



Cambridge International AS & A Level

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PHYSICS**9702/31**

Paper 3 Advanced Practical Skills 1

October/November 2025**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.

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

- 1** In this experiment, you will investigate oscillations.

You have been provided with a double spring and two single springs.

- (a) (i)**
- Slide the double spring and the two single springs onto the longer wooden rod.
 - Set up the apparatus as shown in Fig. 1.1.

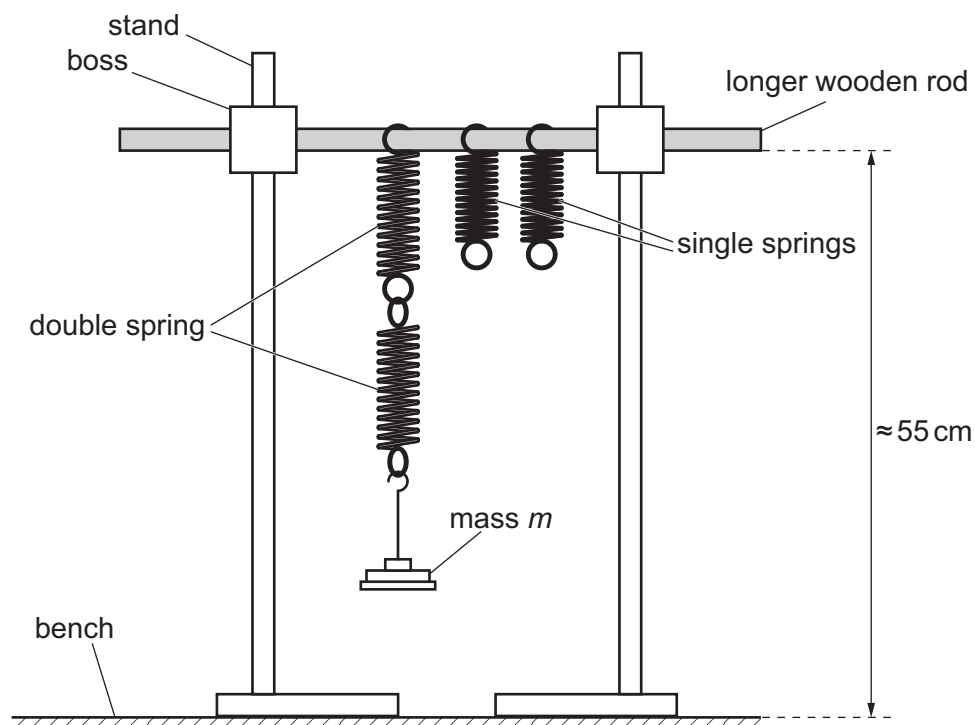


Fig. 1.1

- Use the bosses to fix the wooden rod approximately 55cm above the bench and parallel to the bench.
- Hang a total mass of 270 g from the double spring.
- The mass hanging from the double spring is m .

Record m .

$m = \dots\dots\dots$ [1]



- (ii) • Gently pull the mass down through a short distance. When released, the mass will oscillate.
- Take measurements to determine the period T_1 of the oscillations.

$$T_1 = \dots\dots\dots$$

- Remove the mass from the double spring.

[2]

- (b) • Using the shorter wooden rod, hang mass m as shown in Fig. 1.2.

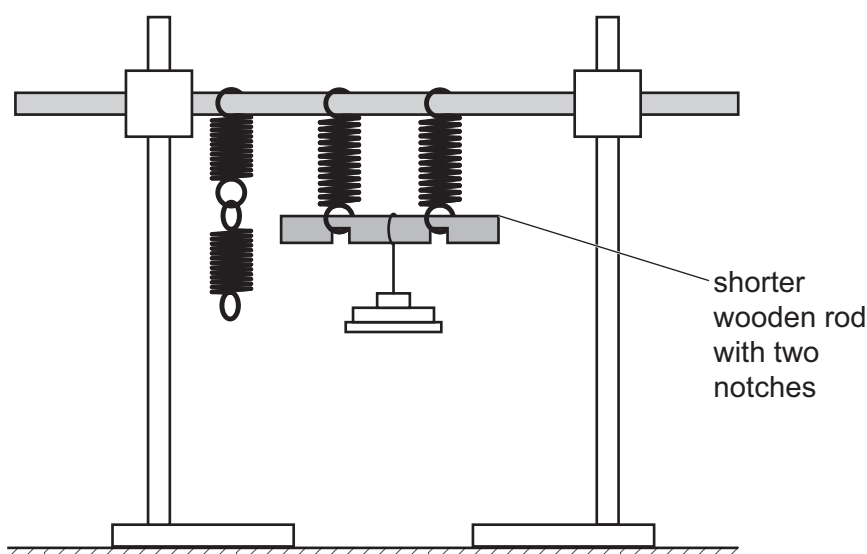


Fig. 1.2

- **Gently** place the hook of the mass hanger near the centre of the shorter rod.
- **Carefully** adjust the position of the mass hanger until the shorter rod is approximately parallel to the bench, as shown in Fig. 1.2.
- Gently pull the mass down through a short distance. When released, the mass will oscillate.
- Take measurements to determine the period T_2 of the oscillations.

$$T_2 = \dots\dots\dots$$

- Remove the mass.

[1]





- (c) Vary m . For each value of m , determine T_1 and T_2 . Repeat until you have five sets of values of m , T_1 and T_2 . Do **not** use values of m less than 200 g.

Record your results in a table. Include values of $\sqrt{T_1}$ and $\sqrt{T_2}$ in your table.

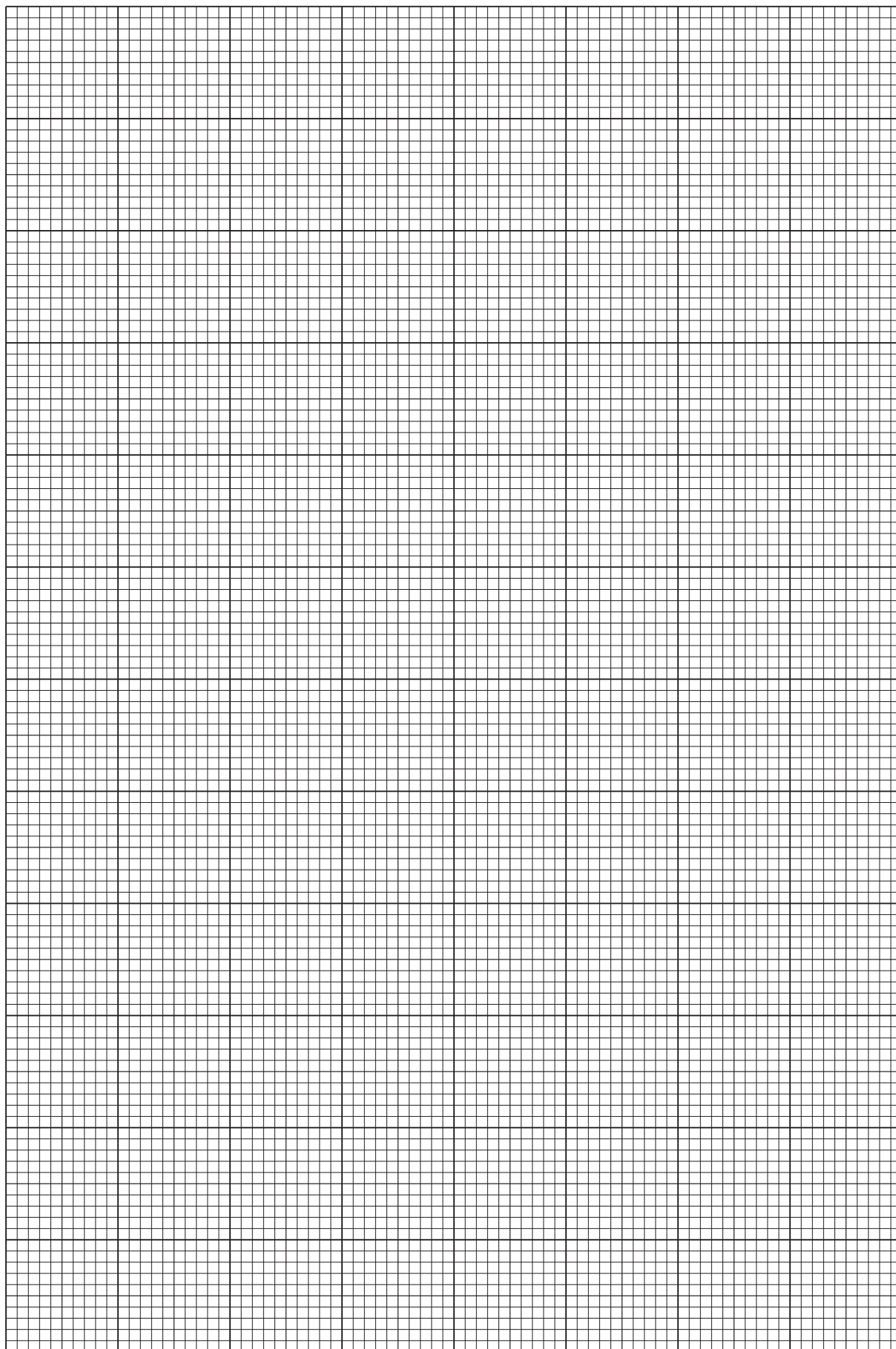
- (d) (i) Plot a graph of $\sqrt{T_2}$ on the y-axis against $\sqrt{T_1}$ on the x-axis. [8]
- (ii) Draw the straight line of best fit. [3]
- (iii) Determine the gradient and y-intercept of this line. [1]

gradient = ...

y-intercept = ...

[2]





(e) It is suggested that the quantities $\sqrt{T_2}$ and $\sqrt{T_1}$ are related by the equation

$$\sqrt{T_2} = P\sqrt{T_1} + Q$$

where P and Q are constants.

Using your answers in (d)(iii), determine the values of P and Q .
Give appropriate units.

$P =$

$Q =$

[2]

[Total: 20]



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

2 In this experiment, you will investigate the deformation of paper cylinders.

(a) You have been provided with two pieces of paper.

The width of a piece of paper is the length w of the shorter side, as shown in Fig. 2.1.



Fig. 2.1

- Select the **smaller** piece of paper.
- Measure and record w .

$w =$ cm

- Roll the paper into a cylinder and use two paper clips to hold the paper in place, as shown in Fig. 2.2.

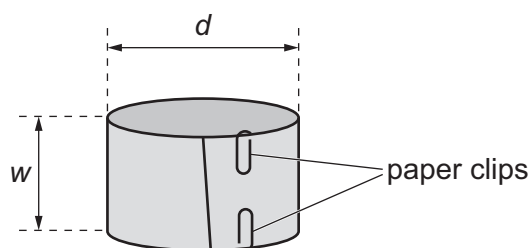


Fig. 2.2

- The diameter of the cylinder is d , as shown in Fig. 2.2.

Adjust the paper and paper clips until d is as close as possible to 7.0 cm.

- Measure and record d .

$d =$ cm
[2]



- (b) (i) • Set up the apparatus as shown in Fig. 2.3.

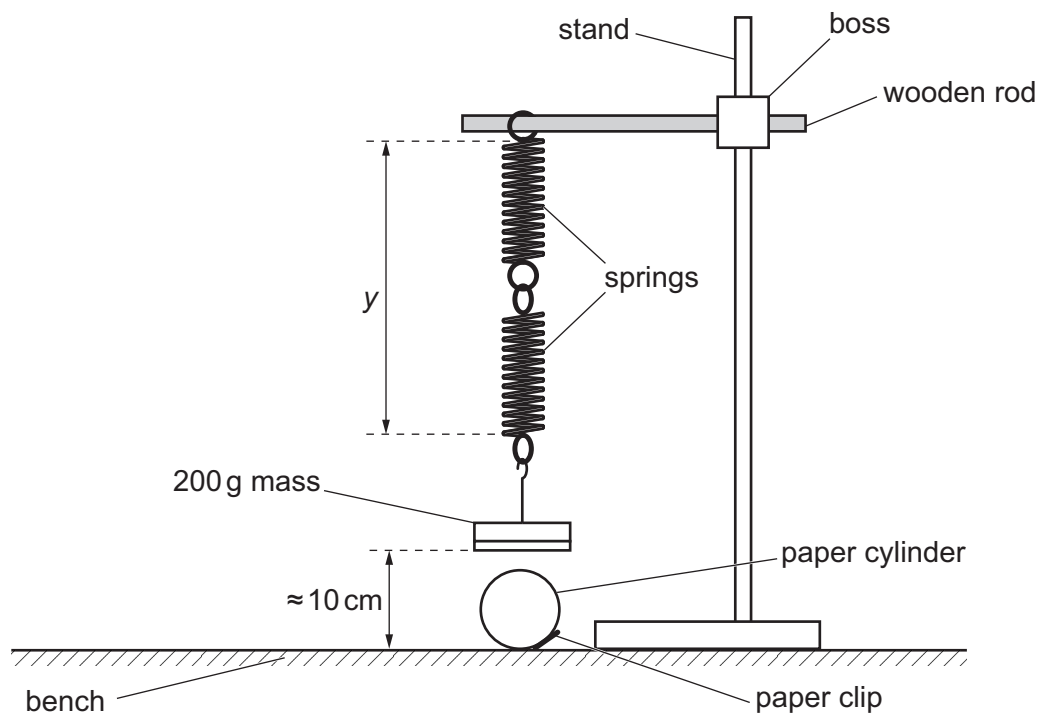


Fig. 2.3

- Slide the loop of the upper spring onto the wooden rod.
- Hang a mass of 200 g from the lower spring.
- Adjust the height of the boss until the bottom of the mass is approximately 10 cm above the bench.
- Place the paper cylinder so that the middle of the cylinder is under the mass, as shown in Fig. 2.3.
- The length of the springs is y , as shown in Fig. 2.3.

