Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

PHYSICS **9702/34**

Paper 3 Advanced Practical Skills 2 **May/June 2019**

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.

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

1 In this experiment, you will investigate the equilibrium position of a cardboard triangle.

(a) • Assemble the apparatus as shown in Fig. 1.1, with the nail passing through the hole marked A and the wire hook passing through one of the remaining holes.

• Ensure that the nail is held securely in the clamp and that the cardboard triangle can swing freely on the nail.

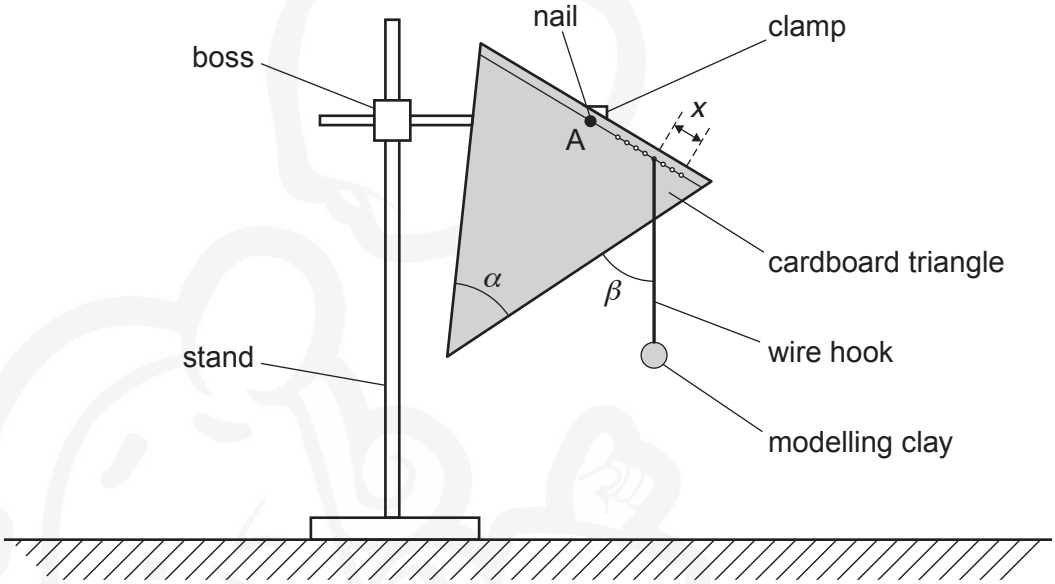


Fig. 1.1 (not to scale)

• The angle of the lower corner of the card is α, as shown in Fig. 1.1.

• Measure and record α.

α = ... °

• Calculate the value of $\frac{\alpha}{2}$.

$\frac{\alpha}{2}$ = ... °

[1]

(b) • The angle between the wire hook and the edge of the card is β, as shown in Fig. 1.1.

Measure and record β.

β = ... °

• The distance between the hole with the wire hook in it and the hole furthest from A is x, as shown in Fig. 1.1.

Measure and record x.

x = ... cm
[1]

(c) Move the wire hook to another hole and repeat **(b)** until you have six sets of values of β and x.

Record your results in a table.
Include values of $\tan\left(\beta - \frac{\alpha}{2}\right)$ in your table.

[10]

