



Cambridge International AS & A Level

CANDIDATE
NAME
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PHYSICS

9702/33

Paper 3 Advanced Practical Skills 1

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	
Total	

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

2

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

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

(a) Using the calipers, determine the diameter of one of the masses.

diameter = cm [2]

(b) • Set up the apparatus as shown in Fig. 1.1, with the scale on the metre rule facing upwards.

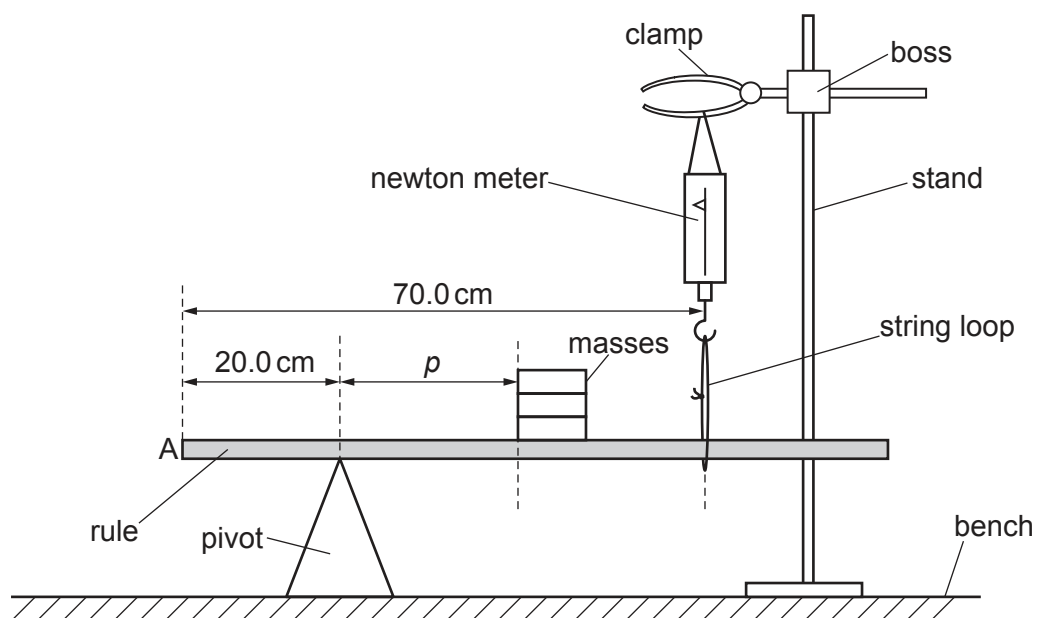


Fig. 1.1 (not to scale)

3

- Adjust the apparatus until the pivot is 20.0 cm from end A of the rule and the string loop is 70.0 cm from end A of the rule.
The pivot and string loop should remain at these positions throughout the experiment.
- Place the three masses with the edge of the bottom mass approximately 37 cm from end A of the rule.
- Adjust the stand until the newton meter and string are perpendicular to the bench.
- Adjust the boss and the clamp until the rule is parallel to the bench.
- The distance from the pivot to the edge of the mass is p , as shown in Fig. 1.1.

Measure and record p .

$p = \dots\dots\dots$ cm

- Measure and record the newton meter reading F .

$F = \dots\dots\dots$ N
[1]

4

- (c) • Using your value of diameter from (a), calculate the radius r of a mass.

$r =$ cm

- Vary p in the range $5.0\text{ cm} \leq p \leq 45.0\text{ cm}$ and determine six sets of readings of p and F . For each value of p , adjust the boss and clamp until the rule is parallel to the bench.

Record your values in a table. Include values of $(p + r)$ in your table.

[8]

- (d) (i) Plot a graph of F on the y -axis against $(p + r)$ on the x -axis.

[3]

- (ii) Draw the straight line of best fit.