Measure and record y .

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



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

percentage uncertainty = ...% [1]

- (c) (i) • By adjusting the height of the boss, lower the mass to squash the middle of the paper cylinder until the bottom of the mass is 2.5 cm above the bench, as shown in Fig. 2.4.

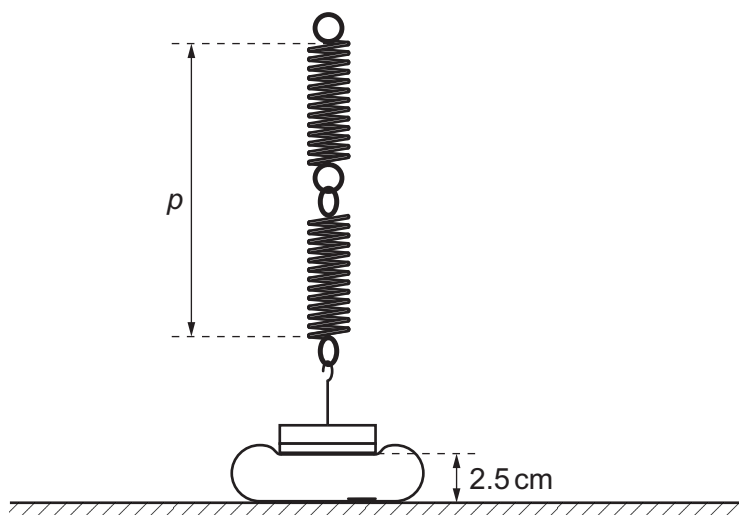


Fig. 2.4 (not to scale)

- The length of the springs is p , as shown in Fig. 2.4.

Measure and record p .

$p =$ cm [1]

- (ii) Calculate $(y - p)$.

$(y - p) =$ cm [1]





(d) Using the **larger** sheet of paper, repeat (a), (b)(i), (c)(i) and (c)(ii).

$w = \dots\dots\dots$ cm

$d = \dots\dots\dots$ cm

$y = \dots\dots\dots$ cm

$p = \dots\dots\dots$ cm

$(y - p) = \dots\dots\dots$ cm
[3]

(e) It is suggested that the relationship between w , y and p is

$$w = k(y - p)$$

where k is a constant.

(i) Using your data, calculate **two** values of k .

first value of $k = \dots\dots\dots$

second value of $k = \dots\dots\dots$
[1]

(ii) Justify the number of significant figures that you have given for your values of k .

.....
.....
..... [1]





(f) It is suggested that the percentage uncertainty in the values of k is 10%.

Using this uncertainty, explain whether your results support the relationship in (e).

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..... [1]



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

For any uncertainties in measurement that you describe, you should state the quantity being measured and a reason for the uncertainty.

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[4]

- (ii) Describe **four** improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

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PHYSICS

9702/33

Paper 3 Advanced Practical Skills 1

October/November 2025

2 hours

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1 In this experiment, you will investigate the oscillations of a pendulum on a board.

- (a) • Fix the string of the pendulum onto the nail using some of the adhesive putty, as shown in Fig. 1.1.

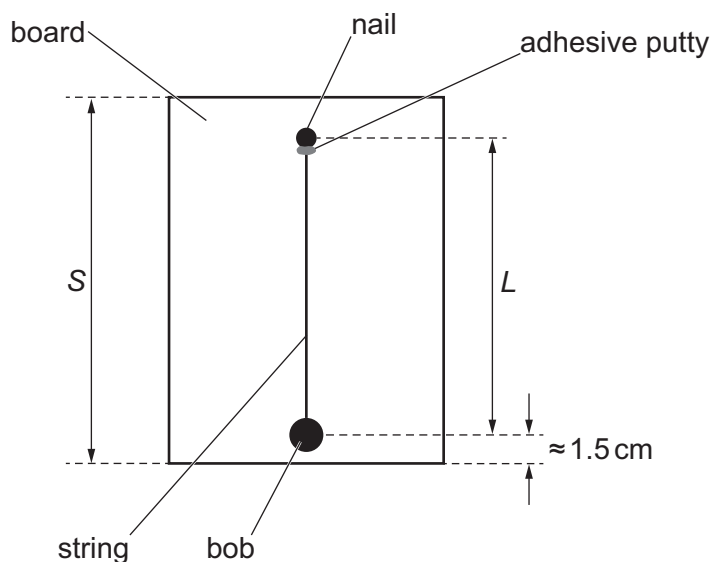


Fig. 1.1

- The distance between the two edges of the board is S , as shown in Fig. 1.1.

The length L of the pendulum is the distance between the centre of the nail and the centre of the bob.

Adjust the length of the pendulum by wrapping the string around the nail so that the centre of the bob is approximately 1.5 cm from the edge of the board.

- Measure and record S and L .

$S =$ cm

$L =$ cm
[1]



- (b) • Set up the apparatus as shown in Fig. 1.2.

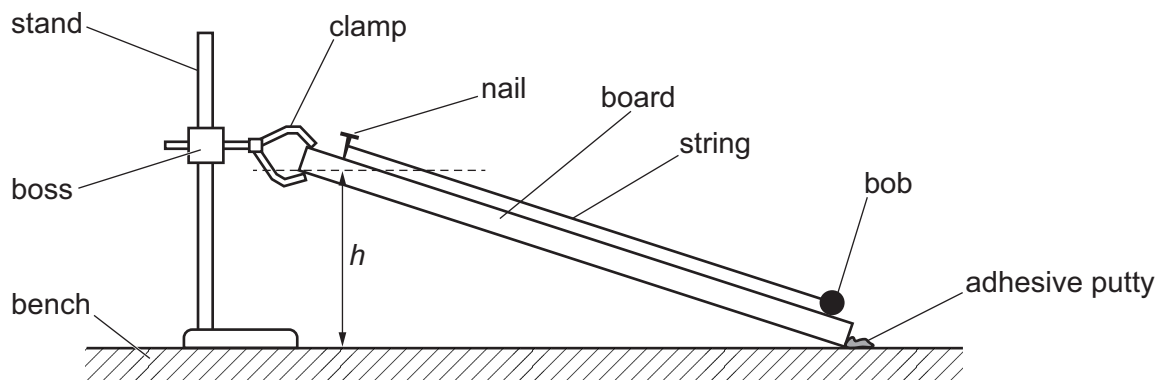


Fig. 1.2

- The distance between the lower edge of the top of the board and the bench is h , as shown in Fig. 1.2.

Adjust the position of the boss so that h is approximately 22 cm.

- Fix the position of the bottom of the board using adhesive putty.
- Measure and record h .

$h = \dots\dots\dots$ cm

- Move the bob to the edge of the board, as shown in Fig. 1.3.

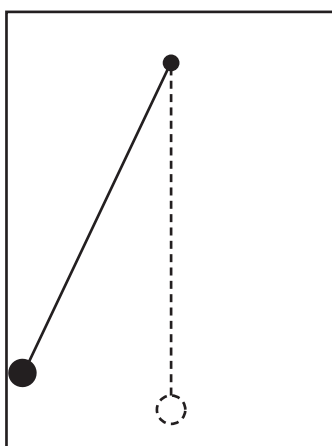


Fig. 1.3

- Release the bob. The bob rolls across the board and the pendulum oscillates.
- Take measurements to determine the period T of the oscillations.

$T = \dots\dots\dots$ s
[2]



- (c) Change h in the range $10.0\text{ cm} \leq h \leq 38.0\text{ cm}$ and determine T . Repeat until you have six sets of values of h and T .

Record your results in a table. Include values of $\frac{S}{h}$ and T^2 in your table.

[8]

- (d) (i) Plot a graph of T^2 on the y -axis against $\frac{S}{h}$ on the x -axis.

[3]

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

[1]

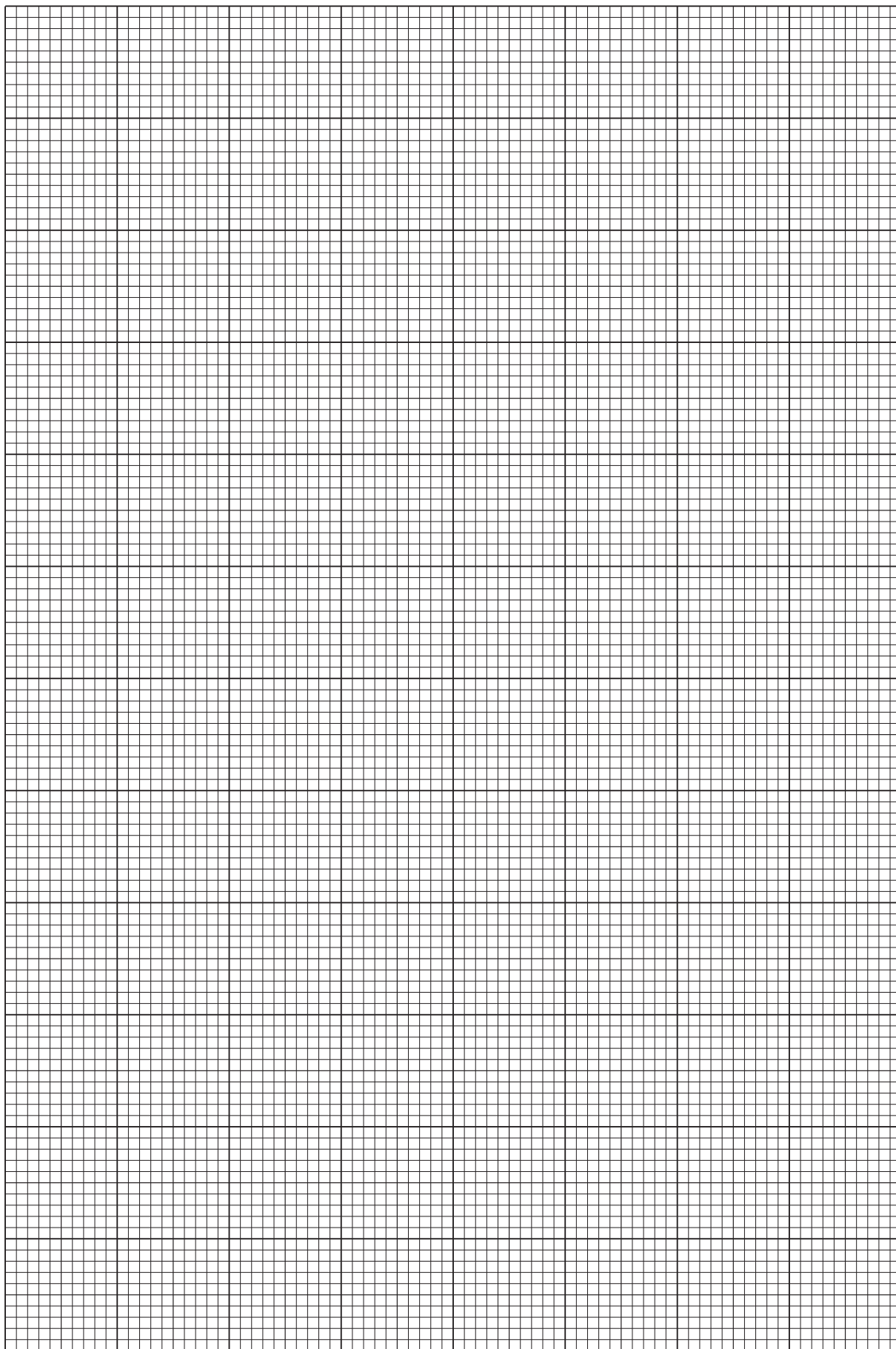
- (iii) Determine the gradient and y -intercept of this line.

gradient = ...

y -intercept = ...

[2]





- (e) (i) It is suggested that the quantities T , S and h are related by the equation

$$T^2 = A \frac{S}{h} + B$$

where A and B are constants.

Using your answers in (d)(iii), determine the values of A and B .
Give appropriate units.

$$A = \dots\dots\dots$$

$$B = \dots\dots\dots$$

[2]

- (ii) Theory suggests that

$$A = \frac{28\pi^2 L}{5g}$$

where g is the acceleration of free fall.

Use your values in (a) and (e)(i) to determine a value for g .
Give an appropriate unit.

$$g = \dots\dots\dots [1]$$

[Total: 20]





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

- 2** In this experiment, you will investigate the resistance of a light-dependent resistor (LDR) using the light from a light-emitting diode (LED).

(a) (i) • Using the LED, set up the circuit shown in Fig. 2.1.

