Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

6081988664

PHYSICS **9702/34**

Paper 3 Advanced Practical Skills 2 **October/November 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 **10** printed pages and **2** blank pages.

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

1 In this experiment, you will investigate the motion of a wooden strip balanced on a curved surface.

(a)
- Assemble the apparatus as shown in Fig. 1.1.
- Use pieces of modelling clay to ensure that the beaker is secure and that its axis is horizontal.
- The centre of each mass should be the same distance *x* from the line at the midpoint of the wooden strip, where *x* is approximately 15 cm.

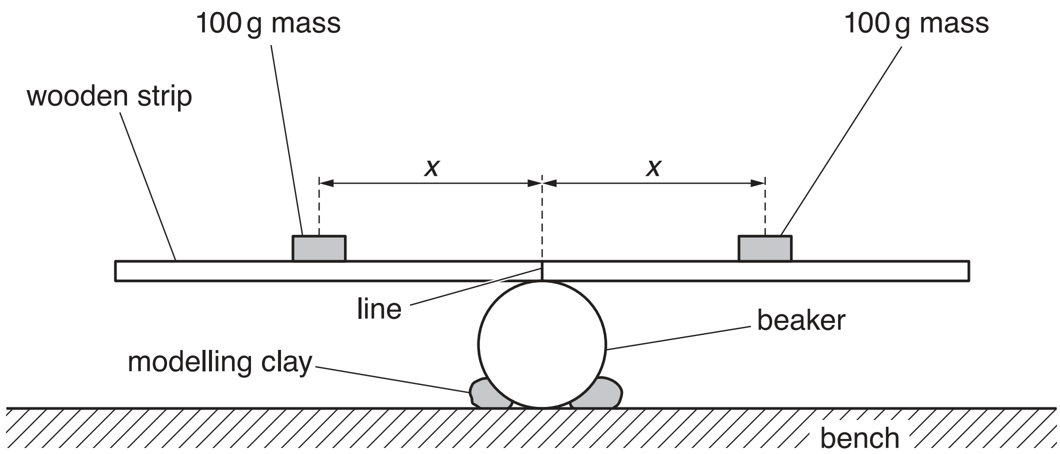

Fig. 1.1

- Measure and record *x*.

x = ... cm [1]

(b)
- Push one end of the strip down by approximately 2 cm and release it so that it oscillates.
- Take measurements to find the period *T* of the oscillations.

T = ... s [1]

(c) Change x and measure T. Repeat until you have six sets of values of x and T.

Record your results in a table. Include values of x^2 and T^2 in your table.

[9]

(d) (i) Plot a graph of T^2 on the y-axis against x^2 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 T and x are related by the equation

$$T^2 = ax^2 + b$$

where a and b are constants.

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

a = ...

b = ...
[2]

(f) • Take measurements to find the radius R of the beaker.

R = ...

• An approximate value for the acceleration of free fall g is given by

$$g = \frac{4\pi^2}{Ra}.$$

Calculate g.

g = ...
[1]

[Total: 20]

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

2 In this experiment, you will investigate the force needed to pull a cylinder up a step.

(a) Measure the thickness *h* of the board, as shown in Fig. 2.1.

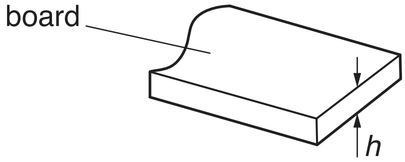

Fig. 2.1

h = ... mm [1]

(b) • Suspend the two **larger** (100 g) slotted masses from the newton meter using the loop of thread, as shown in Fig. 2.2.

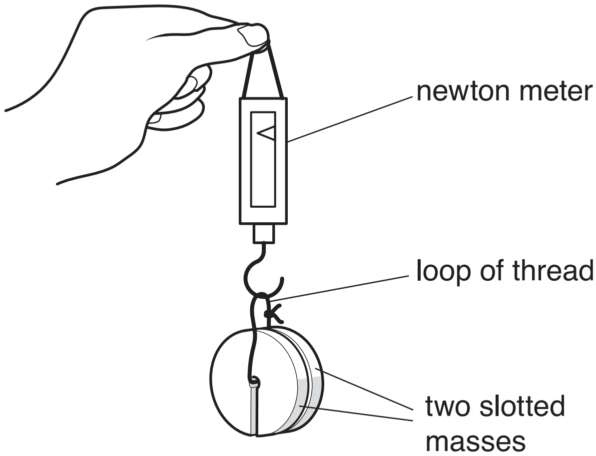

Fig. 2.2

• Record the total weight *W* of these masses.

W = ... N [1]

(c) **(i)** Take measurements to find the radius *r* of one of the larger slotted masses.

r = ... mm [1]

(ii) The value of α is given by

$$\sin \alpha = \frac{(r - h)}{r}.$$

Calculate α.

α = ... ° [1]

(iii) Justify the number of significant figures you have given for your value of α.

....

....

.... [1]

(d) • Place the board on the bench to make a step. Stand the two larger slotted masses on their edges next to the step with their slots at the top, as shown in Fig. 2.3.

• Attach the loop of thread to the masses and the newton meter, as shown in Fig. 2.3.

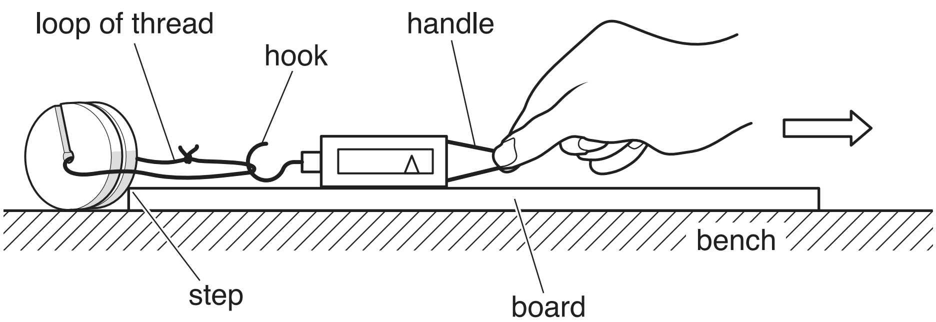

Fig. 2.3

• Pull the handle of the newton meter horizontally and at right angles to the step. The force required to just start the slotted masses rolling up the step is F.

Measure and record F.

F = ... [2]

(e) Estimate the percentage uncertainty in your value of F.

percentage uncertainty = ... [1]

(f) Repeat **(b)**, **(c)(i)**, **(c)(ii)** and **(d)** using the two smaller (50 g) slotted masses.

W = ... N

r = ... mm

α = ... °

F = ...
[2]

(g) It is suggested that the relationship between F, W and α is

$$F = \frac{kW}{\tan \alpha}$$

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 support the suggested relationship.

....

....

.... [1]

(h) **(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]

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