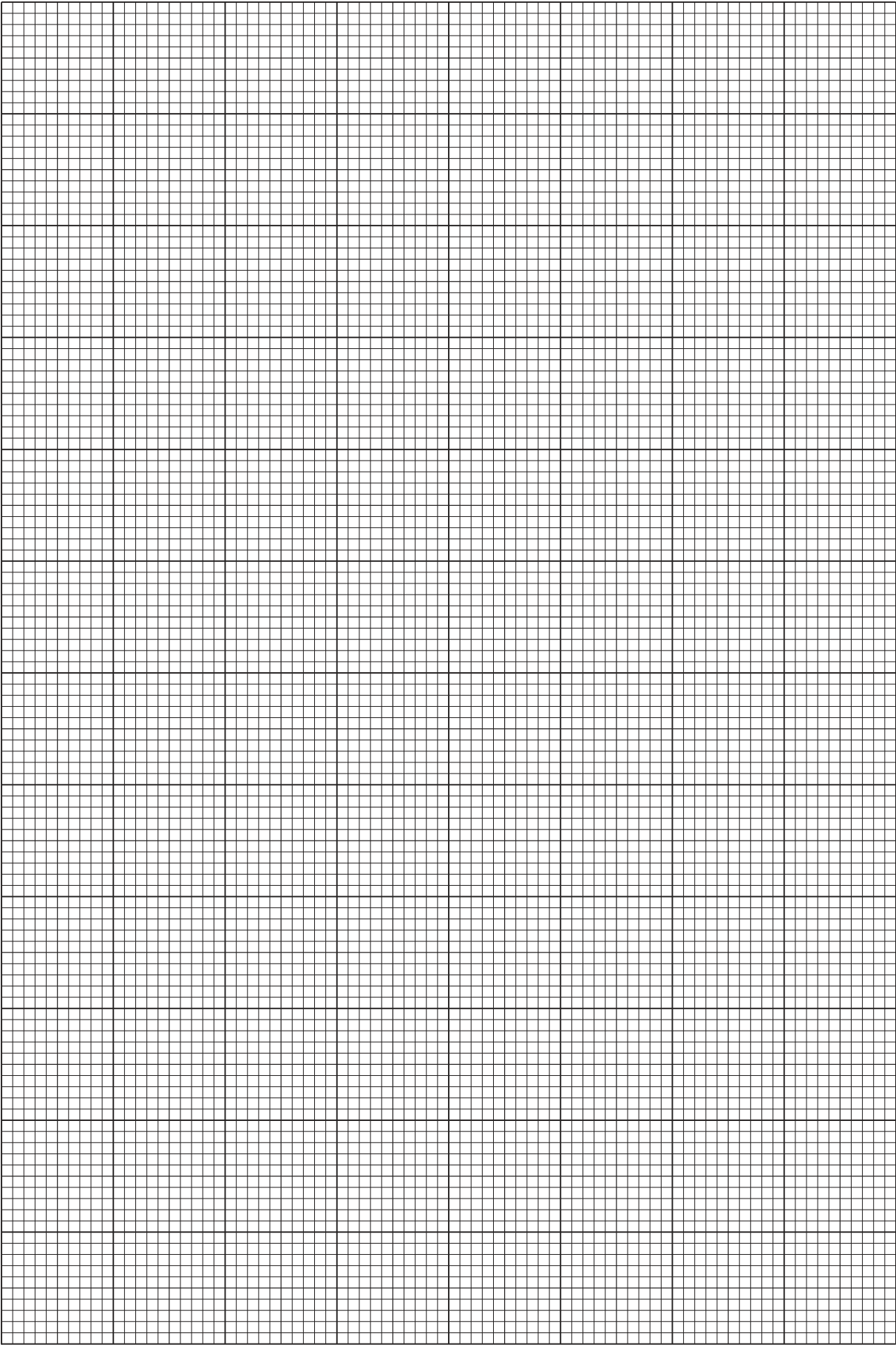
[1]

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

gradient =

y -intercept =

[2]



6

(e) It is suggested that the quantities F and p are related by the equation

$$F = \frac{W}{Q} (p + r) + \frac{S}{Q}$$

where $W = 3.00 \text{ N}$ and Q and S are constants.

Using your answers to **(d)(iii)**, determine values for Q and S .
Give appropriate units.

$Q =$

$S =$

[3]

[Total: 20]

7

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

2 In this experiment, you will investigate the oscillations of a square shape.

- (a) (i) • Bend the wire to form a square shape so that the length L of each side is approximately 12 cm, as shown in Fig. 2.1.

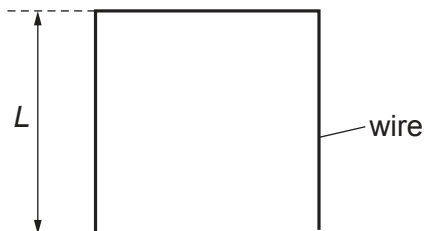


Fig. 2.1

- Use the wire cutters to remove any excess wire.
- Measure and record L .

