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CAMBRIDGE
International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 9 0 9 8 0 0 6 6 3 5 5 *

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 [ ].

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1	
2	
Total	

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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.

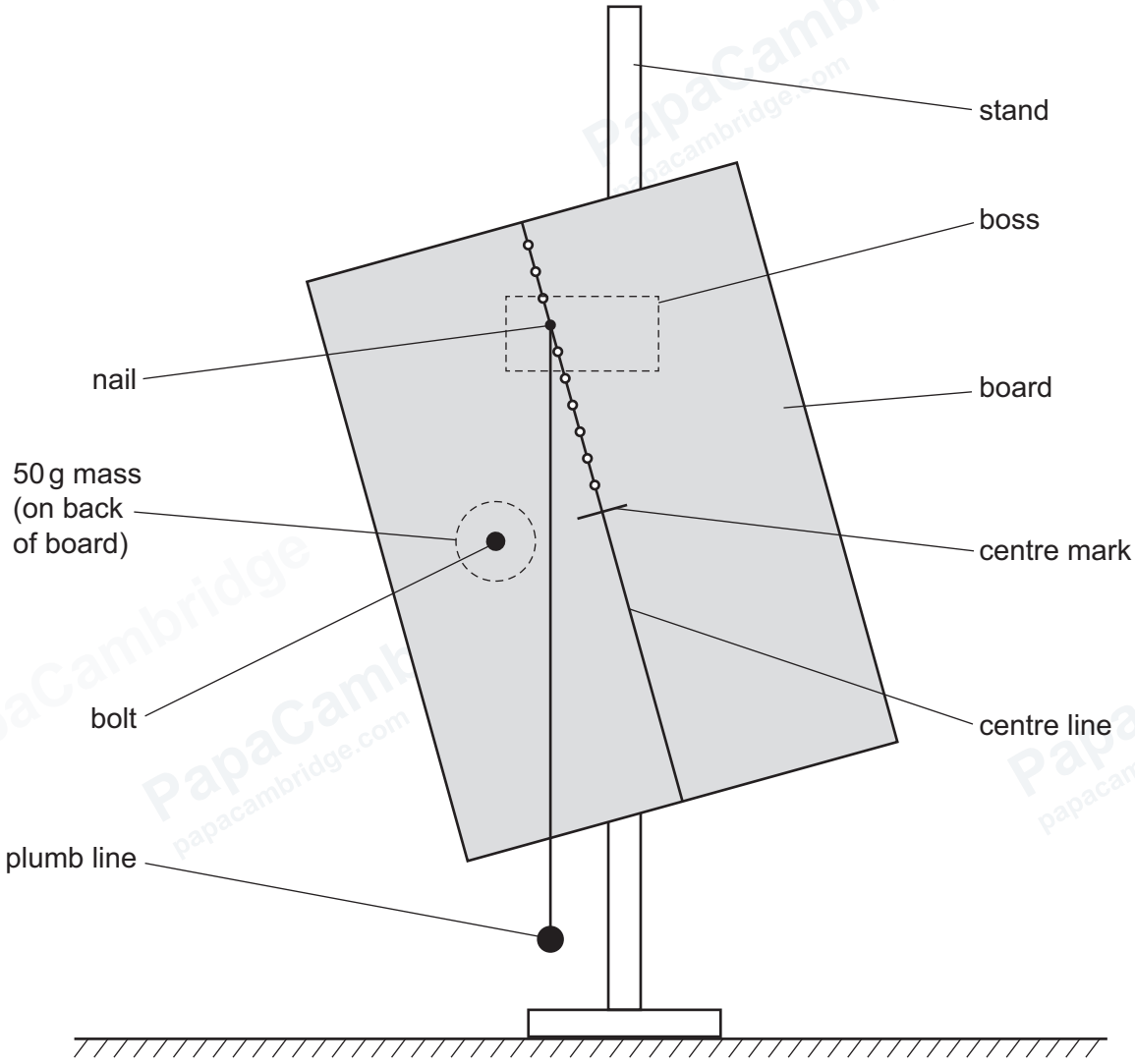

Figure 1.1

- Check that the board swings freely.

