



Cambridge International AS & A Level

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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.
- 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.

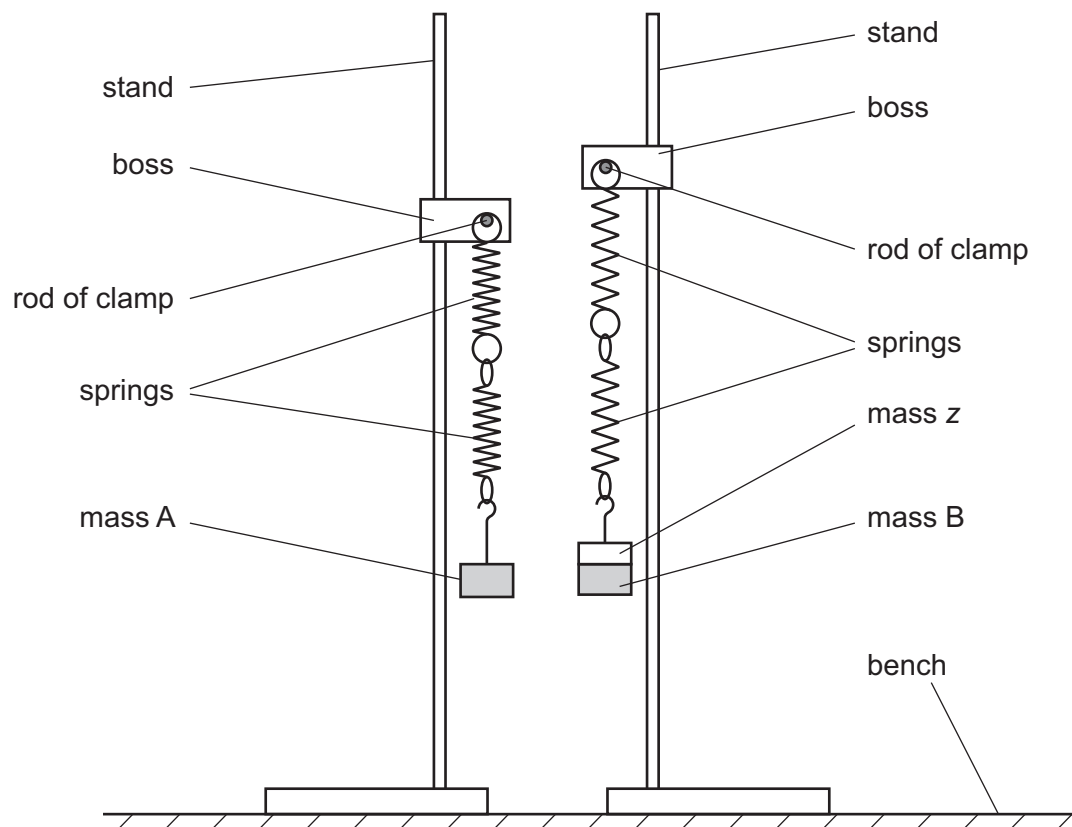


Fig. 1.1

- 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.