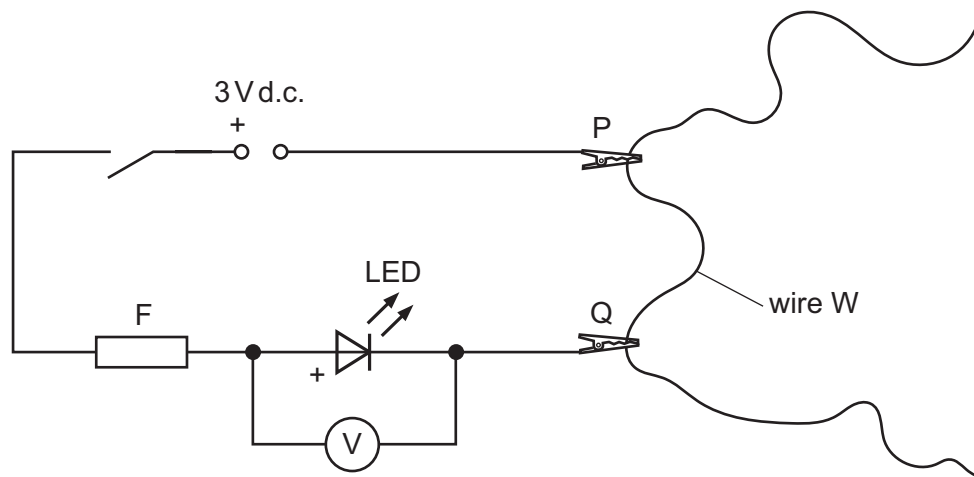


Fig. 2.1

- Ensure that the positive terminal of the power supply and the positive terminal of the LED are connected as shown in Fig. 2.1.
- P and Q are crocodile clips. Position P and Q so that there is approximately 10 cm of wire W between P and Q.
- Close the switch. The LED should light.
- Open the switch.
- Using the LDR and ohmmeter, set up a second circuit as shown in Fig. 2.2.

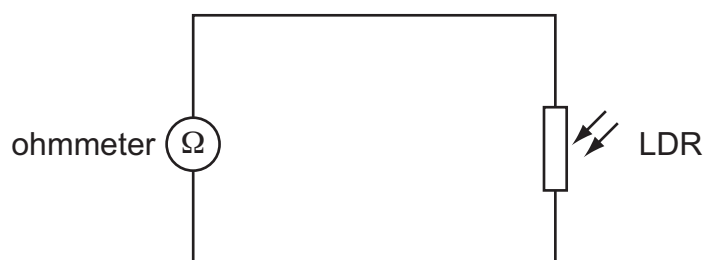


Fig. 2.2



- Arrange the apparatus as shown in Fig. 2.3.

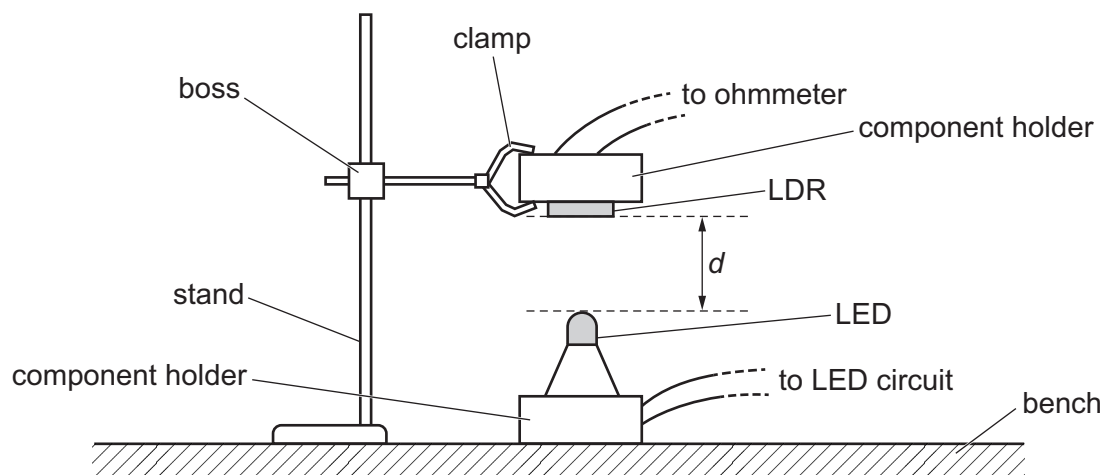


Fig. 2.3 (not to scale)

- The distance between the top of the LED and the surface of the LDR is d .
Adjust the position of the LDR so that d is approximately 0.03 m.
- Measure and record d .

$d = \dots\dots\dots$ m [2]

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

percentage uncertainty = $\dots\dots\dots$ % [1]





- (b) • The length of wire W between P and Q is L .

Measure and record L .

$$L = \dots\dots\dots$$

- Close the switch.
- The potential difference V across the LED is given by the voltmeter.

The resistance R of the LDR is given by the ohmmeter.

Measure and record V and R .

$$V = \dots\dots\dots$$

$$R = \dots\dots\dots$$

- Open the switch.

[2]

- (c) • Change the length of wire W between P and Q so that L is approximately 90 cm.

- Repeat (b).

$$L = \dots\dots\dots$$

$$V = \dots\dots\dots$$

$$R = \dots\dots\dots$$

[3]

- (d) It is suggested that the relationship between V , d and R is

$$V = \frac{Zd}{R} + k$$

where Z has the value $1.00 \times 10^3 \text{ V}\Omega\text{m}^{-1}$ and k is a constant.

- (i) Using your data, calculate **two** values of k .

$$\text{first value of } k = \dots\dots\dots$$

$$\text{second value of } k = \dots\dots\dots$$

[1]



- (ii) Justify the number of significant figures that you have given for your values of k .

.....

.....

..... [1]

- (e) It is suggested that the percentage uncertainty in the values of k is 5%.

Using this uncertainty, explain whether your results support the relationship in (d).

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.....

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..... [1]

- (f) It is suggested that

$$k = \frac{hc}{e\lambda}$$

where h is $6.63 \times 10^{-34} \text{ J s}$,
 c is $3.00 \times 10^8 \text{ m s}^{-1}$,
 e is $1.60 \times 10^{-19} \text{ C}$ and
 λ is the wavelength of the light emitted by the LED.

Use your second value of k to determine λ .

$$\lambda = \dots\dots\dots \text{ m [1]}$$



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

For any uncertainties in measurement that you describe, you should state the quantity being measured and a reason for the uncertainty.

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[4]

- (ii) Describe **four** improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

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[Total: 20]

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PHYSICS**9702/34**

Paper 3 Advanced Practical Skills 2

October/November 2025**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.
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- Write your answer to each question in the space provided.
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- 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

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For Examiner's Use

1	
2	
Total	

This document has **12** pages. Any 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 forces.

(a) (i) • Assemble the apparatus as shown in Fig. 1.1.

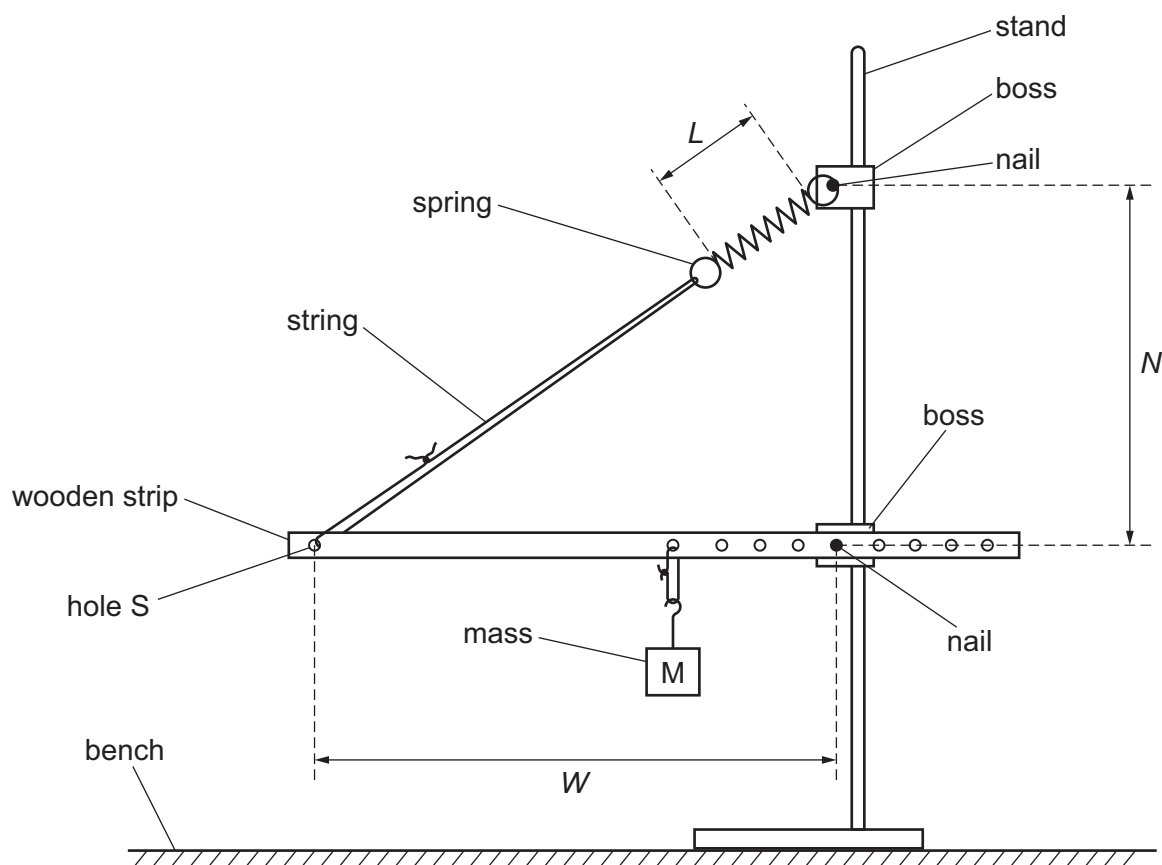


Fig. 1.1

- Adjust the height of the upper boss so that the wooden strip is parallel to the bench.
- The distance between hole S and the lower nail is W .

Measure and record W .

$W =$

- The distance between the two nails is N .

Measure and record N .

$N =$

- The length of the coiled part of the spring is L , as shown in Fig. 1.1.

Measure and record L .

$L =$

[3]





(ii) Calculate Z, where

$$Z = \frac{W}{\sqrt{(N^2 + W^2)}}.$$

Z = ... [1]





- (b) Change W by moving the lower nail to another hole in the wooden strip. Adjust the height of the upper boss so that the wooden strip is parallel to the bench.

Measure and record W , N and L . Repeat until you have six sets of values. Record your results in a table. Include values of Z in your table.

[8]

- (c) (i) Plot a graph of L on the y -axis against Z on the x -axis.

[3]

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

[1]

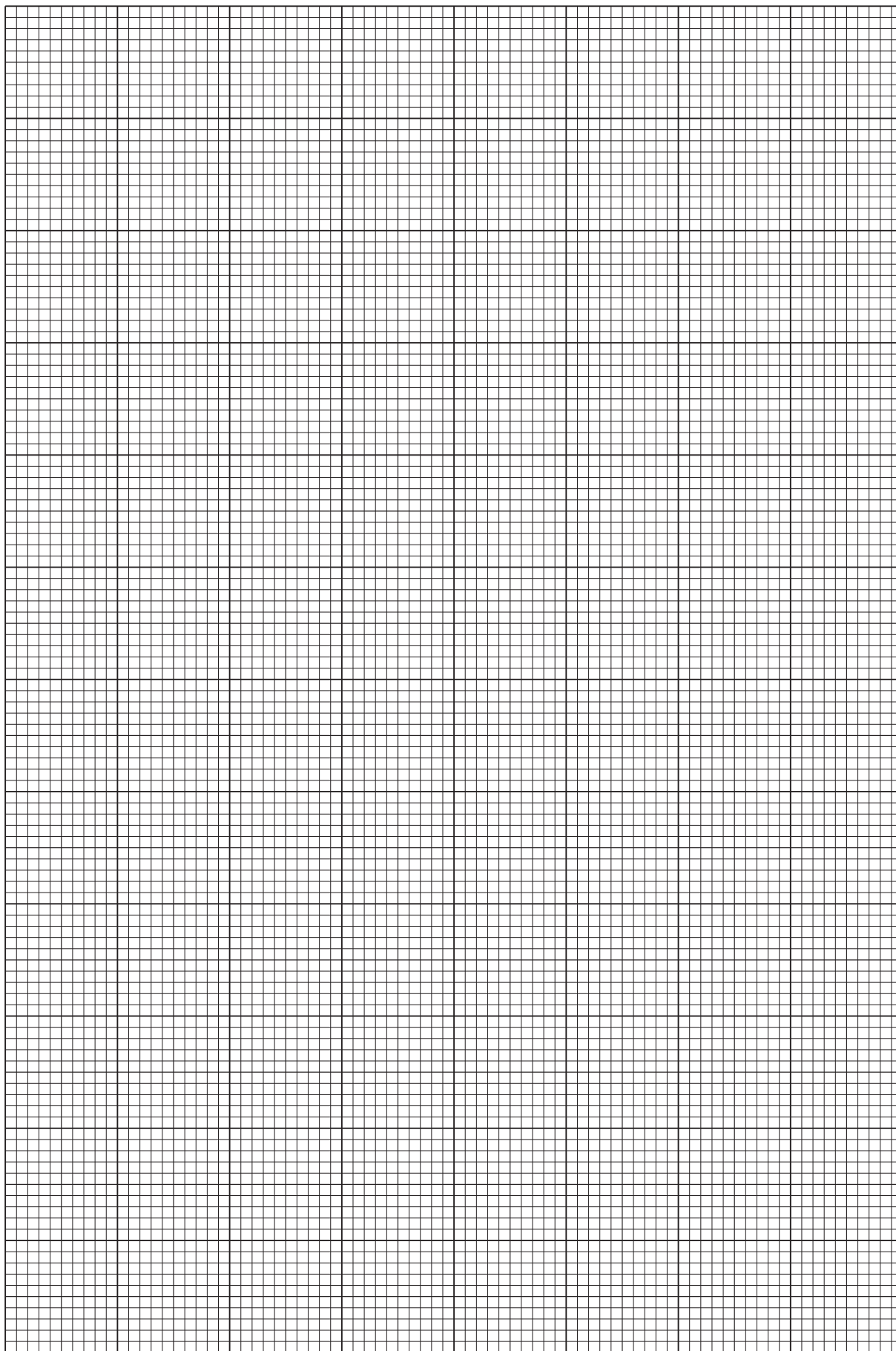
- (iii) Determine the gradient and y -intercept of this line.

gradient = ...

y -intercept = ...