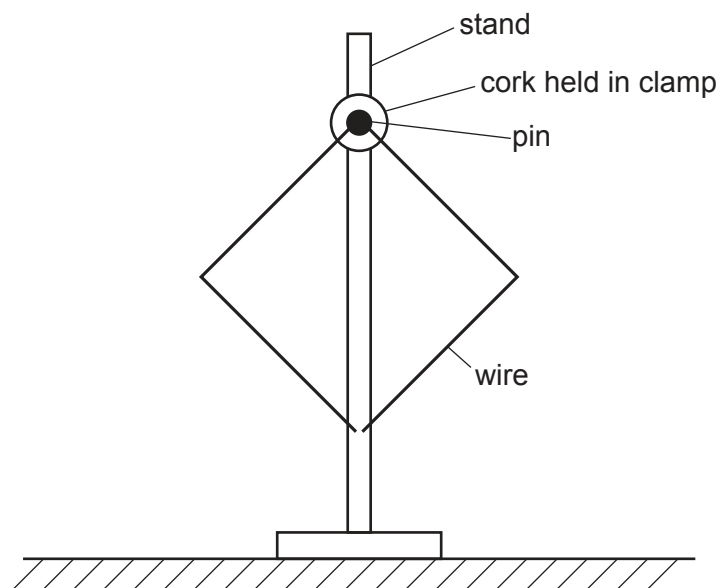
$L =$ cm [1]

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

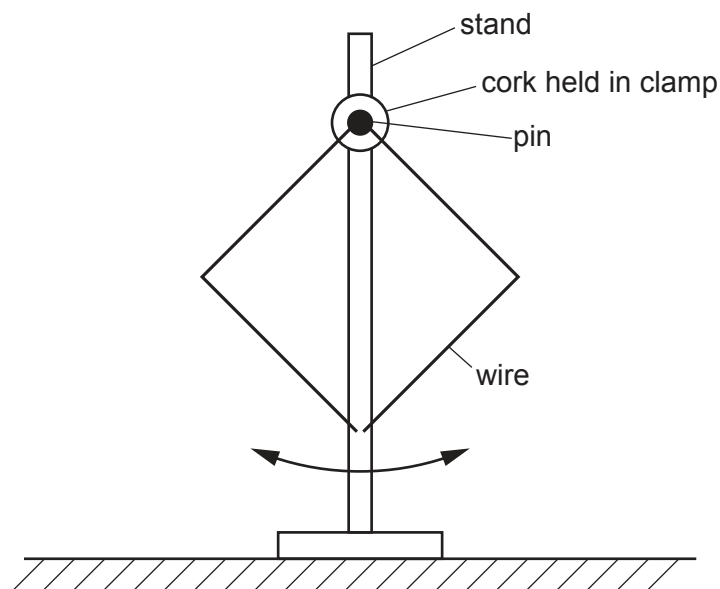
percentage uncertainty = [1]

8

- (b) (i)
- Place the cork in the clamp and attach the clamp to the stand using the boss.
 - Hang the wire square from the pin as shown in Fig. 2.2.

**Fig. 2.2**

- Gently displace the wire square and release it so that it oscillates as shown in Fig. 2.3.

**Fig. 2.3**

9

- Determine the period T of the oscillations.

$$T = \dots\dots\dots \text{ s [3]}$$

- (ii) Calculate T^2 .

$$T^2 = \dots\dots\dots \text{ s}^2 \text{ [1]}$$

- (iii) Justify the number of significant figures you have given for your value of T^2 .

.....

 [1]

- (c)
- Remove the wire square from the pin.
 - Form a new square shape from the wire so that L is approximately 6 cm.
 - Use the wire cutters to remove the excess wire.
 - Measure and record L .

$$L = \dots\dots\dots \text{ cm}$$

- Repeat **(b)(i)** and **(b)(ii)**.

$$T = \dots\dots\dots \text{ s}$$

$$T^2 = \dots\dots\dots \text{ s}^2 \text{ [2]}$$

10

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

$$T^2 = \frac{L}{k}$$

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]

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

$$g = 46.5k.$$

Use your second value of k to calculate a value for g .

g = ms^{-2} [1]

(f) (i) Describe four sources of uncertainty or limitations of the procedure for this experiment.

1.
.....
2.
.....
3.
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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.
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2.
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3.
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4.
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[4]

[Total: 20]

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