Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

1206138039

PHYSICS **9702/34**

Paper 3 Advanced Practical Skills 2 **October/November 2020**

2 hours

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You will be allowed to work with the apparatus for a maximum of 1 hour for each question.
- You should record all your observations in the spaces provided in the question paper as soon as these observations are made.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

For Examiner's Use	
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2	
Total	

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

1 In this experiment, you will investigate the equilibrium of a metre rule with a chain attached.

(a)
- Attach the boss to the stand at a height of approximately 60 cm above the bench.
- Assemble the apparatus as shown in Fig. 1.1 with the nail held securely in the boss.
- Attach one end of the chain of paper clips to the string loop and allow the other end of the chain to rest on the bench.
- Attach the piece of adhesive putty to the metre rule approximately 40 cm from the nail.

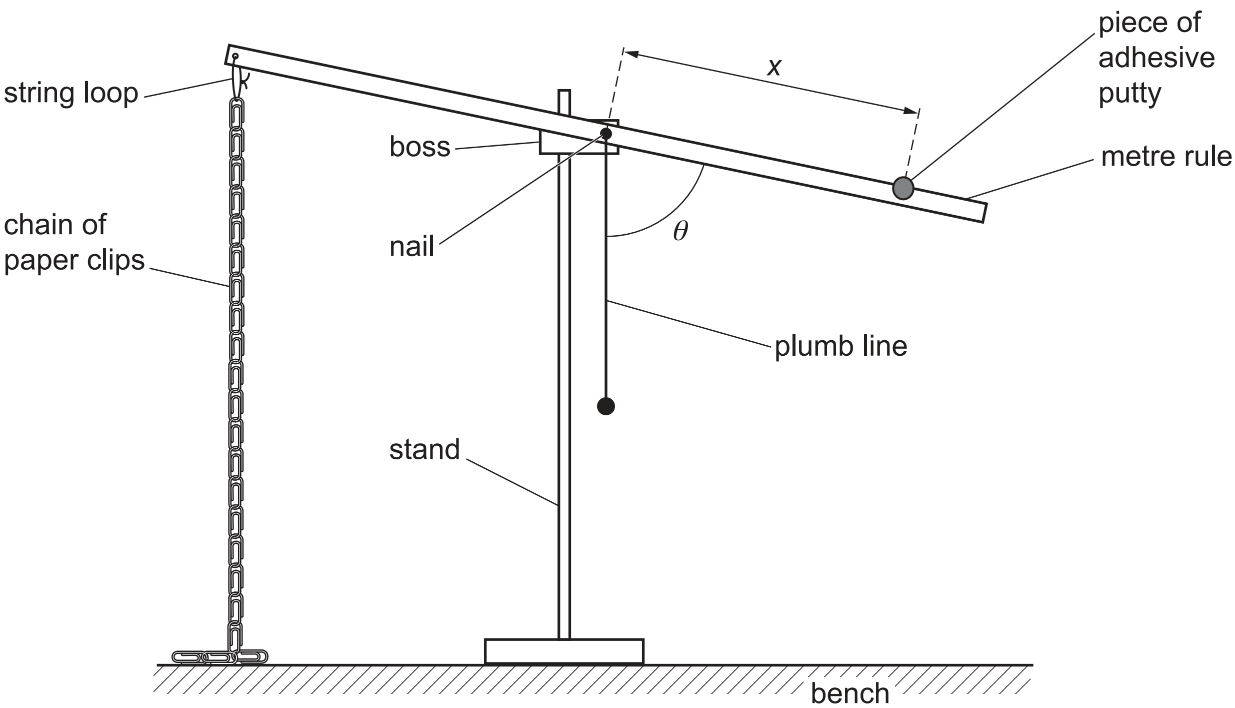

Fig. 1.1

- Measure and record the distance x between the nail and the centre of the piece of adhesive putty, as shown in Fig. 1.1.

x = ... cm [1]

(b) Measure and record the angle θ between the metre rule and the plumb line, as shown in Fig. 1.1.

θ = ... ° [1]

(c) Vary x and measure θ until you have six sets of values of x and θ.
Do not use values of x less than 15 cm.

Record your results in a table. Include values of $\cos\theta$ in your table.

[10]

(d) **(i)** Plot a graph of $\cos\theta$ 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 θ and x are related by the equation

$$\cos\theta = ax + b$$

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]

[Total: 20]

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

2 In this experiment, you will investigate the motion of a roller on an inclined surface.

(a) You are provided with a roller made from a bolt and two washers, as shown in Fig. 2.1.

