



Cambridge International AS & A Level

CANDIDATE
NAME

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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	
1	
2	
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This document has **12** pages. Blank pages are indicated.

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.

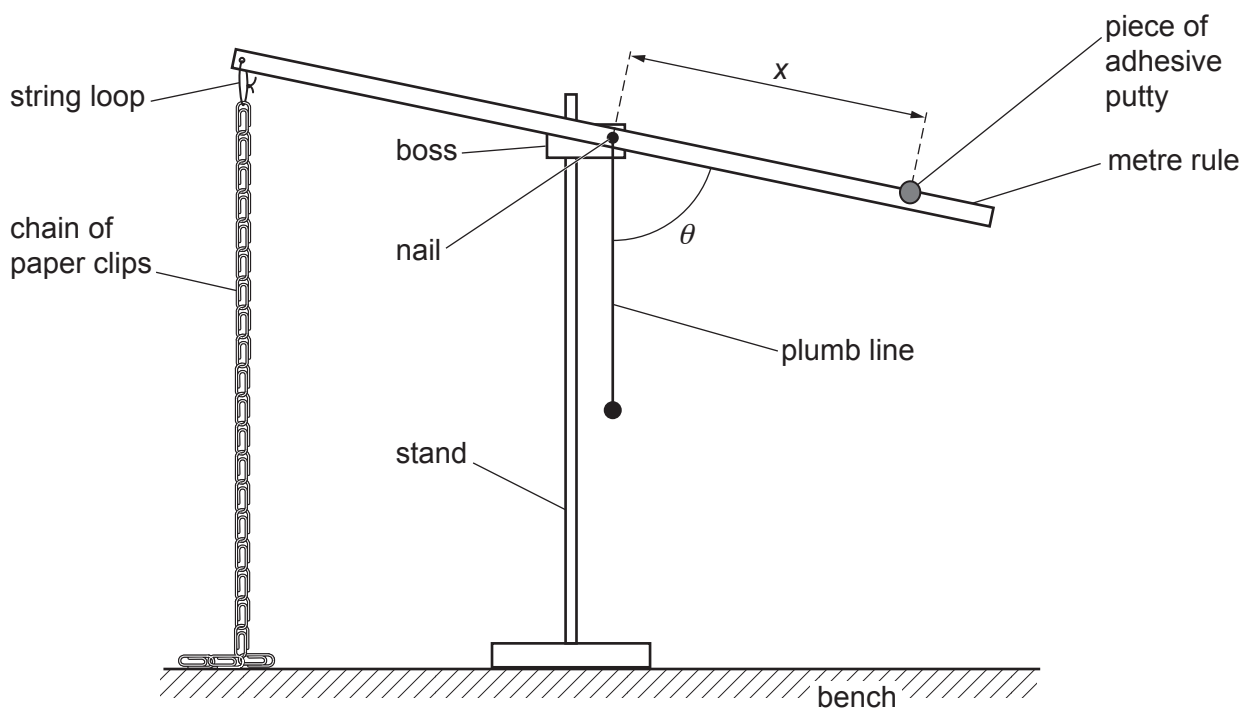


Fig. 1.1

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

$x = \dots\dots\dots$ cm [1]

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

$\theta = \dots\dots\dots^\circ$ [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.

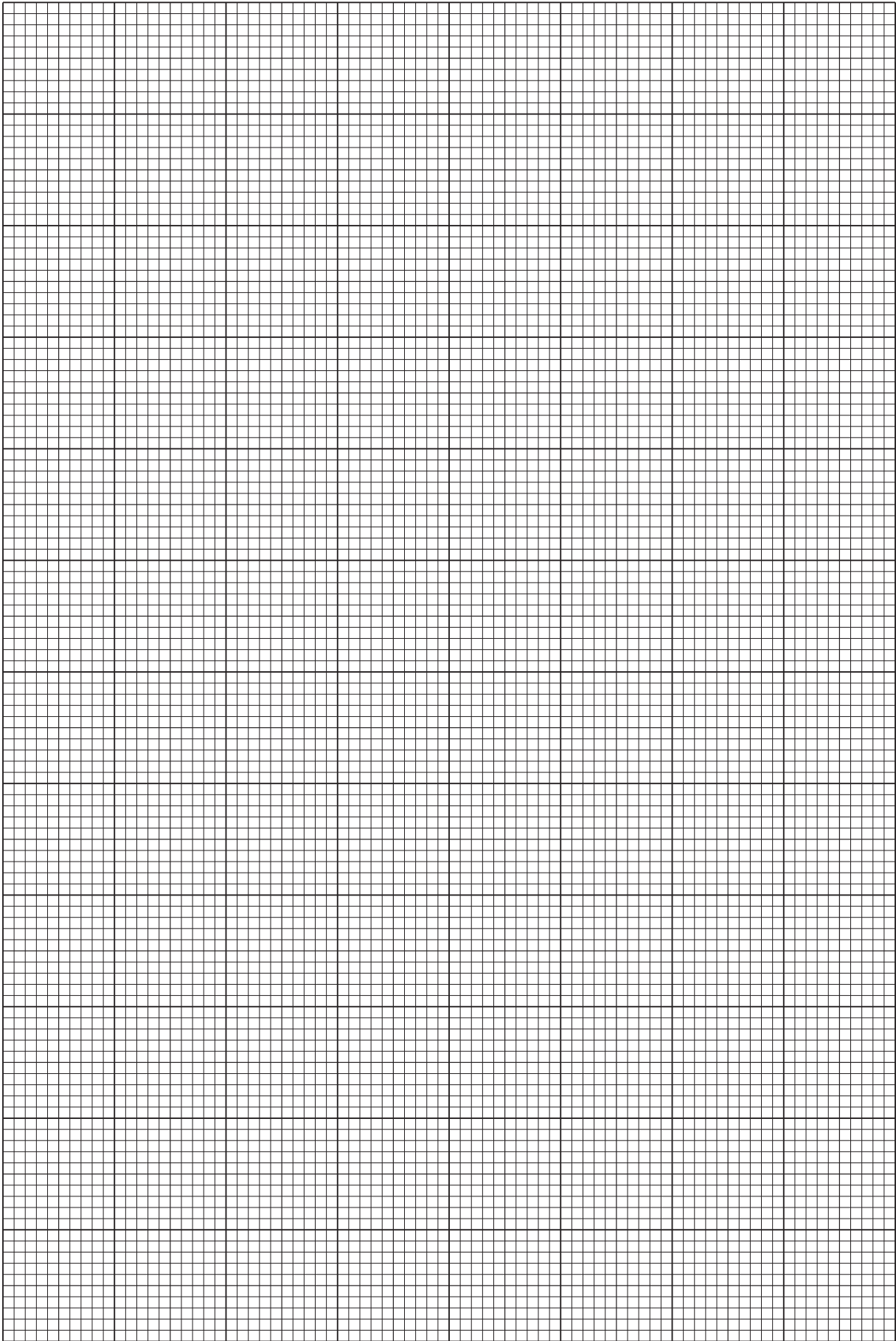
Record your results in a table. Include values of $\cos \theta$ in your table.