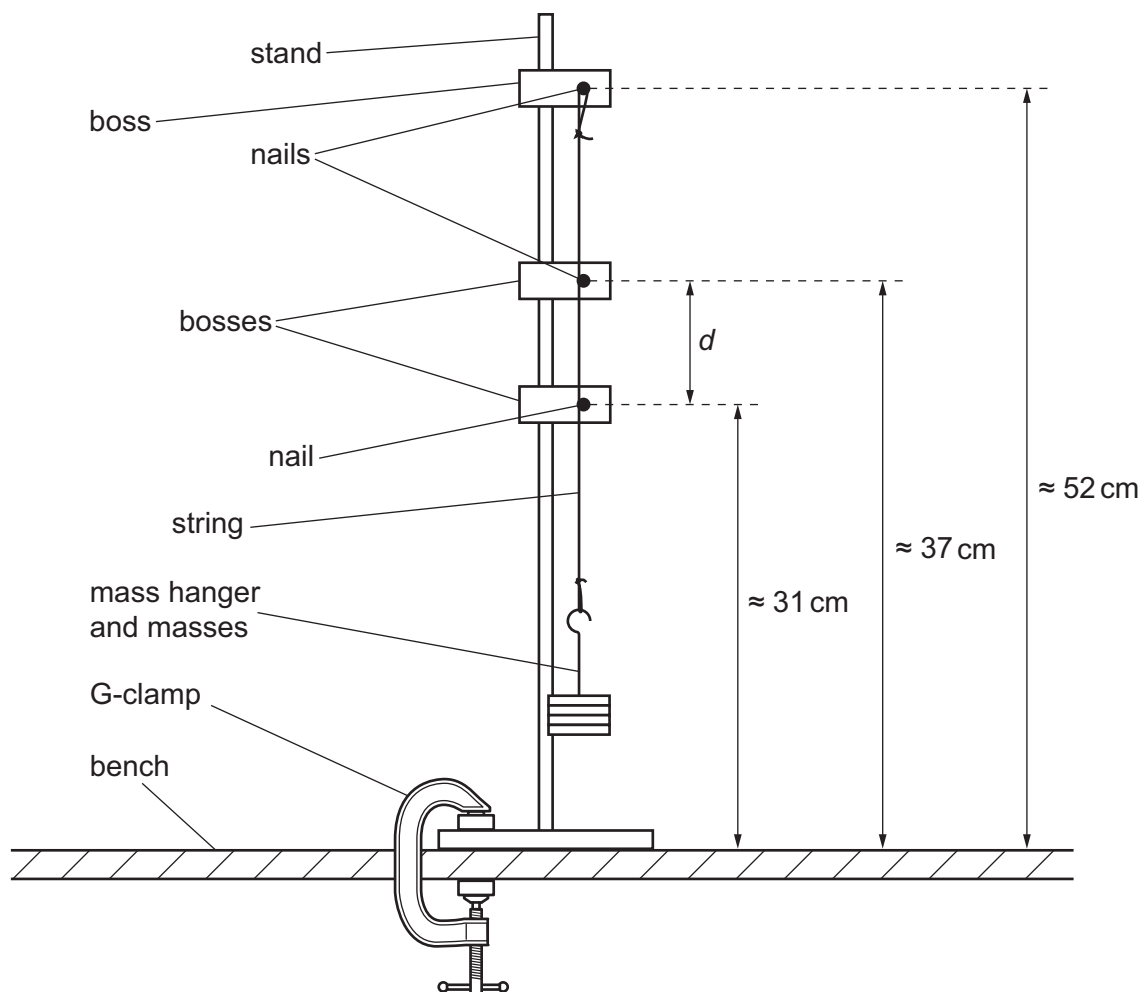


Fig. 2.1

- 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.

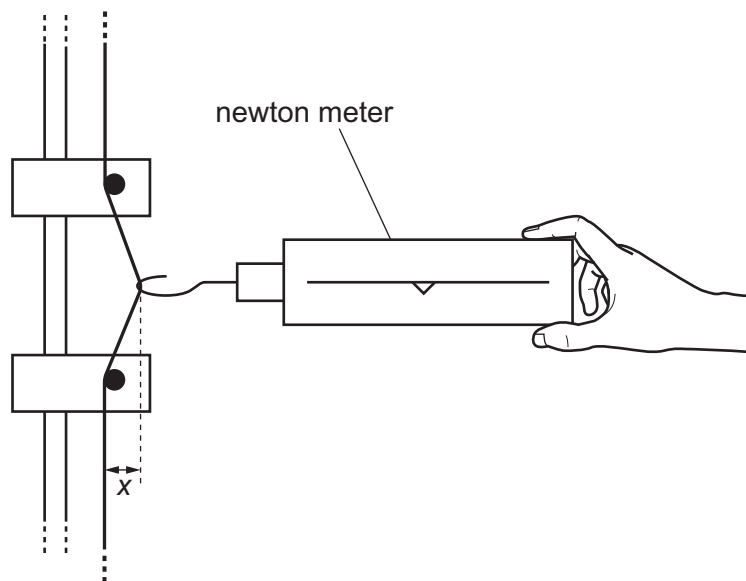


Fig. 2.2

• 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

.....

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

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2

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3

.....

4

.....

[4]

[Total: 20]





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