[2]





(d) It is suggested that the quantities L and Z are related by the equation

$$L = aZ + b$$

where a and b are constants.

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

$a =$

$b =$

[2]

[Total: 20]





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

- 2 In this experiment, you will investigate the motion of a sphere rolling along a track.
- (a) You are provided with a length of plastic channel. When the channel is positioned with its open side at the top, it forms a track with a pair of rails along which a sphere can roll.

An end view of the channel is shown in Fig. 2.1.

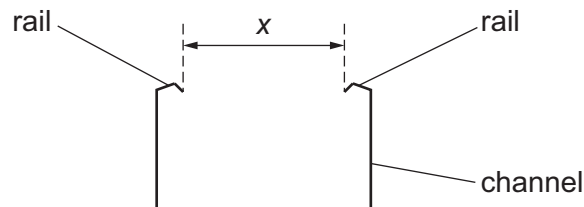


Fig. 2.1

The distance between the rails is x .

Measure and record x .

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

- (b) (i) • Set up the apparatus as shown in Fig. 2.2.

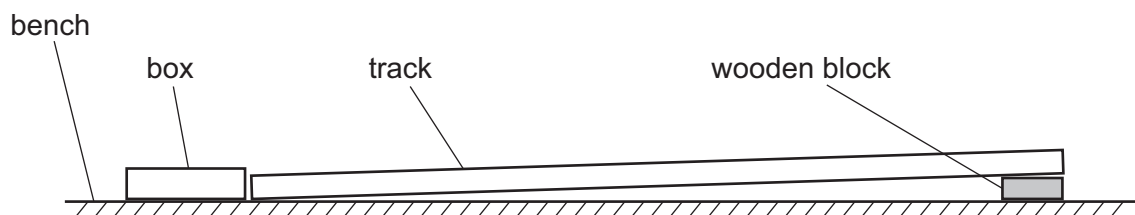


Fig. 2.2

- You are provided with two spheres.

Place the **smaller** sphere on the track. If necessary, adjust the position of the wooden block until the sphere is able to roll along the full length of the track and into the box.

- Secure the block to the track with a small piece of adhesive putty as shown in Fig. 2.3. **The block and track must remain in these positions for the rest of the experiment.**

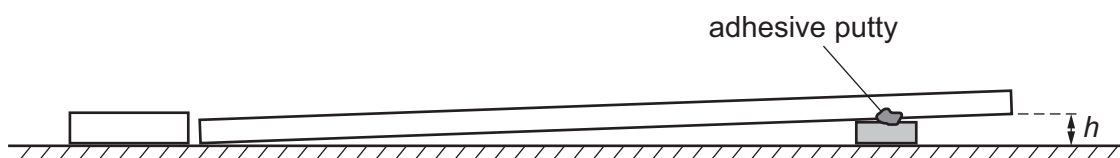


Fig. 2.3



- The height of the raised end of the track above the bench is h , as shown in Fig. 2.3.

Measure and record h .

$$h = \dots\dots\dots [1]$$

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

$$\text{percentage uncertainty} = \dots\dots\dots \% [1]$$

- (c) (i) • Measure and record the diameter d of the smaller sphere.

$$d = \dots\dots\dots$$

- Calculate $1 - \left(\frac{x}{d}\right)^2$.

$$1 - \left(\frac{x}{d}\right)^2 = \dots\dots\dots [1]$$

- (ii) • Place the smaller sphere on the track at the raised end.
- Release the sphere.
 - The time taken for the sphere to roll along the track into the box is t .

Take measurements to determine t .

$$t = \dots\dots\dots [2]$$





(d) Repeat (c) using the **larger** sphere.

$$d = \dots\dots\dots$$

$$1 - \left(\frac{x}{d}\right)^2 = \dots\dots\dots$$

$$t = \dots\dots\dots$$

[3]

(e) It is suggested that the relationship between t , h , x and d is

$$t^2 h = k \left(5 + \frac{2}{1 - \left(\frac{x}{d}\right)^2} \right)$$

where k is a constant.

(i) Using your data, calculate **two** values of k .

$$\text{first value of } k = \dots\dots\dots$$

$$\text{second value of } k = \dots\dots\dots$$

[1]

(ii) Justify the number of significant figures that you have given for your values of k .

.....

.....

..... [1]



(f) It is suggested that the percentage uncertainty in the values of k is 30%.

Using this uncertainty, explain whether your results support the relationship in (e).

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..... [1]





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

For any uncertainties in measurement that you describe, you should state the quantity being measured and a reason for the uncertainty.

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PHYSICS

9702/35

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2 hours

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- You should show all your working and use appropriate units.

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- 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 **16** pages. Any 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 wooden rod.

Some of the apparatus has been set up for you.

- (a) (i) • Fig. 1.1 shows the rod with two eyes.

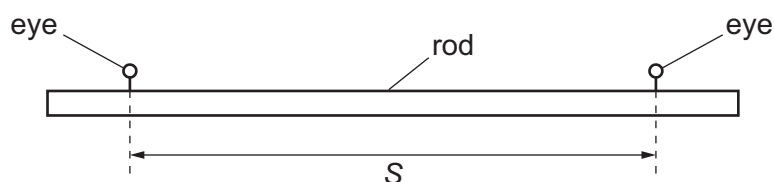


Fig. 1.1

The distance between the two eyes on the rod is S .

Measure and record S .

$S =$

- Complete the set-up of the apparatus as shown in Fig. 1.2.

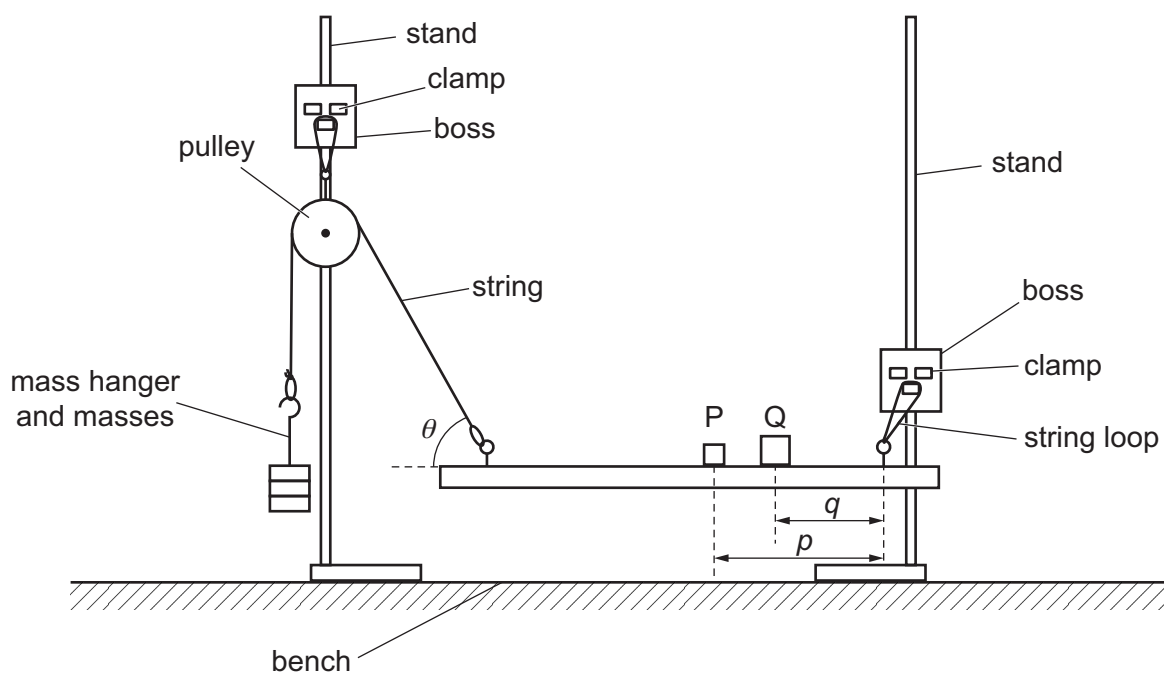


Fig. 1.2



- P and Q are masses.

The distance between the centre of mass P and the centre of the right-hand eye is p , as shown in Fig. 1.2.

The distance between the centre of mass Q and the centre of the right-hand eye is q , as shown in Fig. 1.2.

The angle between the string and the rod is θ .

Use some of the adhesive putty to attach Q to the rod so that q is approximately 26 cm.

- Use some of the adhesive putty to attach P to the rod. Adjust the position of P and the position of the stand with the pulley so that the rod is parallel to the bench and θ is approximately 45° .

Do not move the stands for the remainder of the experiment.

- Measure and record θ , p and q .

$\theta = \dots\dots\dots^\circ$

$p = \dots\dots\dots$

$q = \dots\dots\dots$

[2]

- (ii) The moment of the force about the eye due to mass P is T_P .

The moment of the force about the eye due to mass Q is T_Q .

The values of T_P and T_Q are given by:

$$T_P = 5Wp \quad \text{and} \quad T_Q = 7Wq$$

where W has the value 0.0981 N.

Calculate T_P and T_Q .

$T_P = \dots\dots\dots$

$T_Q = \dots\dots\dots$

[1]





- (b) Change the position of Q and adjust the position of P until the rod is again parallel to the bench. Measure p and q . Repeat until you have six sets of values of p and q .

Record your results in a table. Include values of T_P and T_Q in your table.

[8]

- (c) (i) Plot a graph of T_Q on the y -axis against T_P on the x -axis.

[3]

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

[1]

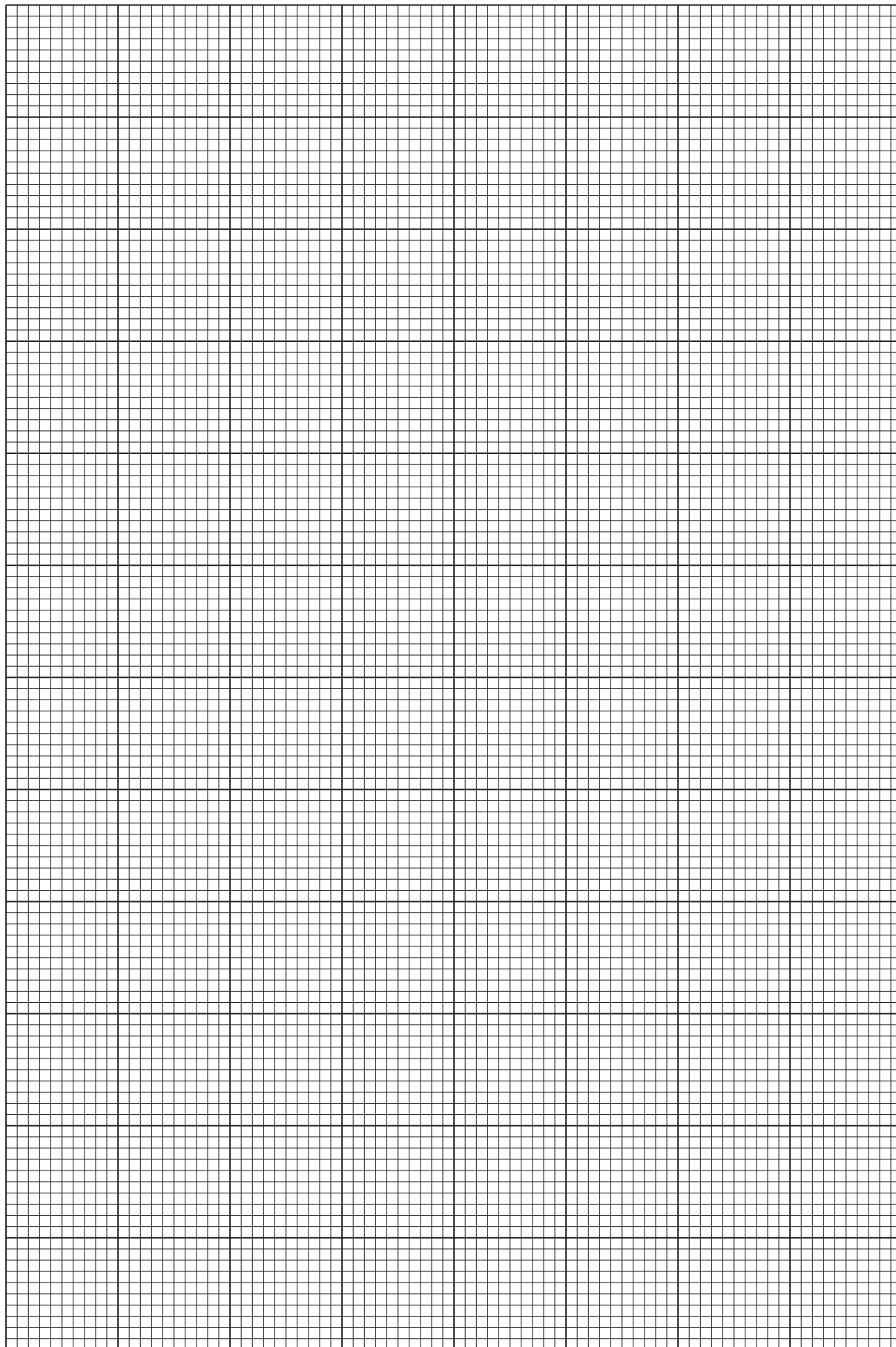
- (iii) Determine the gradient and y -intercept of this line.

gradient = ...

y -intercept = ...

