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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

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.

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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.

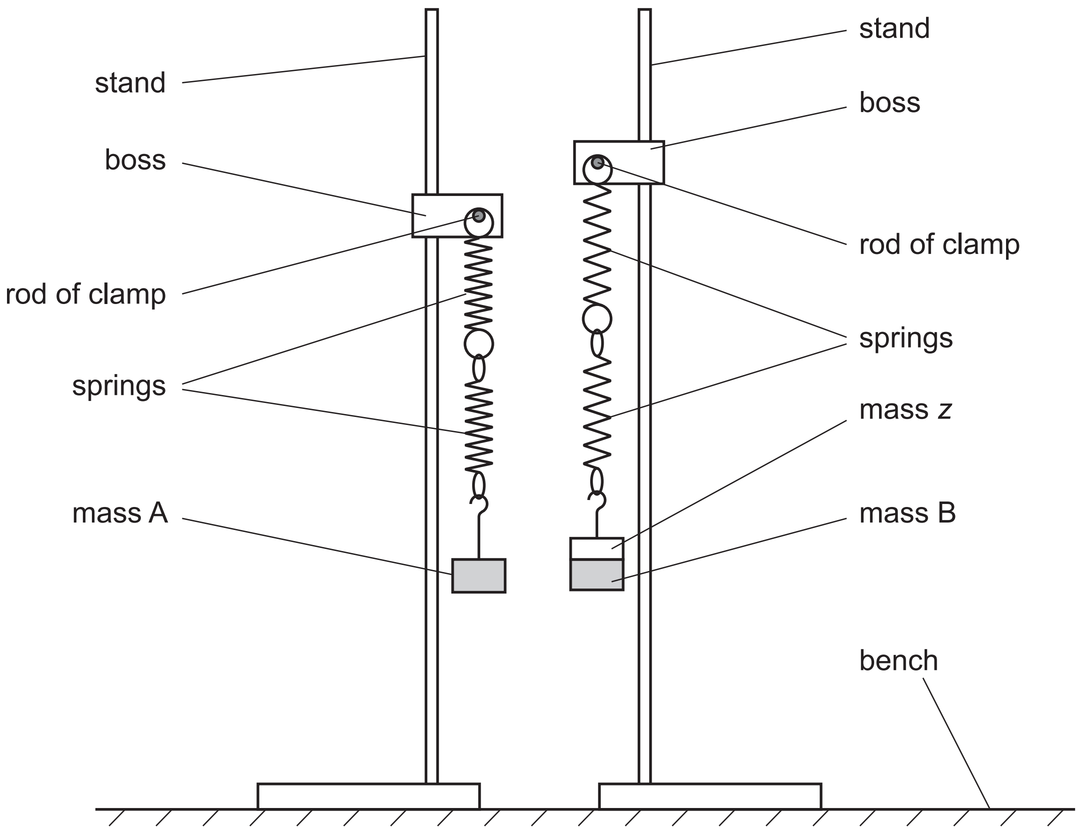

Fig. 1.1

- 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 = ... g

- *M* is given by *M* = 200 g + *z*.

  Calculate *M*.

M = ... 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.

