Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

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	

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[Turn over

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.

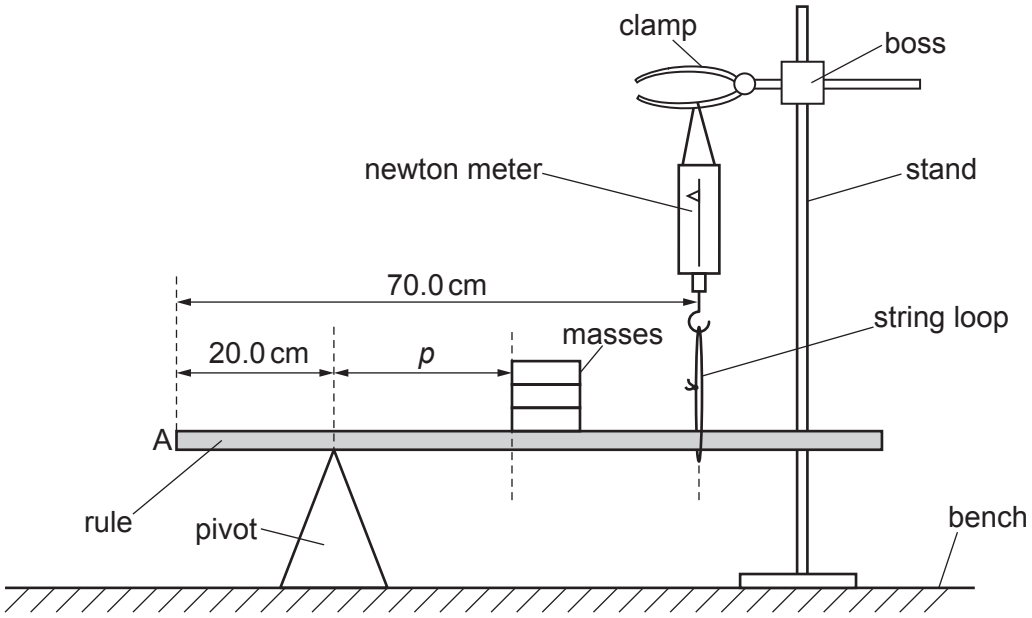


Fig. 1.1 (not to scale)

- 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 = ... cm

- Measure and record the newton meter reading *F*.

F = ... N
[1]

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

r = ... cm

● Vary p in the range 5.0 cm ≤ p ≤ 45.0 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]

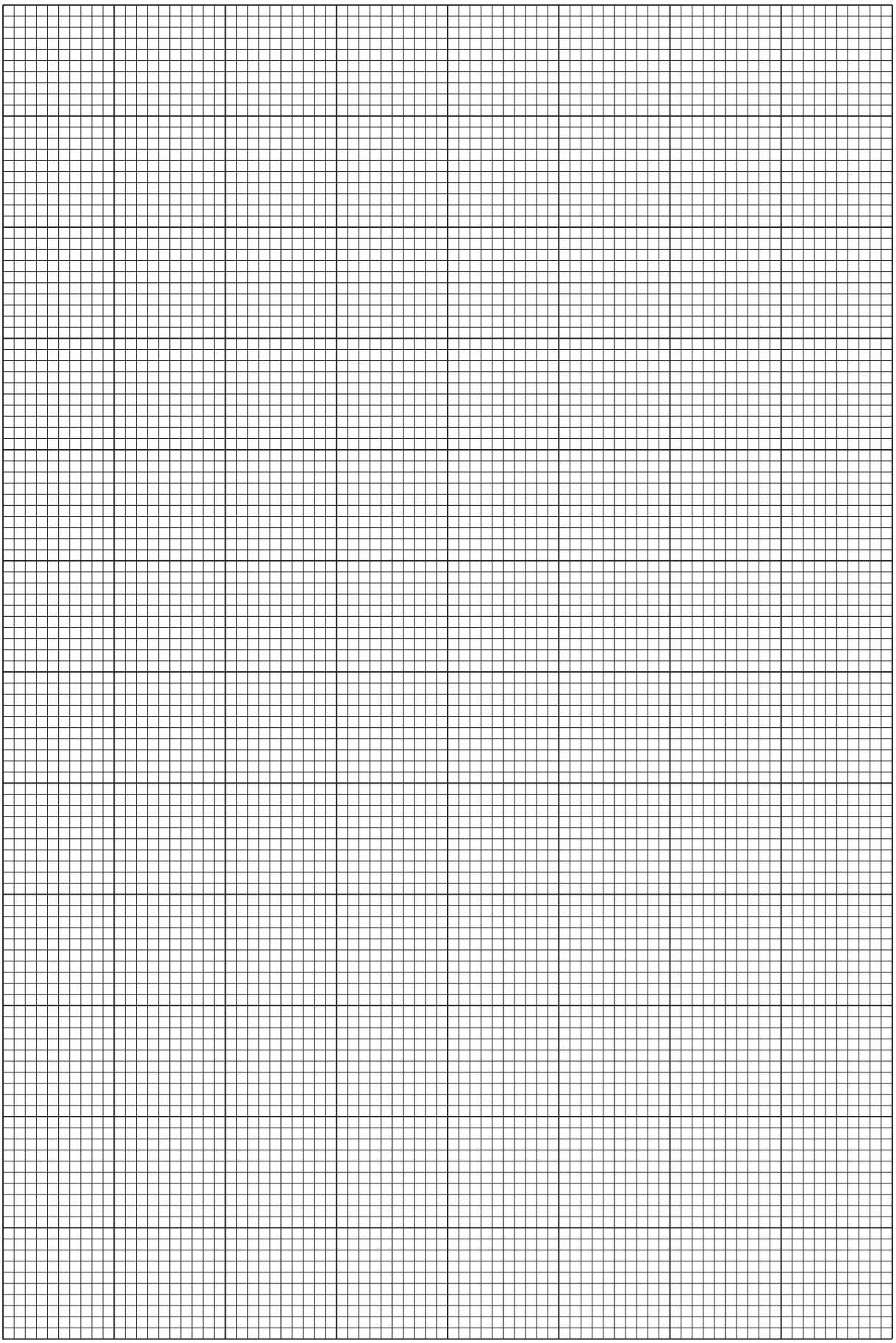
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...