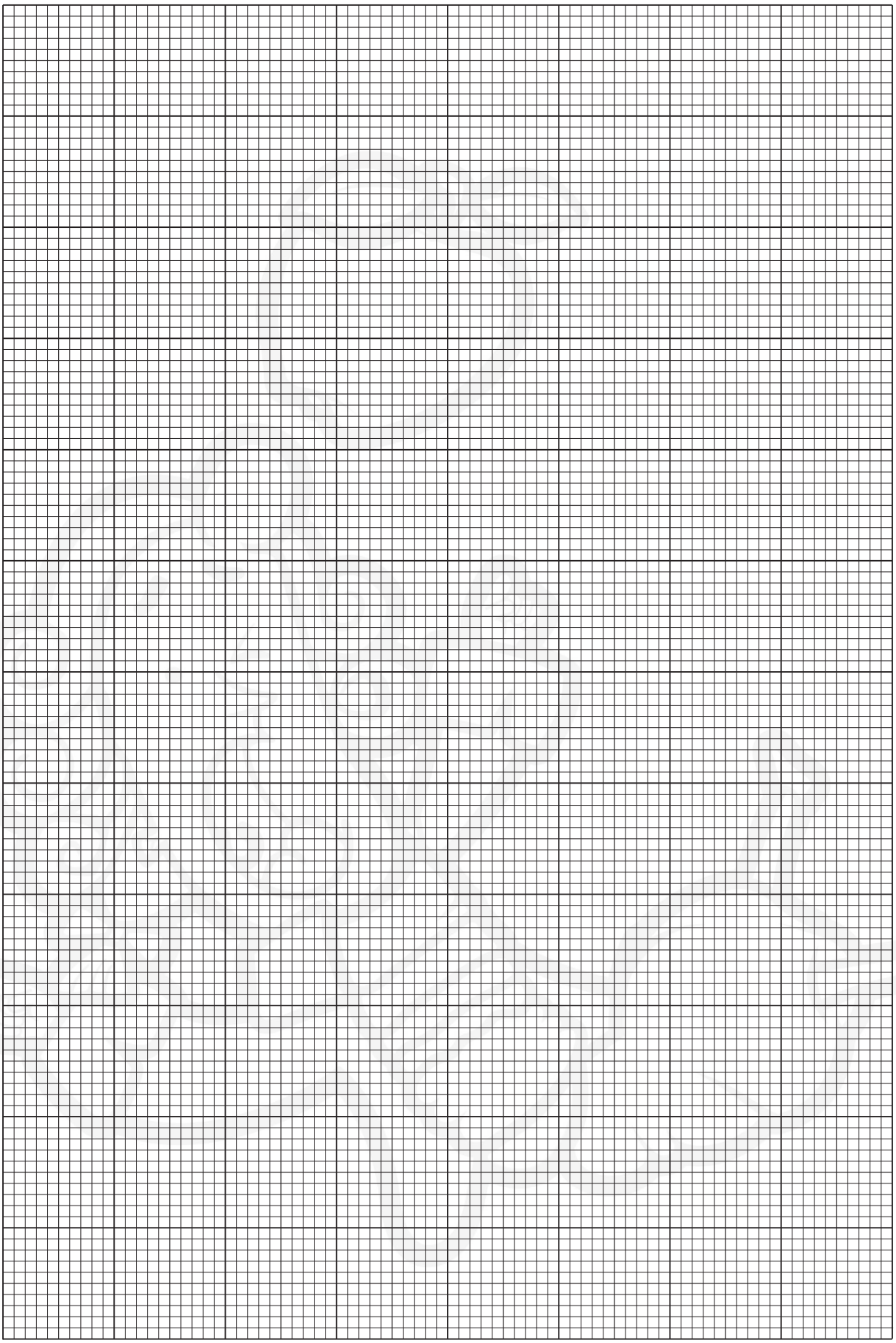
(d) **(i)** Plot a graph of $\tan\left(\beta - \frac{\alpha}{2}\right)$ on the y-axis against x on the x-axis. [3]

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

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

gradient = ...

y-intercept = ...
[2]



(e) It is suggested that the quantities β, α and x are related by the equation

$$\tan\left(\beta - \frac{\alpha}{2}\right) = Px + Q$$

where P and Q are constants.

Use your answers in **(d)(iii)** to determine the values of P and Q.
Give appropriate units.

P = ...

Q = ...
[2]

[Total: 20]

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

2 In this experiment, you will investigate the forces on an irregularly shaped object.

(a) • Position the wooden strip on the prism so that it is balanced. Make a small mark on the side of the strip where it rests on the prism, as shown in Fig. 2.1.