- [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.

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots$$

[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.

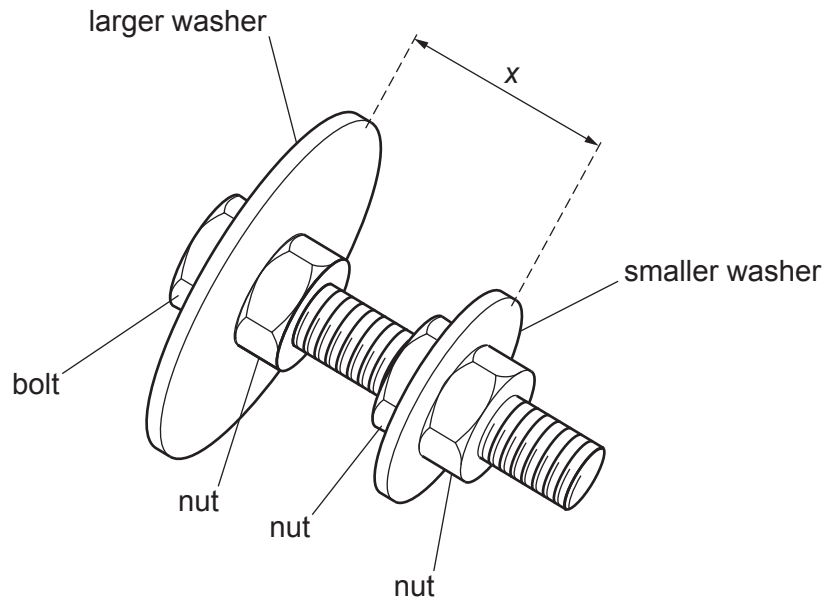


Fig. 2.1

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

$x = \dots\dots\dots$ [1]

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

$D = \dots\dots\dots$

$d = \dots\dots\dots$ [1]

(iii) Calculate L , where

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

$L = \dots\dots\dots$ [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.

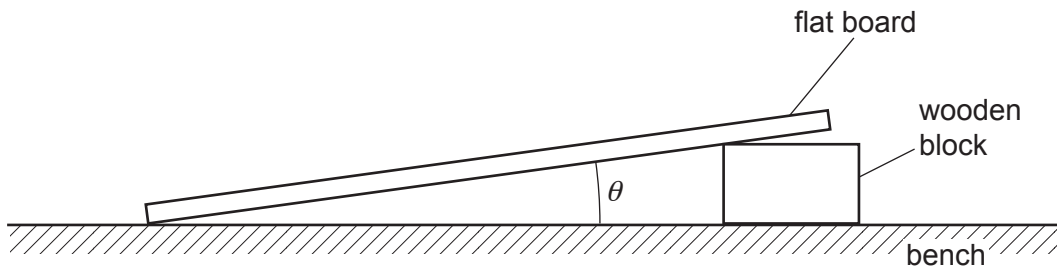


Fig. 2.2

• Measure and record θ .

$\theta =$ $^\circ$

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

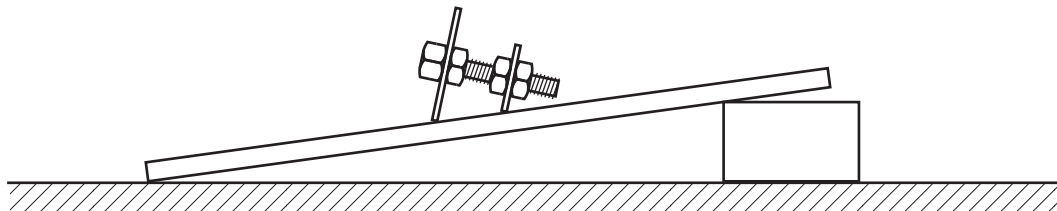


Fig. 2.3

- 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 .

$g = \dots \text{ms}^{-2}$ [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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