



# 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	
<b>Total</b>	

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.

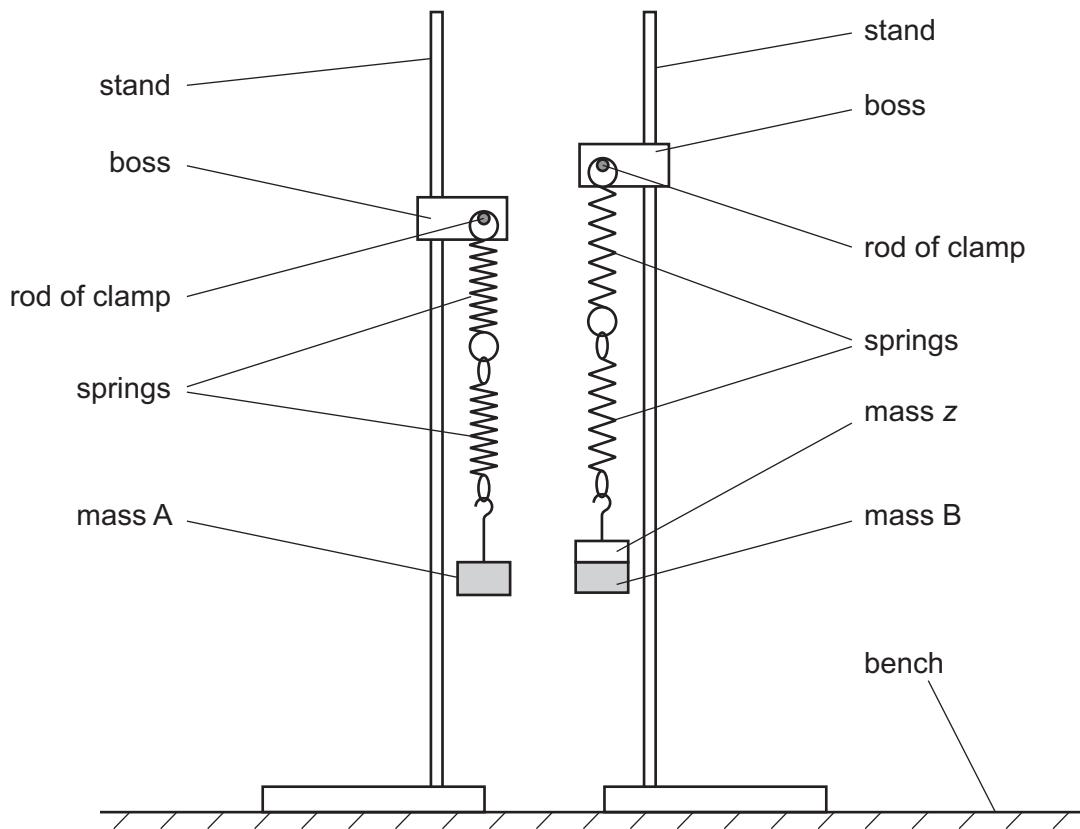


Fig. 1.1

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

Record the value of z.

$z = \dots$  g

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

Calculate  $M$ .

$M = \dots$  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  $P$ .

$P = \dots$

[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.

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gradient = .....

$y$ -intercept = .....

[2]



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(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.

$a = \dots$

$b = \dots$

[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.