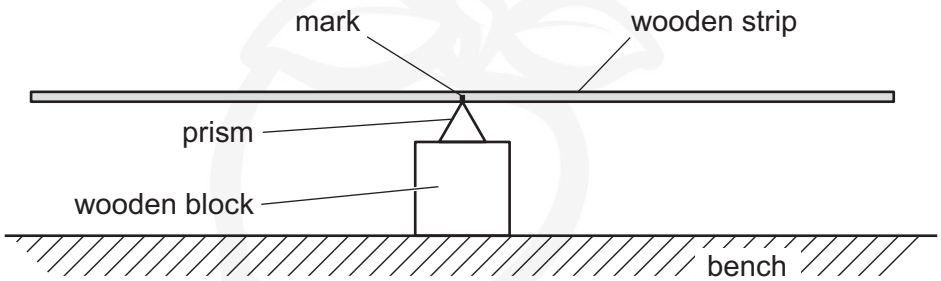

Fig. 2.1

- Place the beaker under the wooden strip.
- Hang the **larger** rock inside the beaker at a distance of 30.0 cm from the mark, then balance the strip by placing the mass on the other side of the mark, as shown in Fig. 2.2.

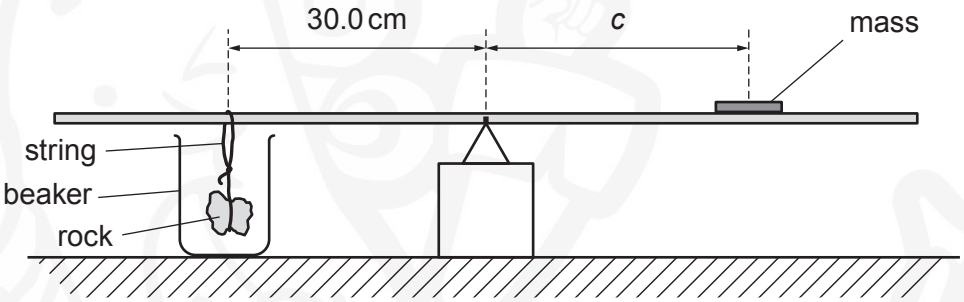

Fig. 2.2

- The distance between the centre of the mass and the mark is *c*.

  Measure and record *c*.

c = ... [2]

(b) • Pour water into the beaker until the rock is completely immersed.

• Balance the strip by moving the position of the mass, as shown in Fig. 2.3.

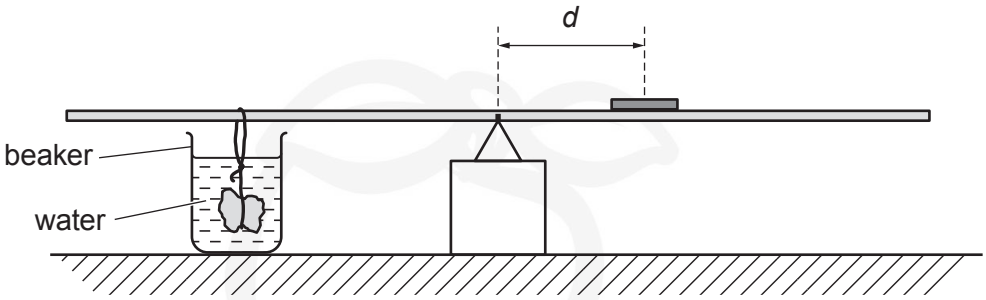

Fig. 2.3

• Ensure that the rock is completely immersed and is not touching the bottom of the beaker.

• The distance between the centre of the mass and the mark is *d*.

Measure and record *d*.

d = ... [1]

(c) Estimate the percentage uncertainty in your value of *d*.

percentage uncertainty = ... [1]

(d)
- Carefully remove the rock from the water.
- Pour the water from the beaker into the jug.
- Replace the rock with the **smaller** rock, ensuring that it is 30.0 cm from the mark.
- Balance the strip by placing the mass on the other side of the mark, as shown in Fig. 2.2.
- Measure and record c.

c = ...

- Repeat **(b)**.

d = ...
[3]

(e) It is suggested that the relationship between c and d is

$$k(c - d) = c$$

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]

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

.....

.....

..... [1]

(f) The value of k is related to the densities of water and of the rock by

$$k = \frac{\text{density of the rock}}{\text{density of water}} .$$

The density of water is $1000\,\text{kg}\,\text{m}^{-3}$. Calculate the density of the larger rock.

density of the larger rock = ... [2]

(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. .....

.....

3. .....

.....

4. .....

.....

[4]

[Total: 20]