[2]





- (d) (i) It is suggested that the quantities T_Q and T_P are related by the equation

$$T_Q = A + BT_P$$

where A and B are constants.

Using your answers in (c)(iii), determine the values of A and B .
Give appropriate units.

$$A = \dots\dots\dots$$

$$B = \dots\dots\dots$$

[2]

- (ii) Theory suggests that

$$R = F \sin \theta - \frac{2A}{S}$$

where R is the weight of the rod and F has the value 2.94 N.

Use your answers in (a)(i) and (d)(i) to determine a value for R .
Give an appropriate unit.

$$R = \dots\dots\dots [1]$$

[Total: 20]





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

2 In this experiment, you will investigate the rolling of a plastic bottle.

(a) (i) You are provided with a plastic bottle with a cap, as shown in Fig. 2.1.

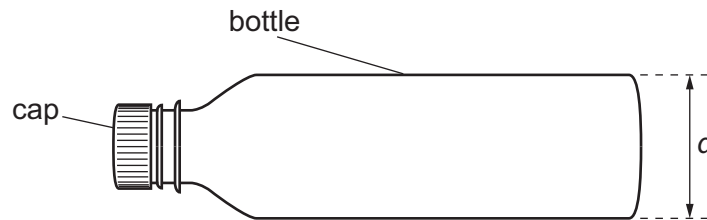


Fig. 2.1

The diameter of the base of the bottle is d .

Measure and record d .

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

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

percentage uncertainty = $\dots\dots\dots$ % [1]

(b) • Set up the apparatus as shown in Fig. 2.2.

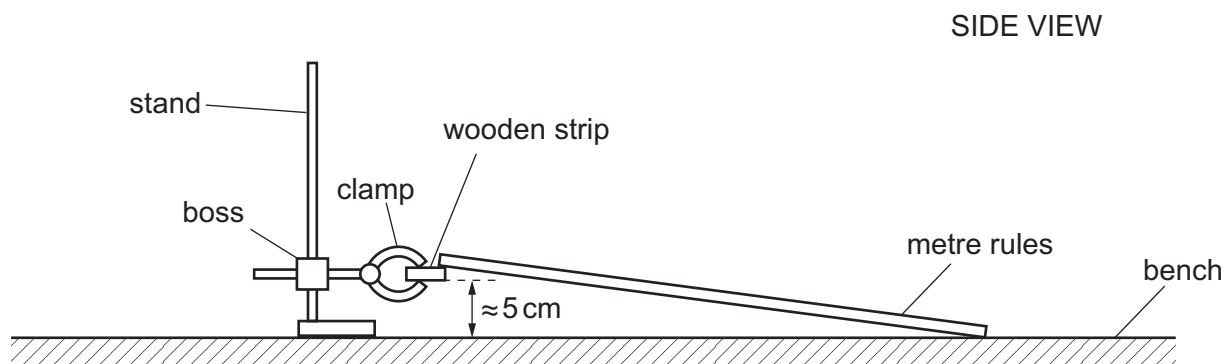


Fig. 2.2



- Adjust the two metre rules so that the rules are approximately parallel to each other, as shown in Fig. 2.3.

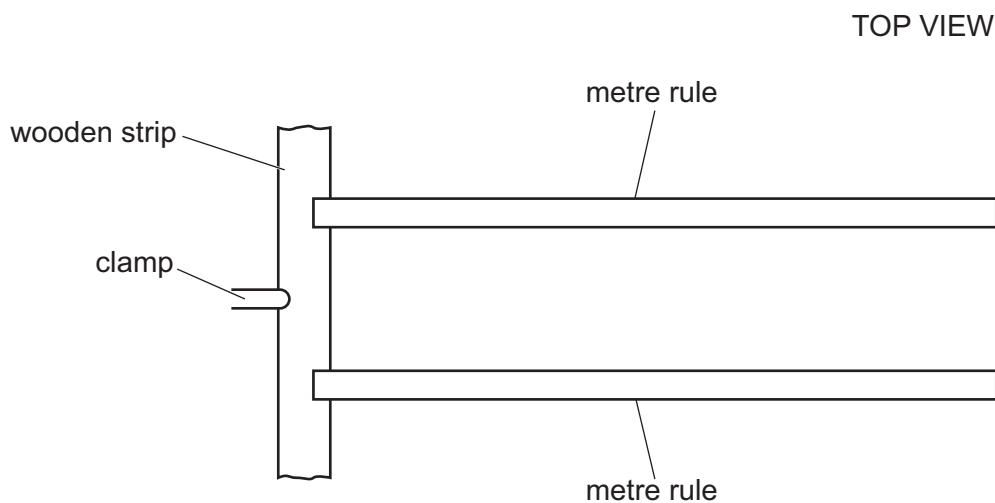


Fig. 2.3

- Pour all the water from the beaker into the bottle.
- Place the bottle on the two rules as shown in Fig. 2.4.

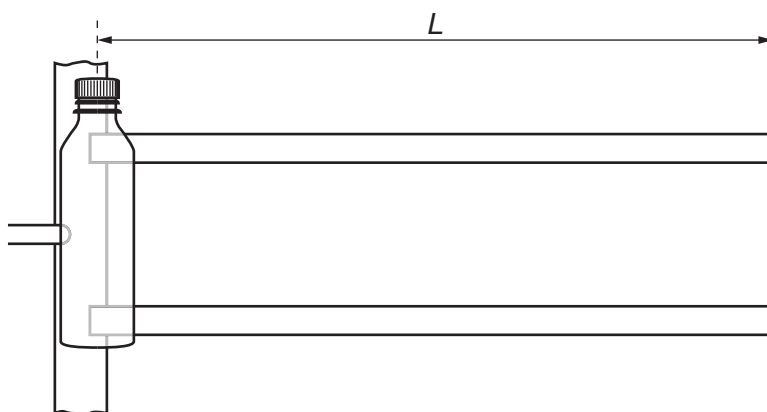


Fig. 2.4 (not to scale)

- Release the bottle. Adjust the rules so that the bottle rolls to the end of the rules.
- The distance that the bottle rolls on the rules is L , as shown in Fig. 2.4.

Measure and record L .

$L = \dots\dots\dots$ [1]



- (c) (i) • Stand the bottle upright on the bench.
- The height of the water in the bottle is h , as shown in Fig. 2.5.

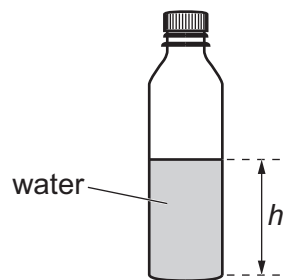


Fig. 2.5

Measure and record h .

$h =$

- The time for the bottle to roll distance L on the rules is t .

Take measurements to determine t .

$t =$ [3]

- (ii) A value for the acceleration a of the bottle is given by

$$a = \frac{2L}{t^2}.$$

Calculate a .

$a =$ [1]

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

.....

.....

..... [1]



- (d) • Pour approximately half the water from the bottle into the beaker.
- Repeat (c)(i) and (c)(ii).

$$h = \dots\dots\dots$$

$$t = \dots\dots\dots$$

$$a = \dots\dots\dots [2]$$

- (e) It is suggested that the relationship between a and h is

$$a = \frac{kd\sqrt{\pi h}}{2}$$

where k is a constant.

Using your data, calculate **two** values of k .

$$\text{first value of } k = \dots\dots\dots$$

$$\text{second value of } k = \dots\dots\dots [1]$$





(f) It is suggested that the percentage uncertainty in the values of k is 15%.

Using this uncertainty, explain whether your results support the relationship in (e).

.....

.....

.....

..... [1]



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

For any uncertainties in measurement that you describe, you should state the quantity being measured and a reason for the uncertainty.

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[4]

(ii) Describe **four** improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

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[Total: 20]









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Cambridge International AS & A Level

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PHYSICS

9702/36

Paper 3 Advanced Practical Skills 2

October/November 2025

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. Any blank pages are indicated.

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

- 1 In this experiment, you will investigate the phase difference between the oscillations of two mass–spring systems.

- (a) • Assemble the apparatus as shown in Fig. 1.1.

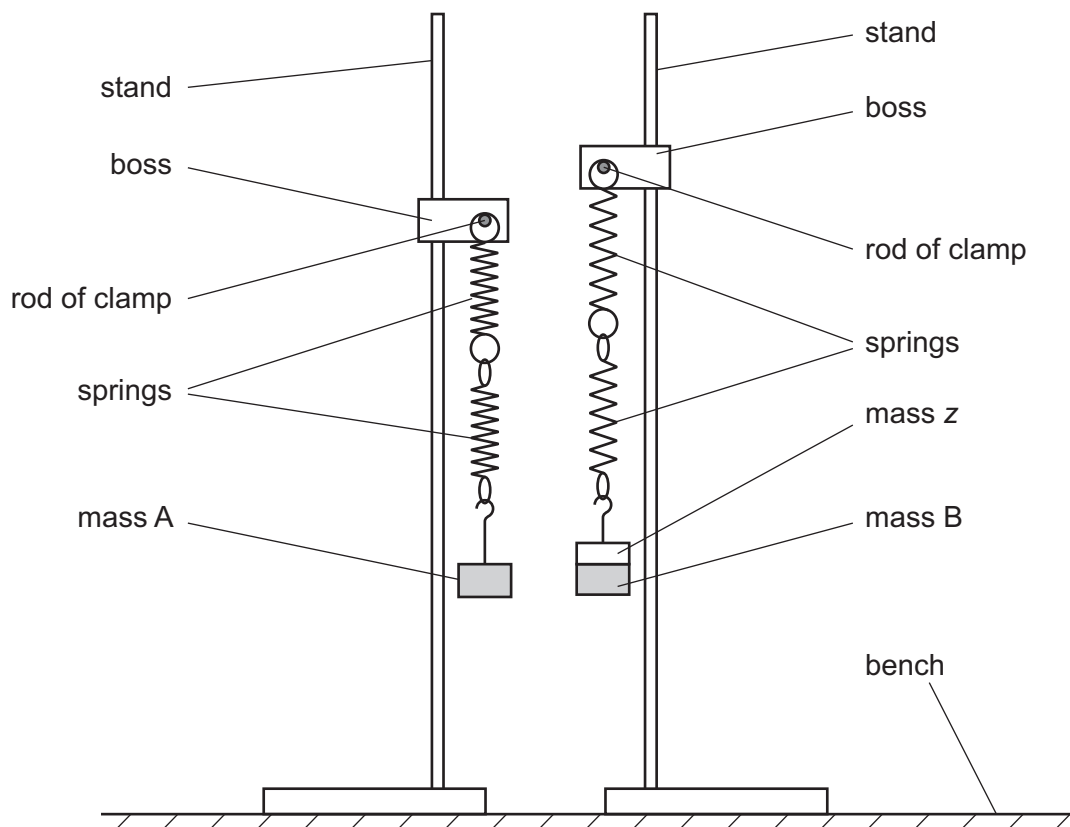


Fig. 1.1

- Mass A and mass B are each 200 g.
- Add a mass z of 40 g to mass B.

Record the value of z.

$z = \dots\dots\dots$ g

- M is given by $M = 200 \text{ g} + z$.

Calculate M .

$M = \dots\dots\dots$ g



- Pull both A and B down a short distance and release them together. Observe the oscillations. A and B initially oscillate in phase (both moving up and down together), then their oscillations go out of phase and then become in phase again.
- The time from A and B oscillating in phase to the next time they oscillate in phase is P .

Measure and record P .