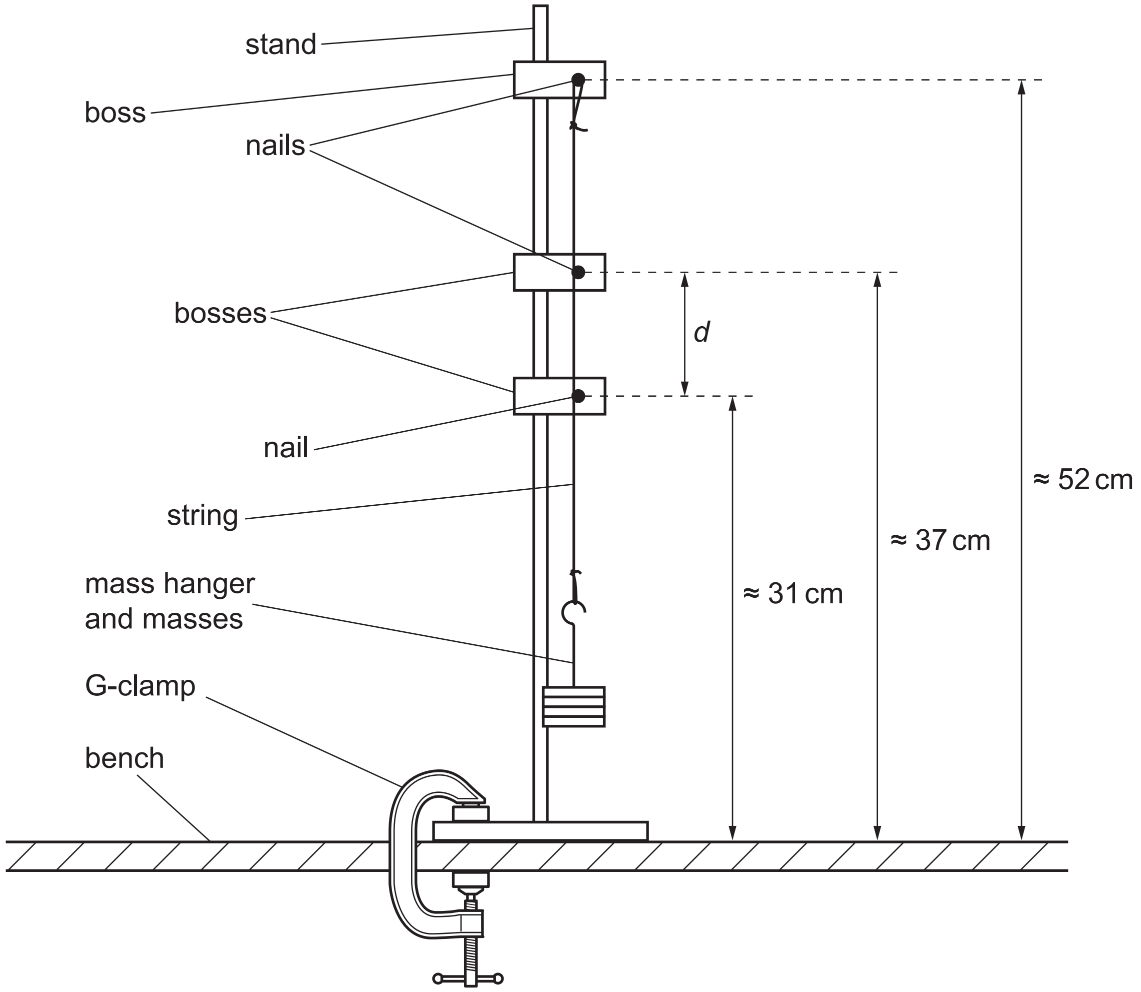

Fig. 2.1

• 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 = ... cm [1]

(b) The tension in the string is T.

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

T = ... 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.

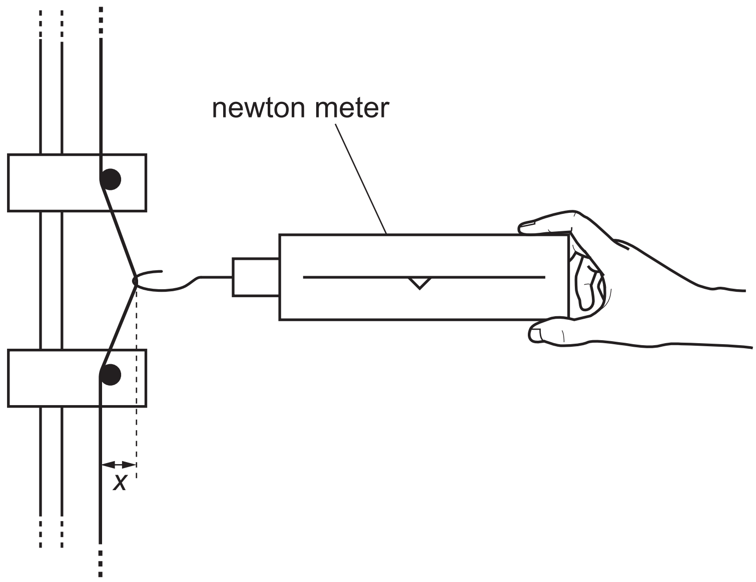

Fig. 2.2

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

Measure and record x.

x = ... cm [2]

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

percentage uncertainty = ... % [1]

DO NOT WRITE IN THIS MARGIN

(iii) Calculate y, where

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

y = ... 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 = ... N

x = ... cm

y = ... 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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