



Cambridge International AS & A Level

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PHYSICS

9702/38

Paper 3 Advanced Practical Skills 2

May/June 2026

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. Do **not** use correction fluid or tape.
- 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.

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

1 In this experiment, you will investigate the equilibrium of forces.

- (a)**
- Assemble the apparatus as shown in Figure 1.1.
 - Attach the 50 g mass to the back of the board using the bolt and nut.
 - Push the nail through the fourth hole from the top of the board, and fix the nail in the boss.
 - Hang the plumb line from the nail.

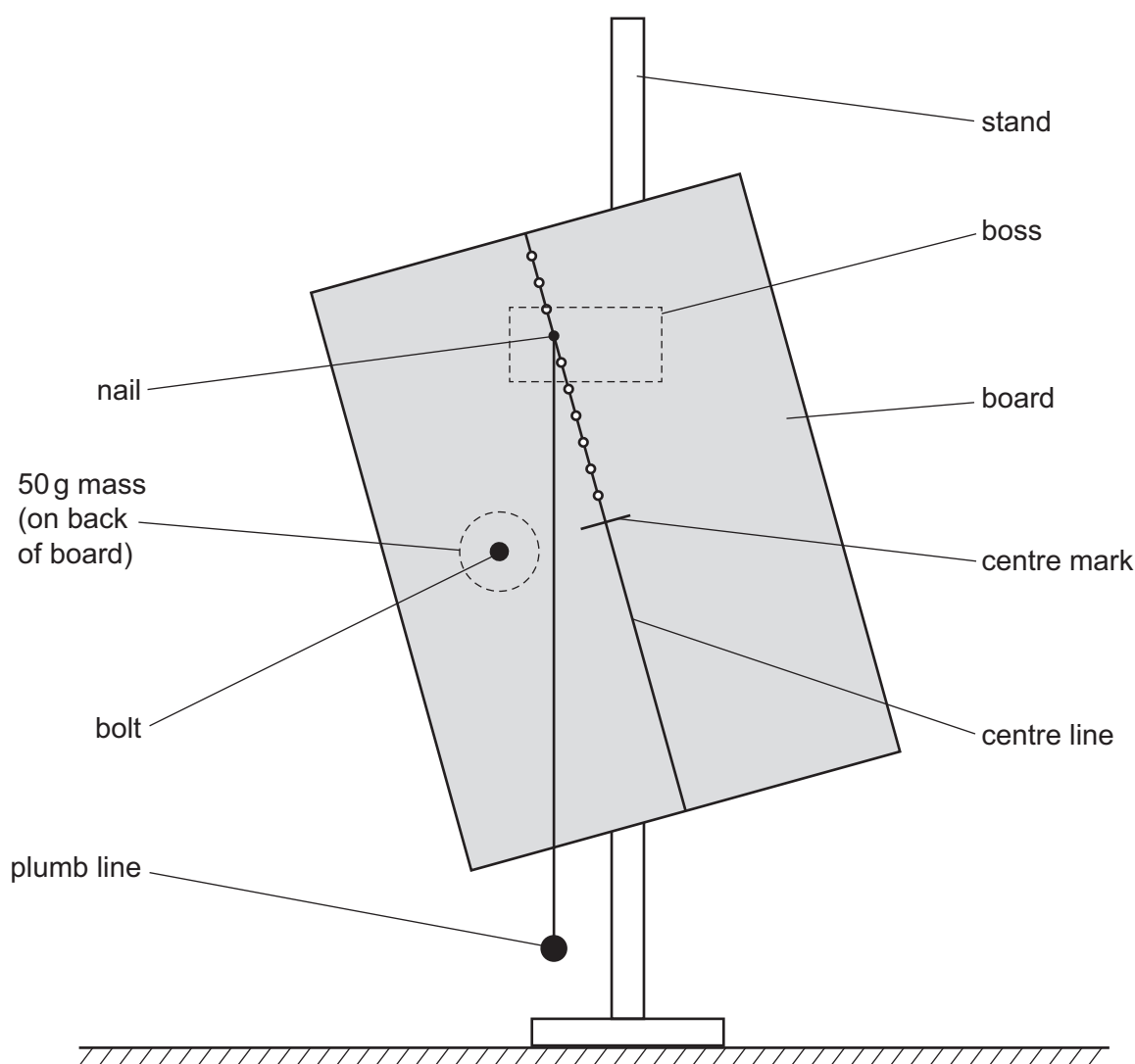


Figure 1.1

- Check that the board swings freely.