$P =$ [2]



(b) Change z and determine P . Repeat until you have six sets of values of z and P .

Record your results in a table. Include values of M , $\frac{1}{\sqrt{M}}$ and $\frac{1}{P}$ in your table.

[10]

(c) (i) Plot a graph of $\frac{1}{P}$ on the y -axis against $\frac{1}{\sqrt{M}}$ 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]



DO NOT WRITE IN THIS MARGIN





(d) It is suggested that the quantities P and M are related by the equation

$$\frac{1}{P} = \frac{a}{\sqrt{M}} + b$$

where a and b are constants.

Use your answers in (c)(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 tension in a string.

(a) • Set up the apparatus as shown in Fig. 2.1.

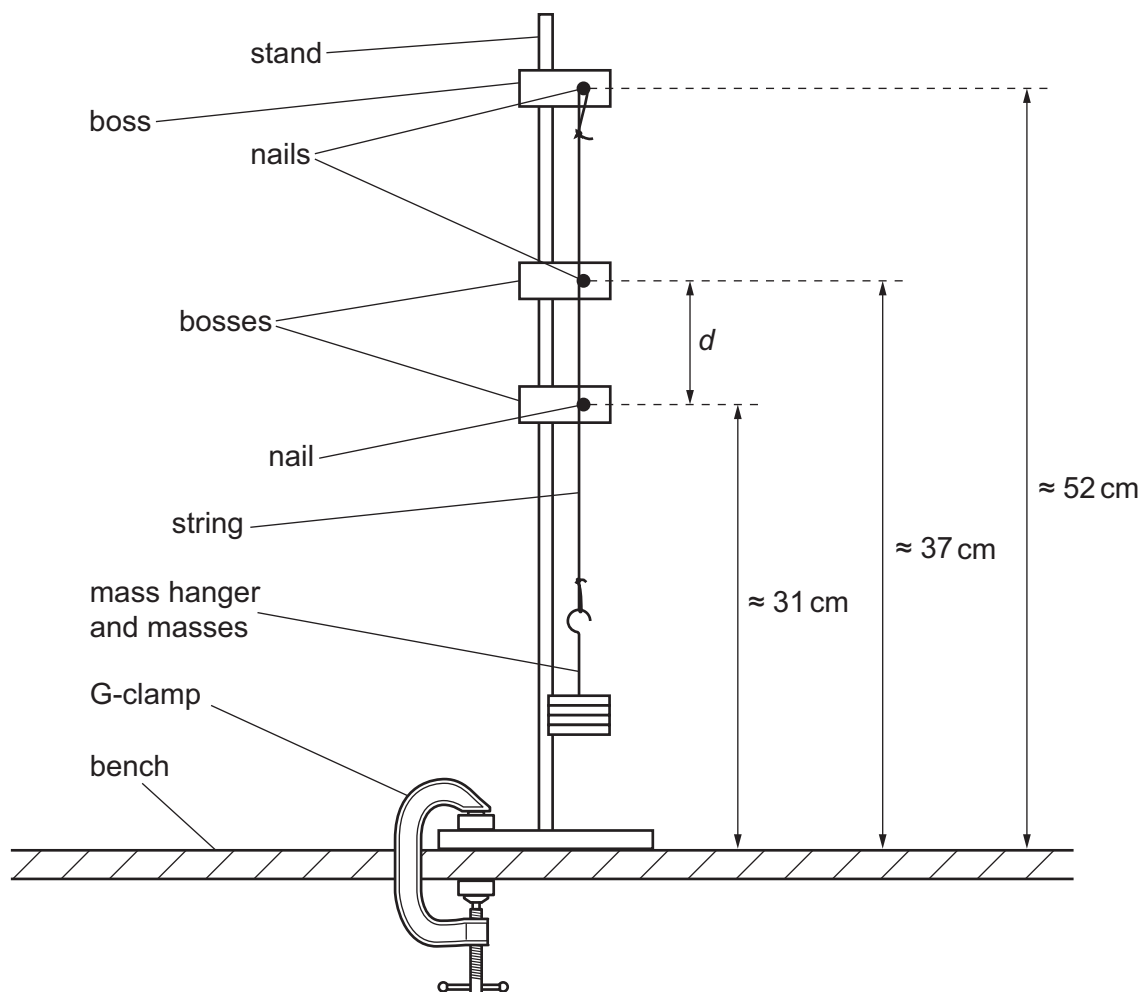


Fig. 2.1

- The mass hanger and masses should have a total mass M of 0.400 kg.
- The distance between the two lower nails is d , as shown in Fig. 2.1.

Measure and record d .

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



(b) The tension in the string is T .

Calculate T using $T = Mg$, where $g = 9.81 \text{ N kg}^{-1}$.

$T = \dots\dots\dots \text{ N [1]}$

(c) (i) • Hook the newton meter on the string half-way between the two lower nails and pull it horizontally with a force F of 5.0 N, as shown in Fig. 2.2.

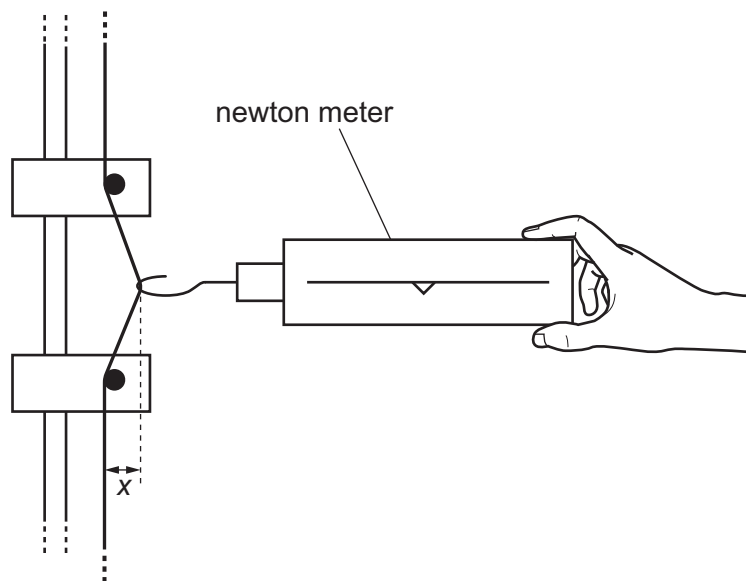


Fig. 2.2

• The force F causes the string to deflect a distance x , as shown in Fig. 2.2.

Measure and record x .

$x = \dots\dots\dots \text{ cm [2]}$

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

percentage uncertainty = $\dots\dots\dots \% [1]$





(iii) Calculate y , where

$$y = \sqrt{\left(x^2 + \frac{d^2}{4}\right)}.$$

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

- (d) • Add slotted masses to the mass hanger so that the total mass M is 0.700 kg.
- Repeat (b), (c)(i) and (c)(iii).

$T = \dots\dots\dots$ N

$x = \dots\dots\dots$ cm

$y = \dots\dots\dots$ cm
[3]





- (e) It is suggested that the relationship between y , T and x is

$$ky = Tx$$

where k is a constant.

- (i) Using your data, calculate **two** values of k .

first value of k = ...

second value of k = ...

[1]

- (ii) Justify the number of significant figures that you have given for your values of k .

.....

 [1]

- (f) It is suggested that the percentage uncertainty in the values of k is 20%.

Using this uncertainty, explain whether your results support the relationship in (e).

.....

 [1]



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

For any uncertainties in measurement that you describe, you should state the quantity being measured and a reason for the uncertainty.

1

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[4]

(ii) Describe **four** improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

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[4]

[Total: 20]





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PHYSICS

9702/37

Paper 3 Advanced Practical Skills 1

October/November 2025

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.
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- Do **not** write on any bar codes.
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- 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

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- The number of marks for each question or part question is shown in brackets [].

For Examiner's Use

1	
2	
Total	

This document has **16** pages. Any 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 wooden rod.

Some of the apparatus has been set up for you.

- (a) (i) • Fig. 1.1 shows the rod with two eyes.

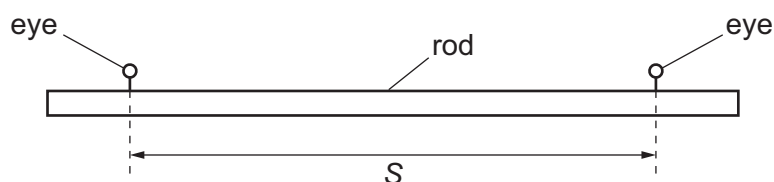


Fig. 1.1

The distance between the two eyes on the rod is S .

Measure and record S .

$S =$

- Complete the set-up of the apparatus as shown in Fig. 1.2.

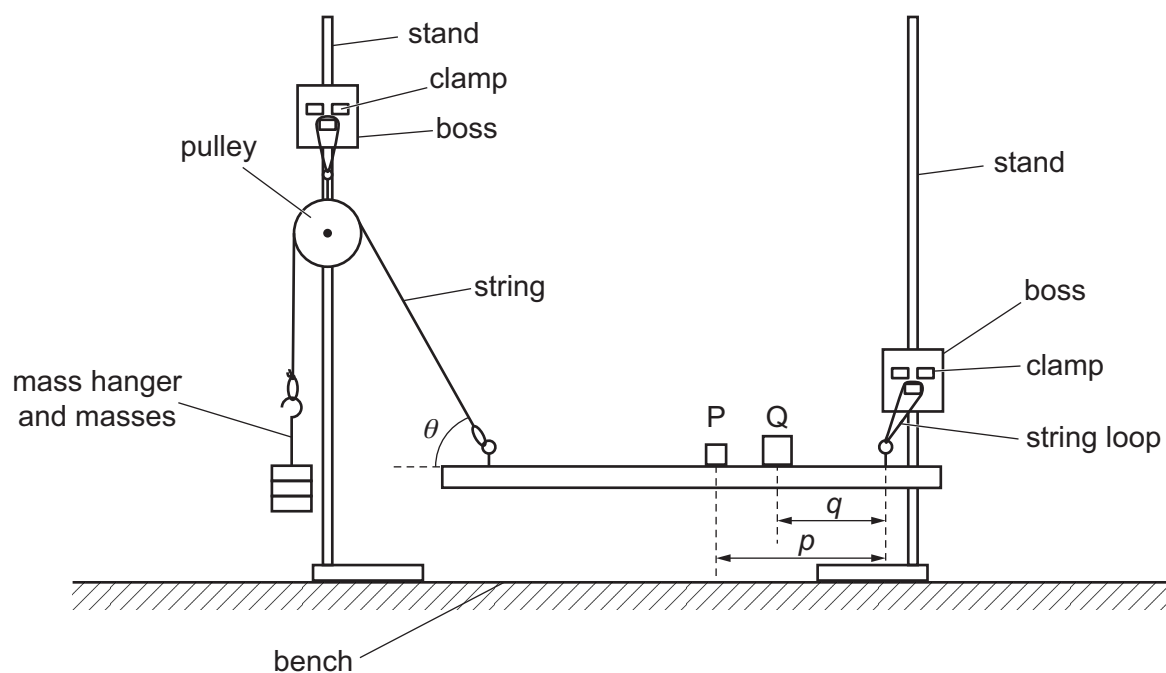


Fig. 1.2



- P and Q are masses.

The distance between the centre of mass P and the centre of the right-hand eye is p , as shown in Fig. 1.2.

The distance between the centre of mass Q and the centre of the right-hand eye is q , as shown in Fig. 1.2.

The angle between the string and the rod is θ .

Use some of the adhesive putty to attach Q to the rod so that q is approximately 26 cm.

- Use some of the adhesive putty to attach P to the rod. Adjust the position of P and the position of the stand with the pulley so that the rod is parallel to the bench and θ is approximately 45° .

Do not move the stands for the remainder of the experiment.

- Measure and record θ , p and q .

$$\theta = \dots\dots\dots^\circ$$

$$p = \dots\dots\dots$$

$$q = \dots\dots\dots$$

[2]

- (ii) The moment of the force about the eye due to mass P is T_P .

The moment of the force about the eye due to mass Q is T_Q .

The values of T_P and T_Q are given by:

$$T_P = 5Wp \quad \text{and} \quad T_Q = 7Wq$$

where W has the value 0.0981 N.

Calculate T_P and T_Q .

$$T_P = \dots\dots\dots$$

$$T_Q = \dots\dots\dots$$

[1]





- (b) Change the position of Q and adjust the position of P until the rod is again parallel to the bench. Measure p and q . Repeat until you have six sets of values of p and q .

Record your results in a table. Include values of T_P and T_Q in your table.

[8]

- (c) (i) Plot a graph of T_Q on the y -axis against T_P on the x -axis.