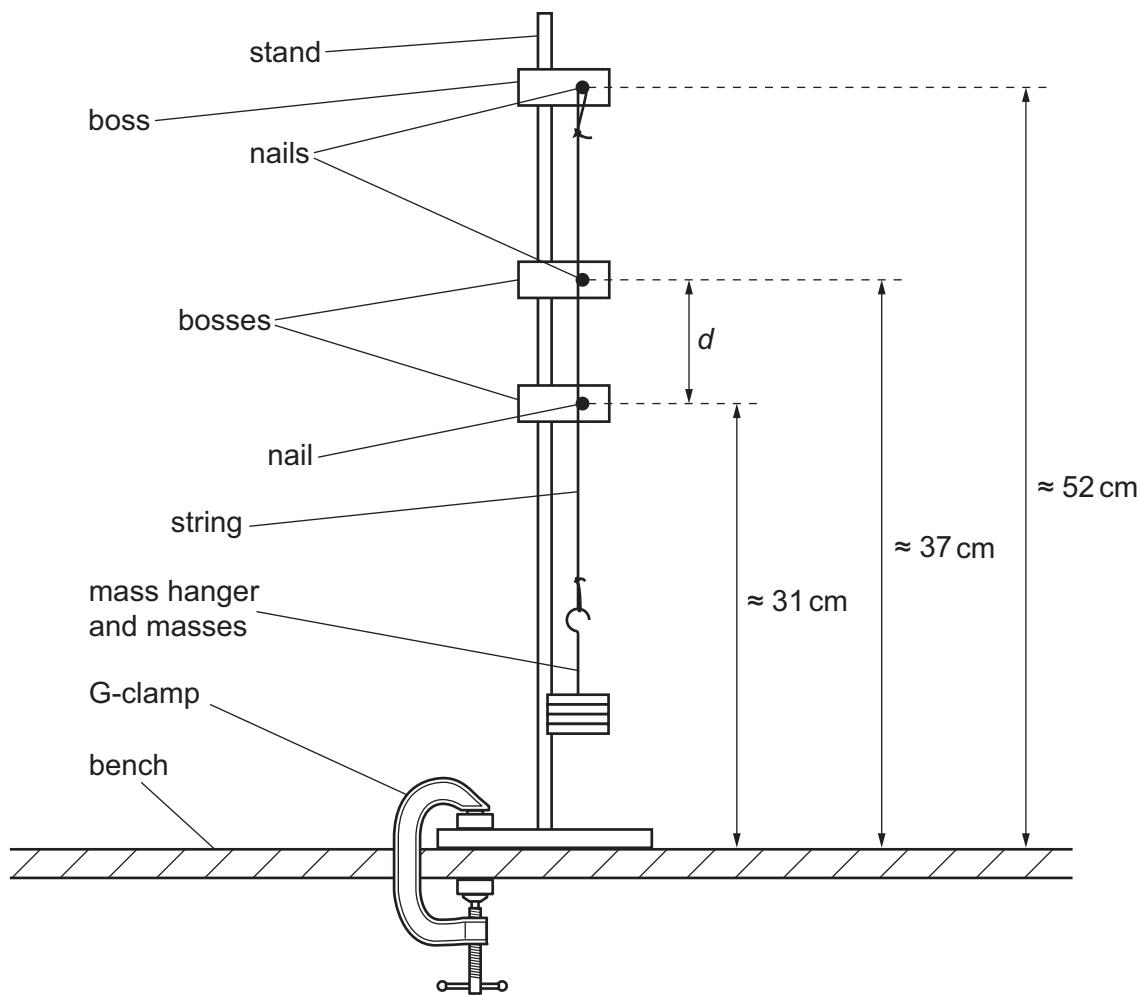


Fig. 2.1

- 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  $d$ .

$$d = \dots \text{ cm} \quad [1]$$



(b) The tension in the string is  $T$ .

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

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

(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.

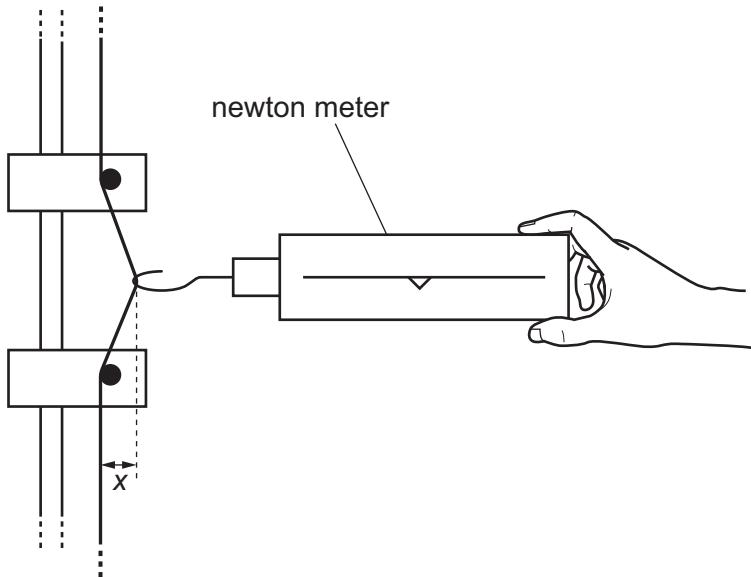


Fig. 2.2

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

Measure and record  $x$ .

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

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

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



(iii) Calculate  $y$ , where

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

$y = \dots$  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).

$T = \dots$  N

$x = \dots$  cm

$y = \dots$  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 .....

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4 .....

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[4]

[Total: 20]





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