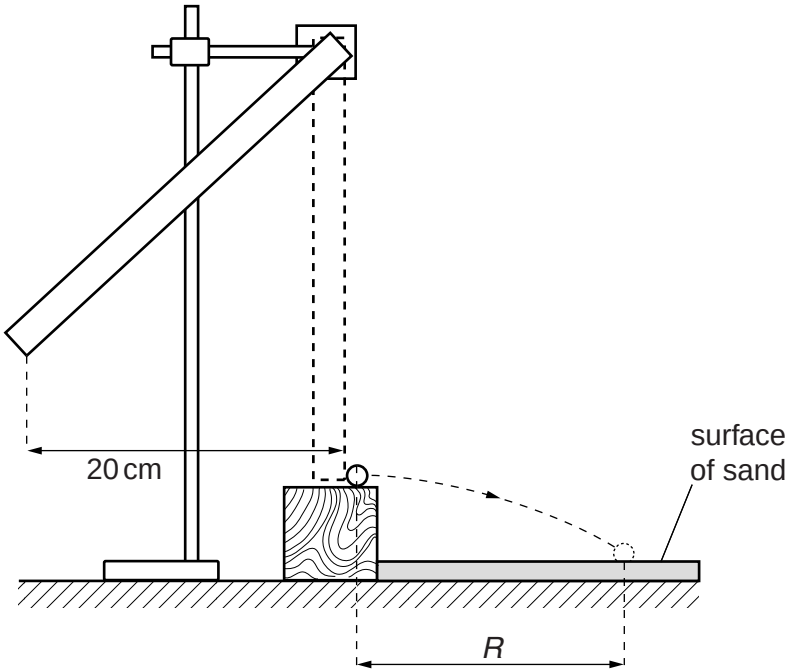


Fig. 2.3

Measure and record the horizontal distance *R* moved by the marble through the air.

R = ...[2]

(iii) Estimate the percentage uncertainty in your value of *R*.

percentage uncertainty = ...[1]

(d) Using hole Q, repeat **(a)**, **(b)(i)**, **(c)(i)** and **(c)(ii)**.

x = ... m

C = ... m

R = ...

[3]

(e) It is suggested that the relationship between C and R is

$$C = \frac{k}{R^2}$$

where k is a constant.

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

first value of k = ...

second value of k = ...

[1]

(ii) Explain whether your results in **(e)(i)** support the suggested relationship.

.....

.....

.....

.....[1]

(f) (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. .....

.....

3. .....

.....

4. .....

.....

[4]

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