[3]

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

[1]

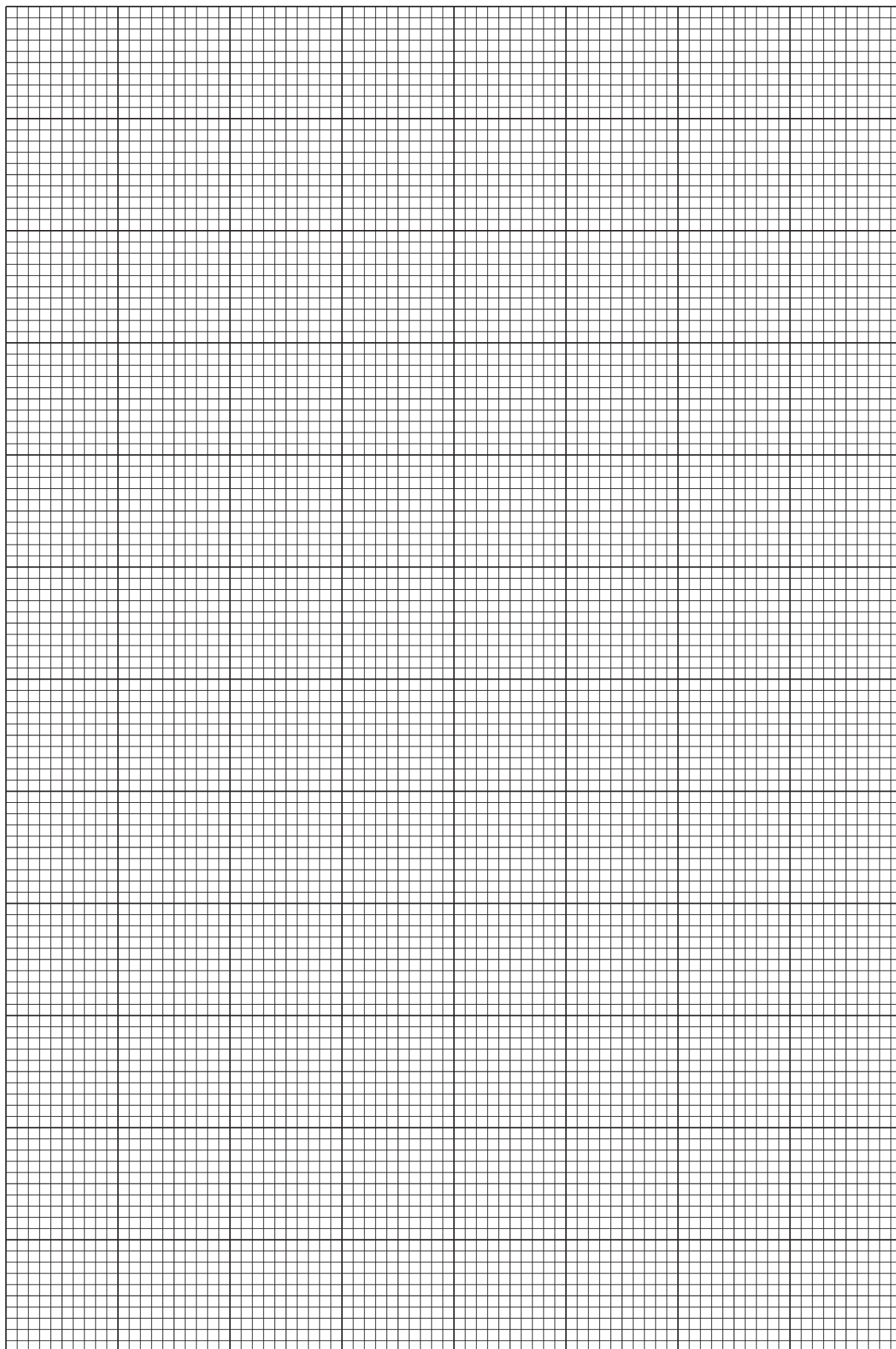
- (iii) Determine the gradient and y -intercept of this line.

gradient = ...

y -intercept = ...

[2]





(d) (i) It is suggested that the quantities T_Q and T_P are related by the equation

$$T_Q = A + BT_P$$

where A and B are constants.

Using your answers in (c)(iii), determine the values of A and B .
Give appropriate units.

$A =$

$B =$

[2]

(ii) Theory suggests that

$$R = F \sin \theta - \frac{2A}{S}$$

where R is the weight of the rod and F has the value 2.94 N.

Use your answers in (a)(i) and (d)(i) to determine a value for R .
Give an appropriate unit.

$R =$ [1]

[Total: 20]





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

2 In this experiment, you will investigate the rolling of a plastic bottle.

(a) (i) You are provided with a plastic bottle with a cap, as shown in Fig. 2.1.

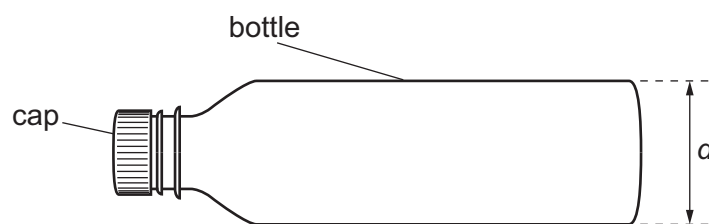


Fig. 2.1

The diameter of the base of the bottle is d .

Measure and record d .

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

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

percentage uncertainty = $\dots\dots\dots$ % [1]

(b) • Set up the apparatus as shown in Fig. 2.2.

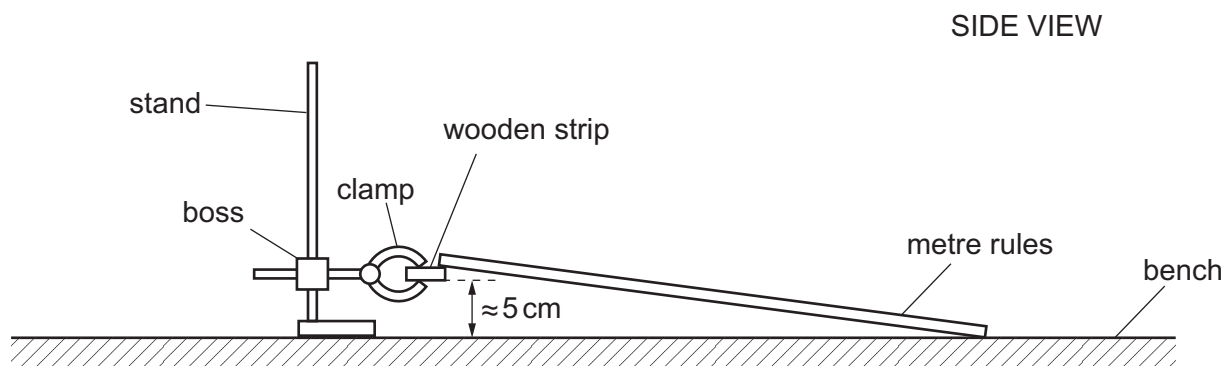


Fig. 2.2



- Adjust the two metre rules so that the rules are approximately parallel to each other, as shown in Fig. 2.3.

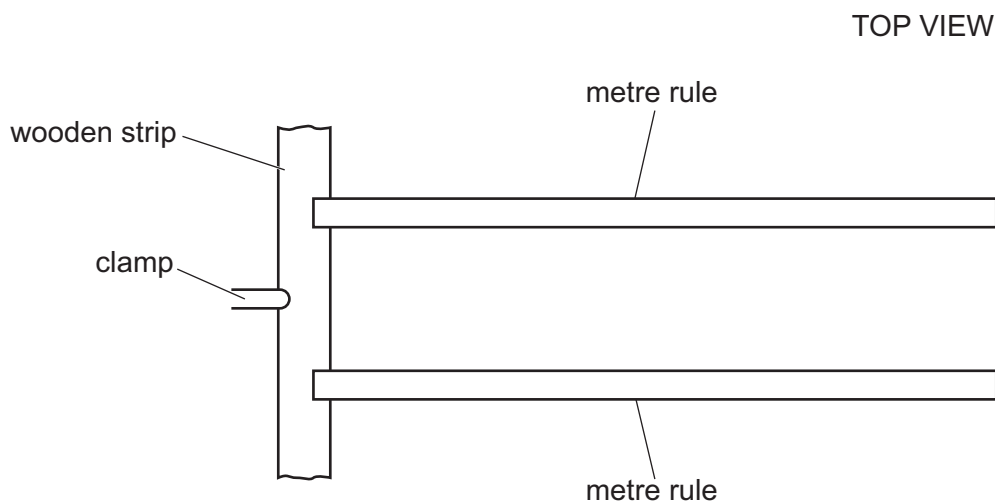


Fig. 2.3

- Pour all the water from the beaker into the bottle.
- Place the bottle on the two rules as shown in Fig. 2.4.

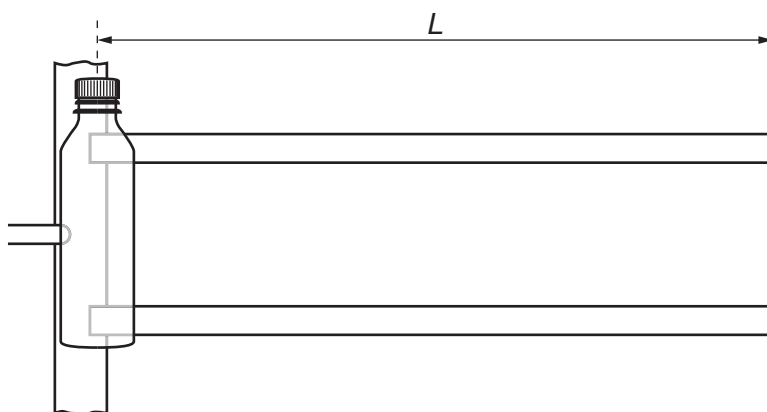


Fig. 2.4 (not to scale)

- Release the bottle. Adjust the rules so that the bottle rolls to the end of the rules.
- The distance that the bottle rolls on the rules is L , as shown in Fig. 2.4.

Measure and record L .

$L = \dots\dots\dots$ [1]



- (c) (i) • Stand the bottle upright on the bench.
- The height of the water in the bottle is h , as shown in Fig. 2.5.

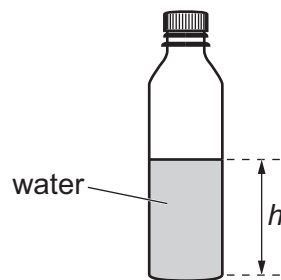


Fig. 2.5

Measure and record h .

$h =$

- The time for the bottle to roll distance L on the rules is t .

Take measurements to determine t .

$t =$ [3]

- (ii) A value for the acceleration a of the bottle is given by

$$a = \frac{2L}{t^2}.$$

Calculate a .

$a =$ [1]

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

.....

.....

..... [1]



- (d) • Pour approximately half the water from the bottle into the beaker.
- Repeat (c)(i) and (c)(ii).

$$h = \dots\dots\dots$$

$$t = \dots\dots\dots$$

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

[2]

- (e) It is suggested that the relationship between a and h is

$$a = \frac{kd\sqrt{\pi h}}{2}$$

where k is a constant.

Using your data, calculate **two** values of k .

$$\text{first value of } k = \dots\dots\dots$$

$$\text{second value of } k = \dots\dots\dots$$

[1]





(f) It is suggested that the percentage uncertainty in the values of k is 15%.

Using this uncertainty, explain whether your results support the relationship in (e).

.....

.....

.....

..... [1]

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DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN



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

For any uncertainties in measurement that you describe, you should state the quantity being measured and a reason for the uncertainty.

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[4]

- (ii) Describe **four** improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

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[4]

[Total: 20]









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PHYSICS

9702/38

Paper 3 Advanced Practical Skills 2

October/November 2025

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.
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- You should show all your working and use appropriate units.

INFORMATION

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- The number of marks for each question or part question is shown in brackets [].

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Total	

This document has **12** pages. Any blank pages are indicated.

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

- 1 In this experiment, you will investigate the phase difference between the oscillations of two mass–spring systems.

(a) • Assemble the apparatus as shown in Fig. 1.1.

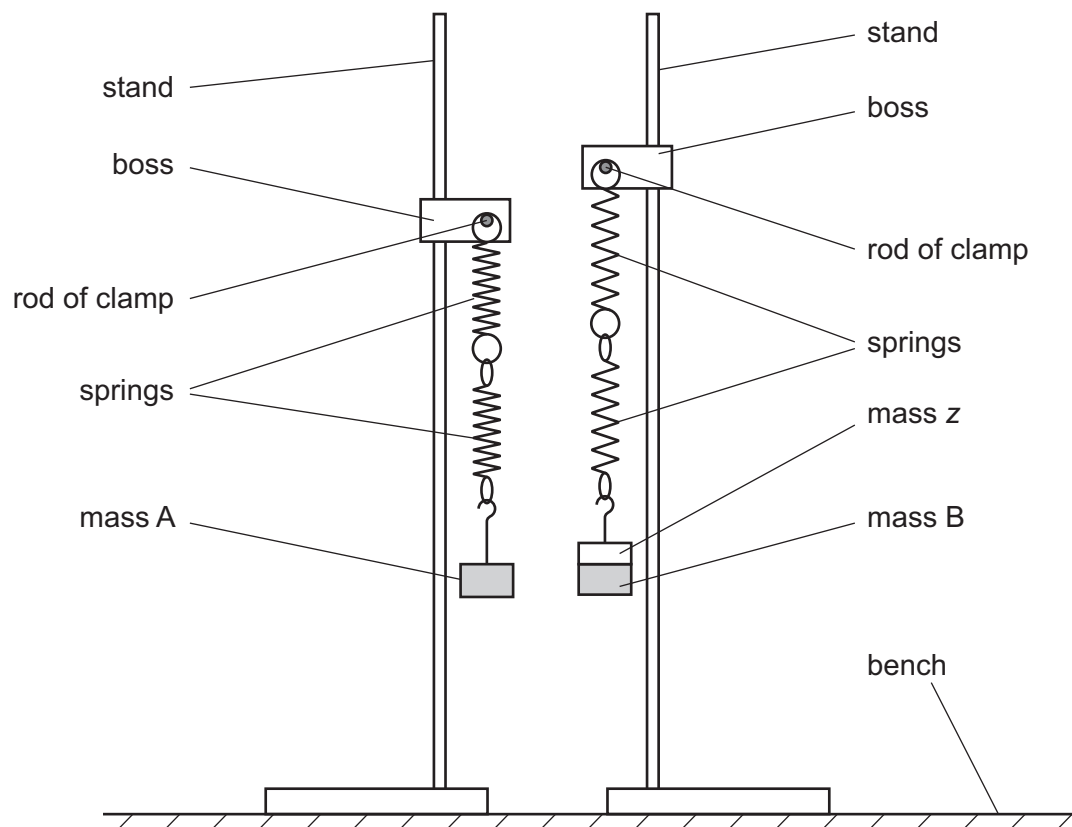


Fig. 1.1

- Mass A and mass B are each 200 g.
- Add a mass z of 40 g to mass B.