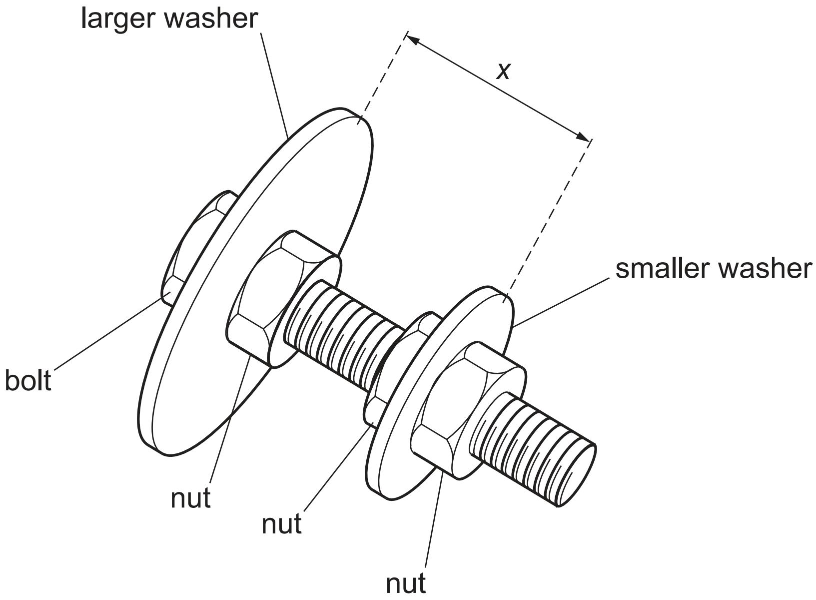

Fig. 2.1

(i) Measure and record the distance x between the two lower faces of the washers, as shown in Fig. 2.1.

x = ... [1]

(ii) Measure and record the diameter D of the larger washer and the diameter d of the smaller washer.

D = ...

d = ...
[1]

(iii) Calculate L, where

$$L = \frac{xD}{(D-d)}.$$

L = ... [1]

(iv) Justify the number of significant figures you have given for your value of L.

....

....

.... [1]

(b) • Place the flat board on the bench and support the board with the wooden block so that the board is at an angle θ of approximately 10° to the bench, as shown in Fig. 2.2.

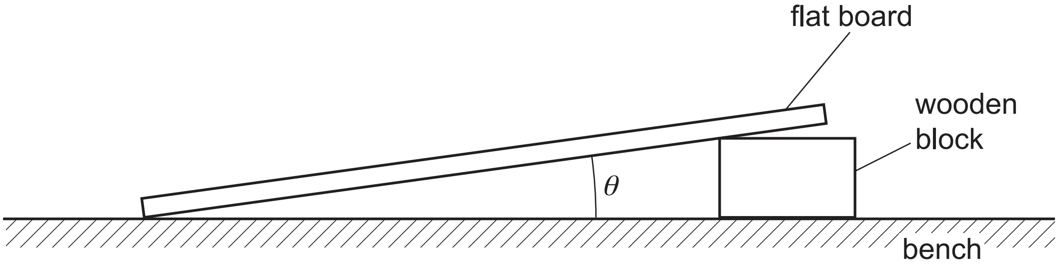

Fig. 2.2

• Measure and record θ.

θ = ... °

(i) • Place the roller on the board as shown in Fig. 2.3 and wait until it is stationary.

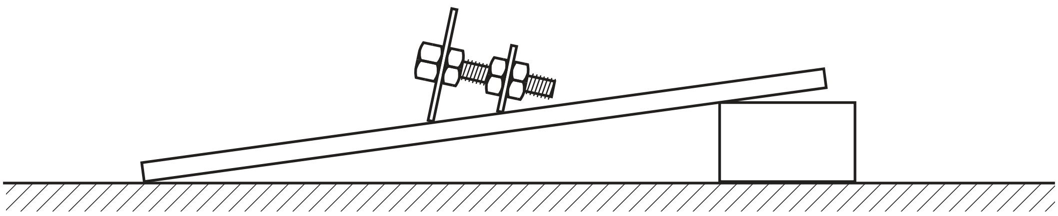

Fig. 2.3

• Push the roller to one side and release it. The roller will oscillate.

• Take measurements to find the period T of the oscillations.

T = ... s [2]

(ii) Estimate the percentage uncertainty in your value of T. Show your working.

percentage uncertainty = ... [1]

(c)
- Use the spanners to loosen the two nuts either side of the smaller washer.
- Move these nuts and the smaller washer along the bolt until x is as large as possible. Use the spanners to tighten the nuts.
- Repeat **(a)(i)**, **(a)(iii)** and **(b)(i)**.

x = ...

L = ...

T = ... s
[2]

(d) It is suggested that the relationship between T, L and x is

$$kT^2 = L - \frac{x}{2}$$

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 **(d)(i)** support the suggested relationship.

....

....

.... [1]

(e) An approximate value for the acceleration of free fall g is given by

$$g = \frac{4\pi^2 k}{\sin\theta}.$$

Use your second value of k and your value of θ from **(b)** to determine g.

g = ... $\mathrm{m\,s^{-2}}$ [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]

[Total: 20]

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