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

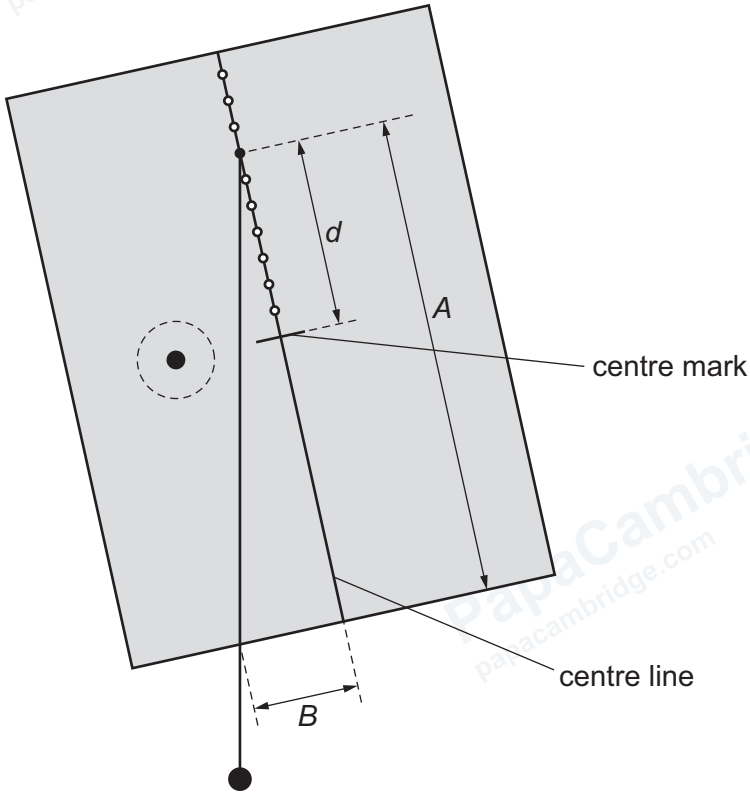

Figure 1.2

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]

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(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]

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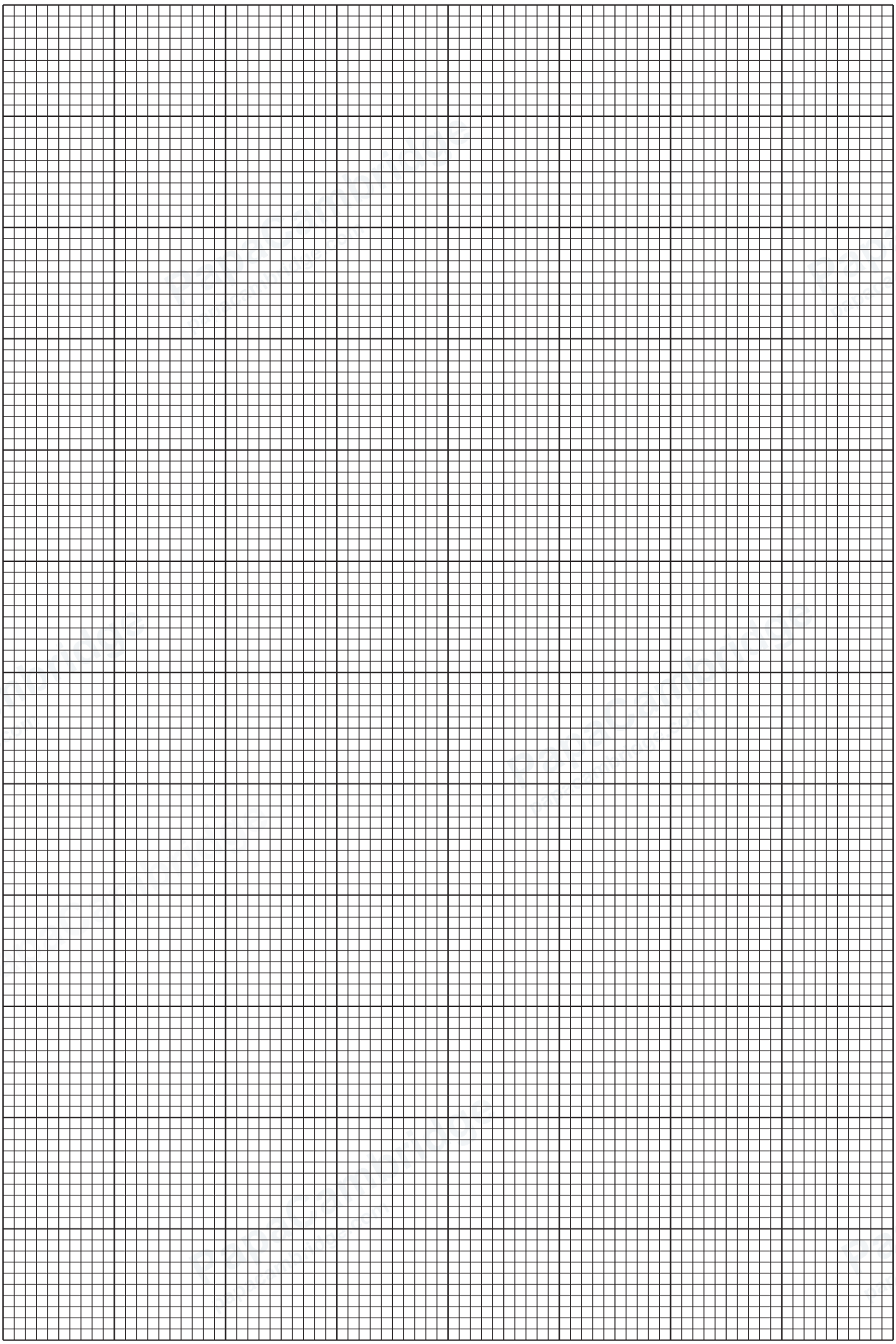