[2]



(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]

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.

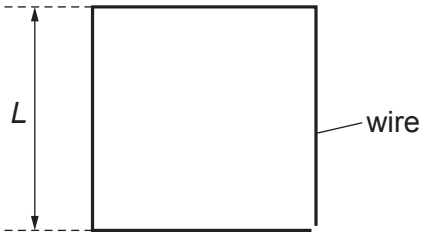


Fig. 2.1

- 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]

[Turn over

(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.

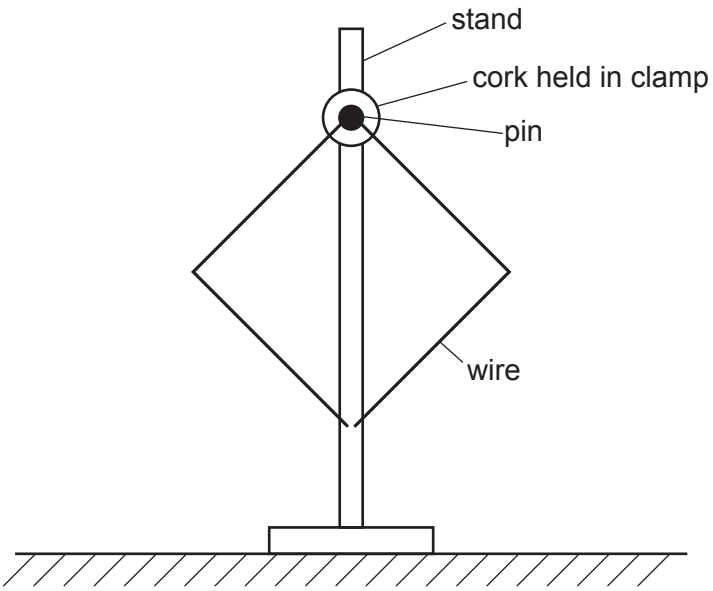


Fig. 2.2

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

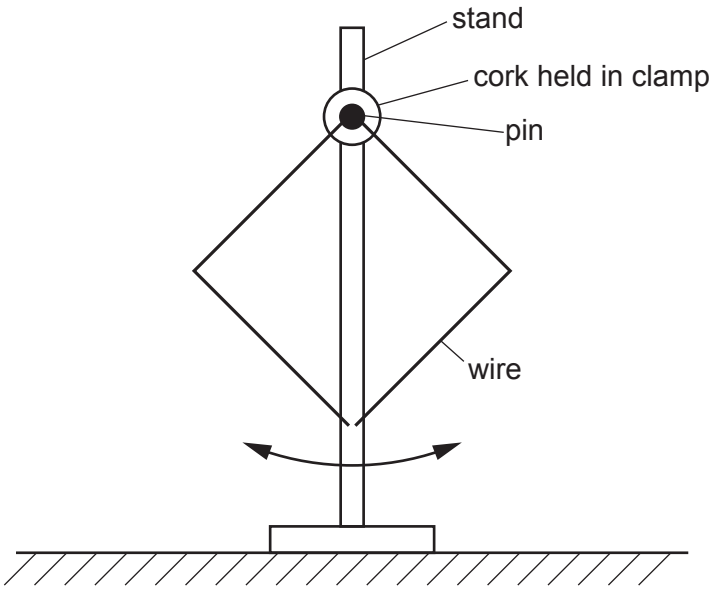


Fig. 2.3

- Determine the period T of the oscillations.

T = ... s [3]

(ii) Calculate T^2.

T^2 = ... s^2 [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 = ... cm

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

T = ... s

T^2 = ... s^2 [2]

[Turn over

(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 = ... $m\,s^{-2}$ [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. .....

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3. .....

.....

4. .....

.....

[4]

[Total: 20]

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