- The distance between the nail and the centre mark is d , as shown in Figure 1.2.

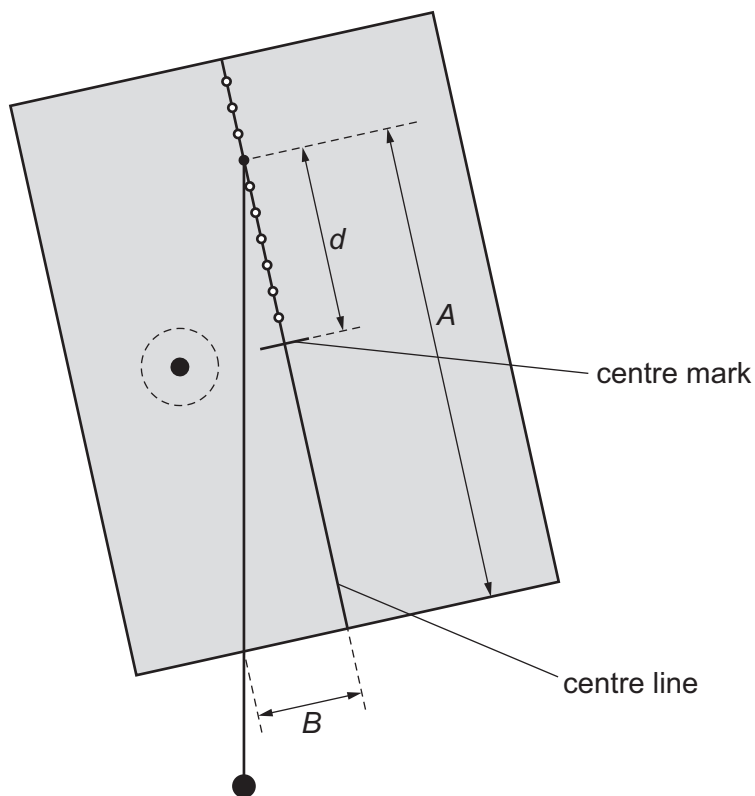


Figure 1.2

Measure and record d .

$d =$

- The distance between the nail and the lower edge of the board is A , as shown in Figure 1.2.

Measure and record A .

$A =$

- The distance along the lower edge of the board between the plumb line and the centre line is B , as shown in Figure 1.2.

Measure and record B .

$B =$

- Calculate t using $t = \frac{B}{A}$.

$t =$

[2]



- (b) Change d by moving the nail to another hole in the board. Measure and record d , A and B . Repeat until you have six sets of values.

Do **not** use holes that give values of B greater than 10.5 cm.

Record your results in a table. Include values of t and $\frac{1}{d}$ in your table.

[10]

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

[3]

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

[1]