Record the value of z.

$z = \dots\dots\dots$ g

- M is given by $M = 200 \text{ g} + z$.

Calculate M .

$M = \dots\dots\dots$ g



- Pull both A and B down a short distance and release them together. Observe the oscillations. A and B initially oscillate in phase (both moving up and down together), then their oscillations go out of phase and then become in phase again.
- The time from A and B oscillating in phase to the next time they oscillate in phase is P .

Measure and record P .

$P =$ [2]



(b) Change z and determine P . Repeat until you have six sets of values of z and P .

Record your results in a table. Include values of M , $\frac{1}{\sqrt{M}}$ and $\frac{1}{P}$ in your table.

[10]

(c) (i) Plot a graph of $\frac{1}{P}$ on the y -axis against $\frac{1}{\sqrt{M}}$ on the x -axis.

[3]

(ii) Draw the straight line of best fit.

[1]

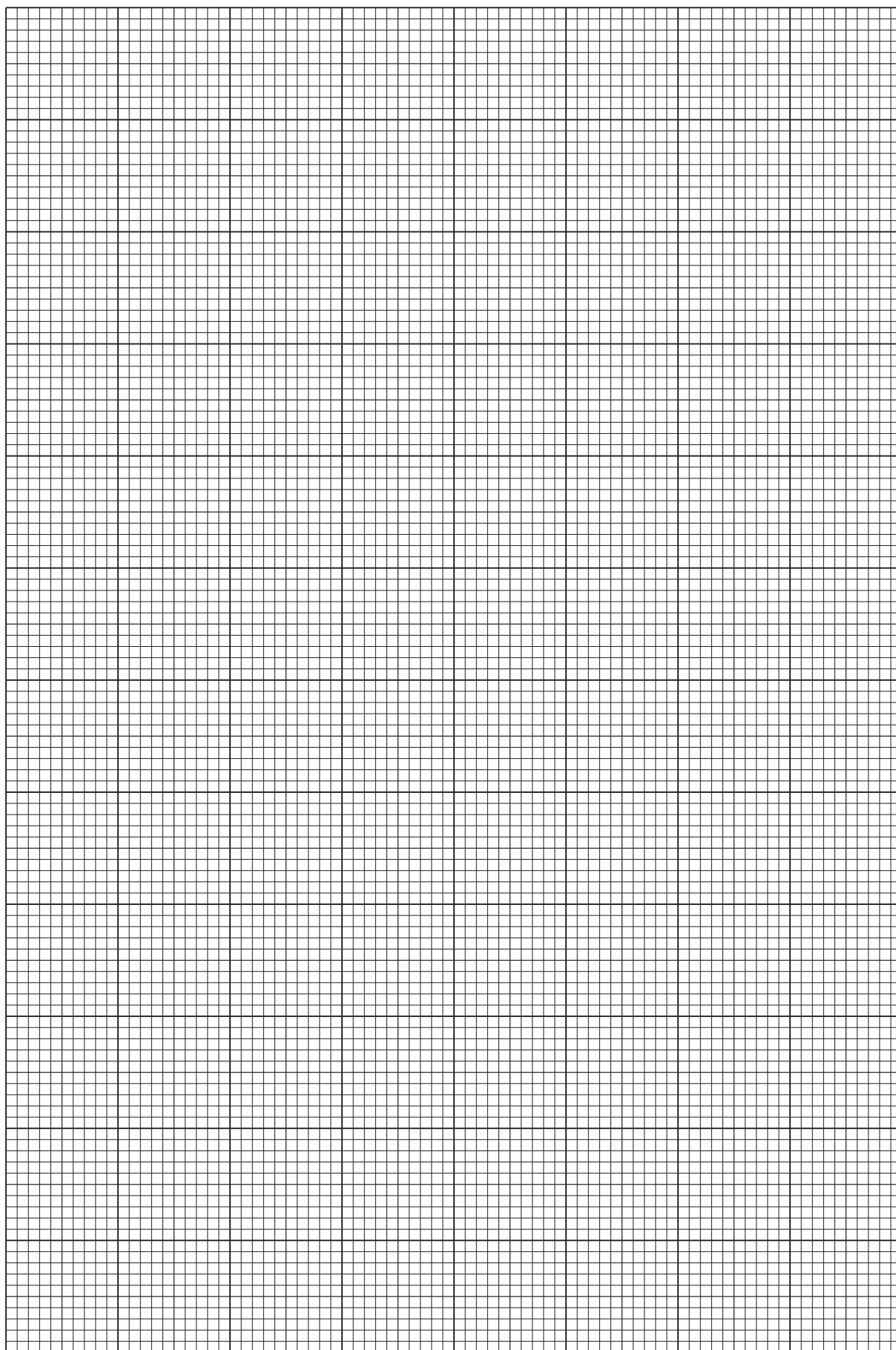
(iii) Determine the gradient and y -intercept of this line.

gradient = ...

y -intercept = ...

[2]







(d) It is suggested that the quantities P and M are related by the equation

$$\frac{1}{P} = \frac{a}{\sqrt{M}} + b$$

where a and b are constants.

Use your answers in (c)(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 tension in a string.

(a) • Set up the apparatus as shown in Fig. 2.1.

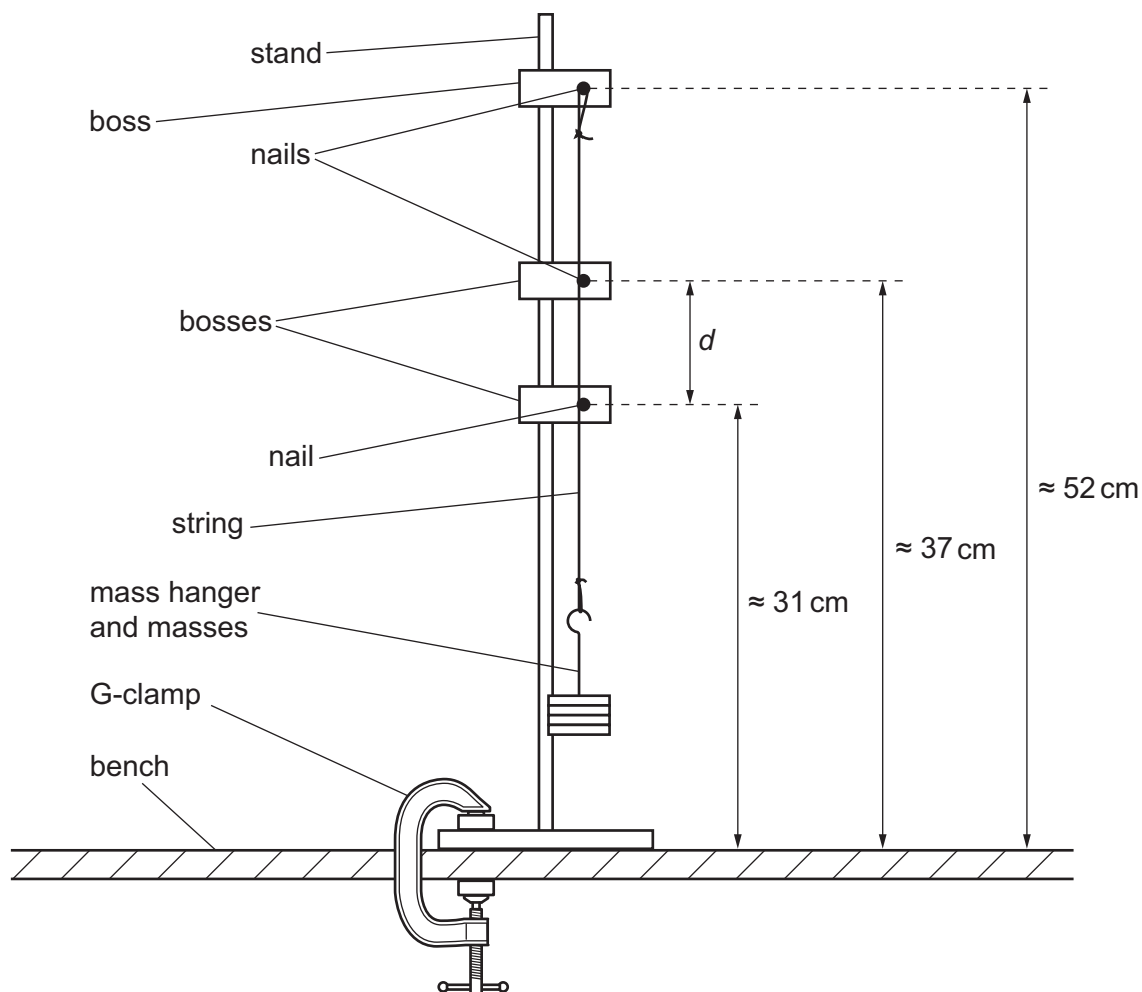


Fig. 2.1

- The mass hanger and masses should have a total mass M of 0.400 kg.
- The distance between the two lower nails is d , as shown in Fig. 2.1.

Measure and record d .

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



(b) The tension in the string is T .

Calculate T using $T = Mg$, where $g = 9.81 \text{ N kg}^{-1}$.

$T = \dots\dots\dots \text{ N [1]}$

(c) (i) • Hook the newton meter on the string half-way between the two lower nails and pull it horizontally with a force F of 5.0 N, as shown in Fig. 2.2.

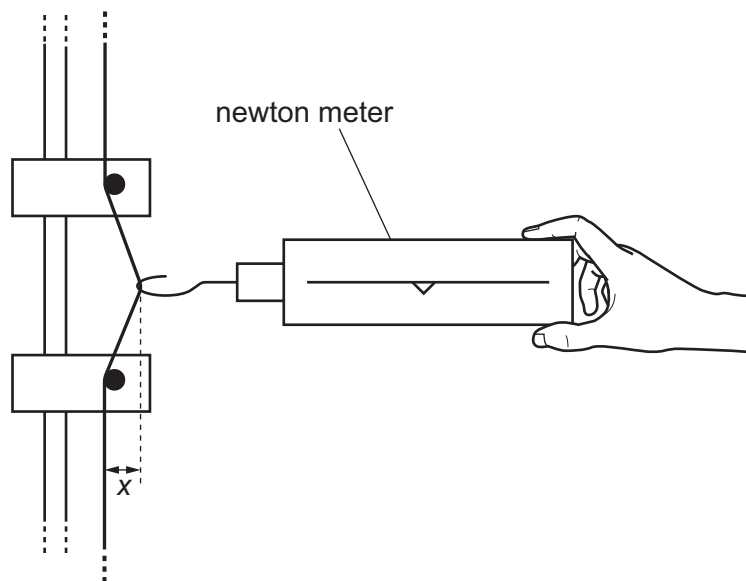


Fig. 2.2

• The force F causes the string to deflect a distance x , as shown in Fig. 2.2.

Measure and record x .

$x = \dots\dots\dots \text{ cm [2]}$

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

percentage uncertainty = $\dots\dots\dots \% [1]$





(iii) Calculate y , where

$$y = \sqrt{\left(x^2 + \frac{d^2}{4}\right)}.$$

$$y = \dots\dots\dots \text{ cm [1]}$$

- (d) • Add slotted masses to the mass hanger so that the total mass M is 0.700 kg.
- Repeat (b), (c)(i) and (c)(iii).

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

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

$$y = \dots\dots\dots \text{ cm [3]}$$





- (e) It is suggested that the relationship between y , T and x is

$$ky = Tx$$

where k is a constant.

- (i) Using your data, calculate **two** values of k .

first value of $k =$

second value of $k =$

[1]

- (ii) Justify the number of significant figures that you have given for your values of k .

.....

 [1]

- (f) It is suggested that the percentage uncertainty in the values of k is 20%.

Using this uncertainty, explain whether your results support the relationship in (e).

.....

 [1]



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

For any uncertainties in measurement that you describe, you should state the quantity being measured and a reason for the uncertainty.

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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