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(d) It is suggested that the quantities t and d are related by the equation

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

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]

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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 = ... [1]

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

D = ... 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.

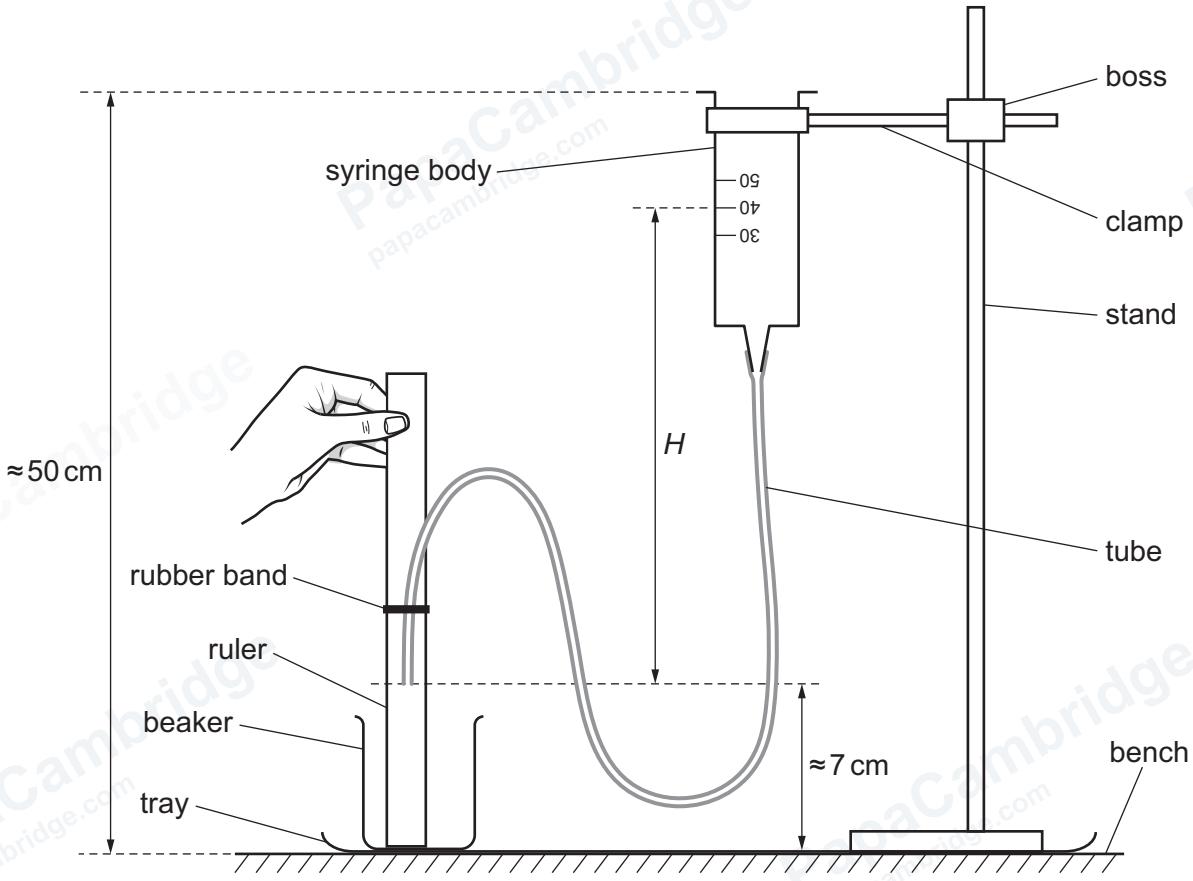

Figure 2.1

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- 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 cm^3 graduation on the syringe body is *H*.

  Measure and record *H*.

H = ... [1]

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

percentage uncertainty = ... % [1]

(iii)
- Fill the syringe body with water from the jug.
- The time taken for the water level to move between the 50 cm^3 graduation and the 30 cm^3 graduation is *T*.

  Determine *T*.

T = ... [2]

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

L = ... [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 = ...

T = ...
[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.

first value of k = ...

second value of k = ...
[1]

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(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]

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(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 .....

.....

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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