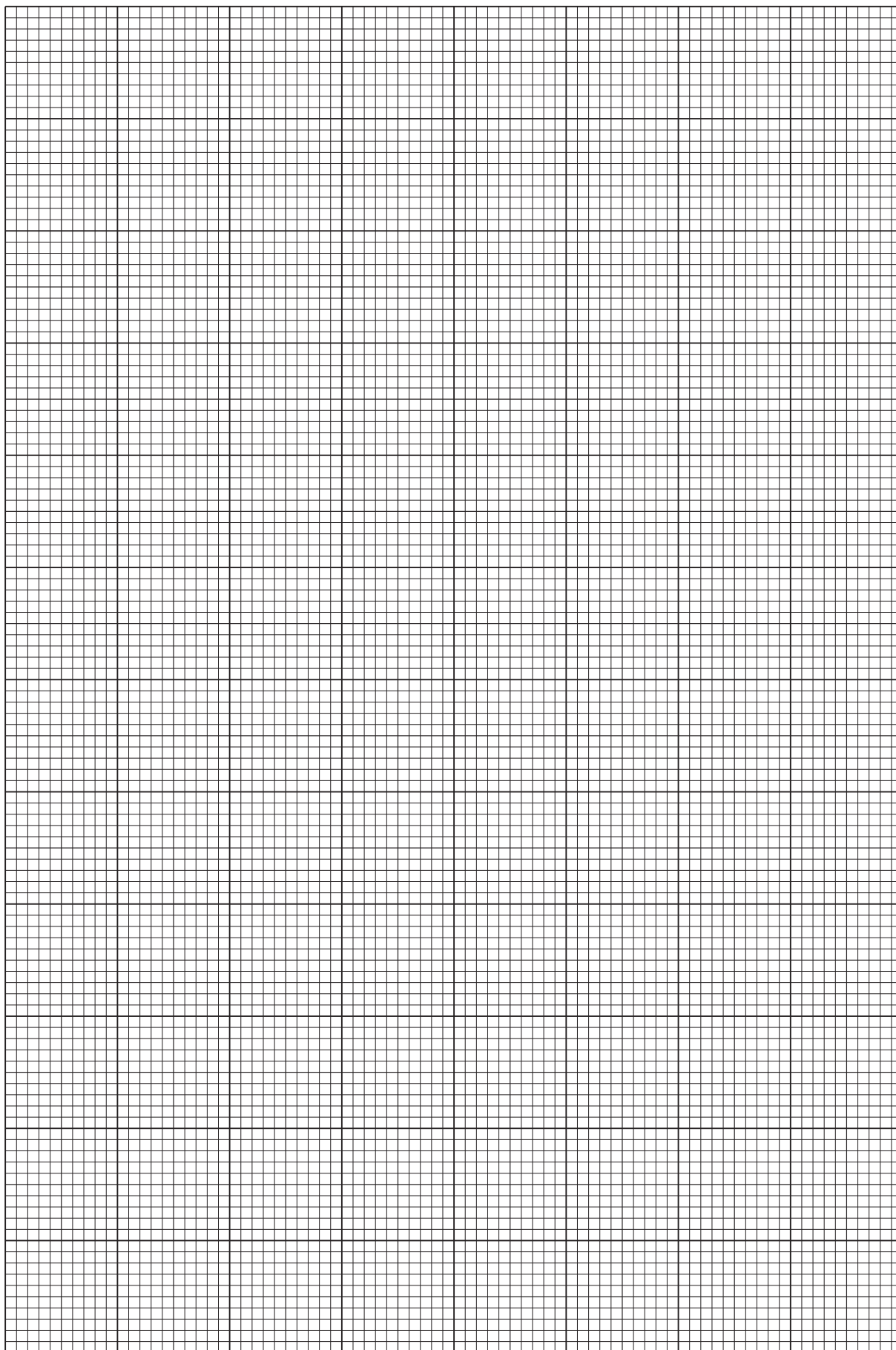
- (iii) Determine the gradient and y -intercept of this line.

gradient =

y -intercept =

[2]







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

$$t = \frac{p}{d} + q$$

where p and q are constants.

Use your answers in **1(c)(iii)** to determine the values of p and q .
Give appropriate units.

$p =$

$q =$

[2]

[Total: 20]





Turn over



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

2 In this experiment, you will investigate the rate of flow of water through a tube.

(a) You have been provided with two lengths of tube. Select the **longer** tube.

(i) Measure and record the length L of the tube.

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

(ii) Using the calipers, measure and record the **internal** diameter D of the tube.

$D = \dots\dots\dots$ mm [1]

- (b) (i)
- Remove the plunger from the syringe.
 - Push one end of the tube onto the nozzle of the syringe body.
 - Assemble the apparatus as shown in Figure 2.1.

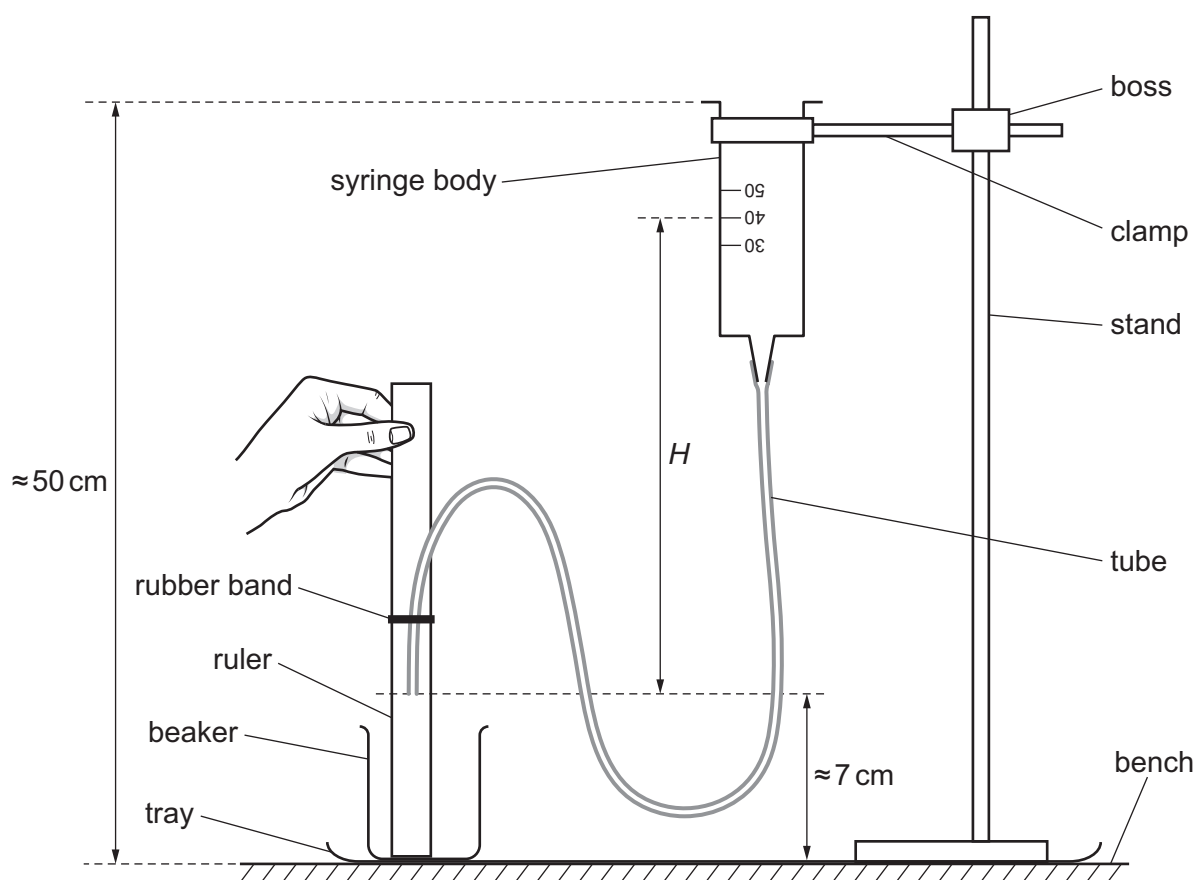


Figure 2.1



- Adjust the height of the boss so that the top of the syringe body is approximately 50 cm above the bench.
- The vertical distance between the lower end of the tube and the 40 cm³ graduation on the syringe body is H .

Measure and record H .

$$H = \dots\dots\dots [1]$$

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

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

- (iii) • Fill the syringe body with water from the jug.
- The time taken for the water level to move between the 50 cm³ graduation and the 30 cm³ graduation is T .

Determine T .

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





(c) (i) Repeat **2(a)(i)** using the **shorter** tube.

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

(ii) Repeat **2(b)(i)** and **2(b)(iii)** using the shorter tube and with the top of the syringe body approximately 30 cm above the bench.

$$H = \dots\dots\dots$$

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

(d) Theory suggests that the relationship between T , D , H and L is

$$\frac{1}{T} = \frac{kD^4H}{L}$$

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]

(e) 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 **2(d)**.

.....

.....

.....

..... [1]



- (f) (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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2

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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

.....

[4]

[Total: 20]

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