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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

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PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **May/June 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	
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Total	

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

1 In this experiment, you will investigate the oscillations of a magnet.

You have been provided with a small magnet attached to a string. You have also been provided with a bar magnet, a plotting compass and a sheet of paper.

(a) • Draw a straight line of approximate length 20 cm on the sheet of paper.

• Mark point X at the centre of this line as shown in Fig. 1.1.

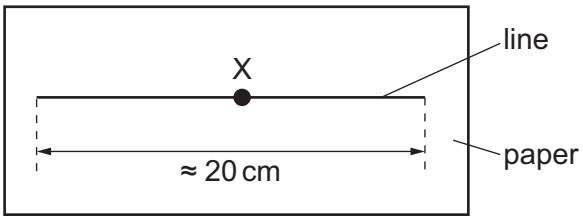


Fig. 1.1

• Rotate the paper so that the straight line on the paper is aligned with the N–S direction shown by the plotting compass, as shown in Fig. 1.2.
Keep the magnets away from the plotting compass while you are doing this.

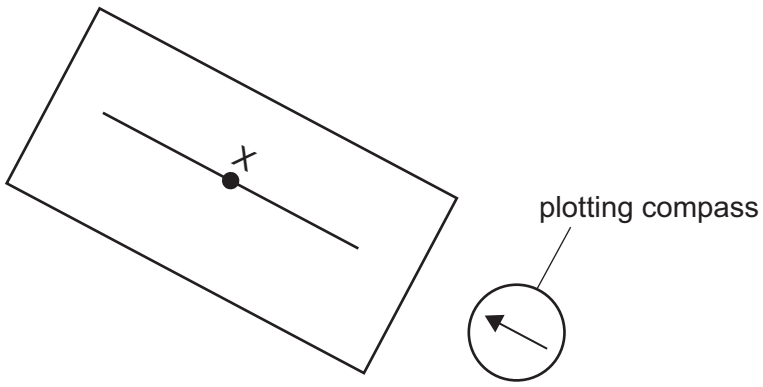


Fig. 1.2

• Fix the paper to the bench in this position using adhesive putty.
The paper should stay in this position throughout the experiment.

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- Set up the apparatus as shown in Fig. 1.3.

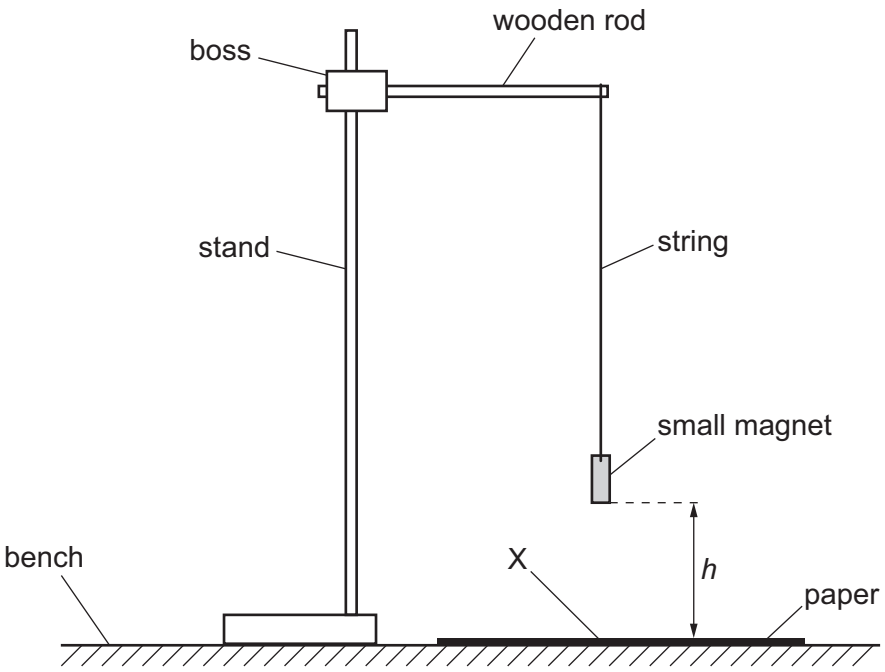


Fig. 1.3

- Adjust the position of the stand until the small magnet is directly over point X on the paper.
- The distance between the bottom of the small magnet and the paper is *h*.

  Adjust the height of the boss until *h* is 3.0 cm.
- Displace the small magnet through a short distance **in the direction of the line on the paper**.
- Release the small magnet. The small magnet will oscillate.
- The period of the oscillations of the small magnet is T_0.

  Take measurements to determine T_0.

T_0 = ... [2]

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(b) • Place the bar magnet on the sheet of paper at the position shown in Fig. 1.4.

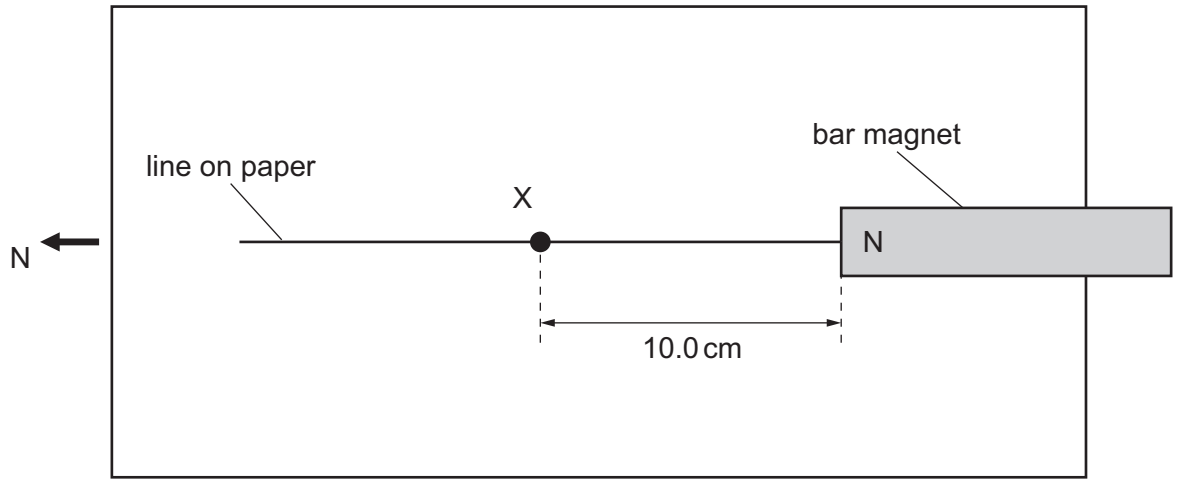


Fig. 1.4

- Draw around the bar magnet. **Do not move it from this position.**
- Displace the small magnet through a short distance in the direction of the line on the paper. Release the small magnet. The small magnet will oscillate.
- The period of the oscillations of the small magnet is *T*.

  Record *h* and determine *T*.

h = ...

T = ...
[1]

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(c) Write down your value of T_0 from **(a)**.

T_0 = ...

Change the height of the boss such that h is in the range 3.0 cm $\leqslant h \leqslant$ 9.0 cm.

For each value of h, determine T.

Repeat until you have six sets of values of h and T. Include your values from **(b)**.

Record your results in a table. Include values of $\frac{T}{T_0}$ in your table.

[9]

(d) (i) Plot a graph of $\frac{T}{T_0}$ on the y-axis against h on the x-axis. [3]

(ii) Draw the straight line of best fit. [1]

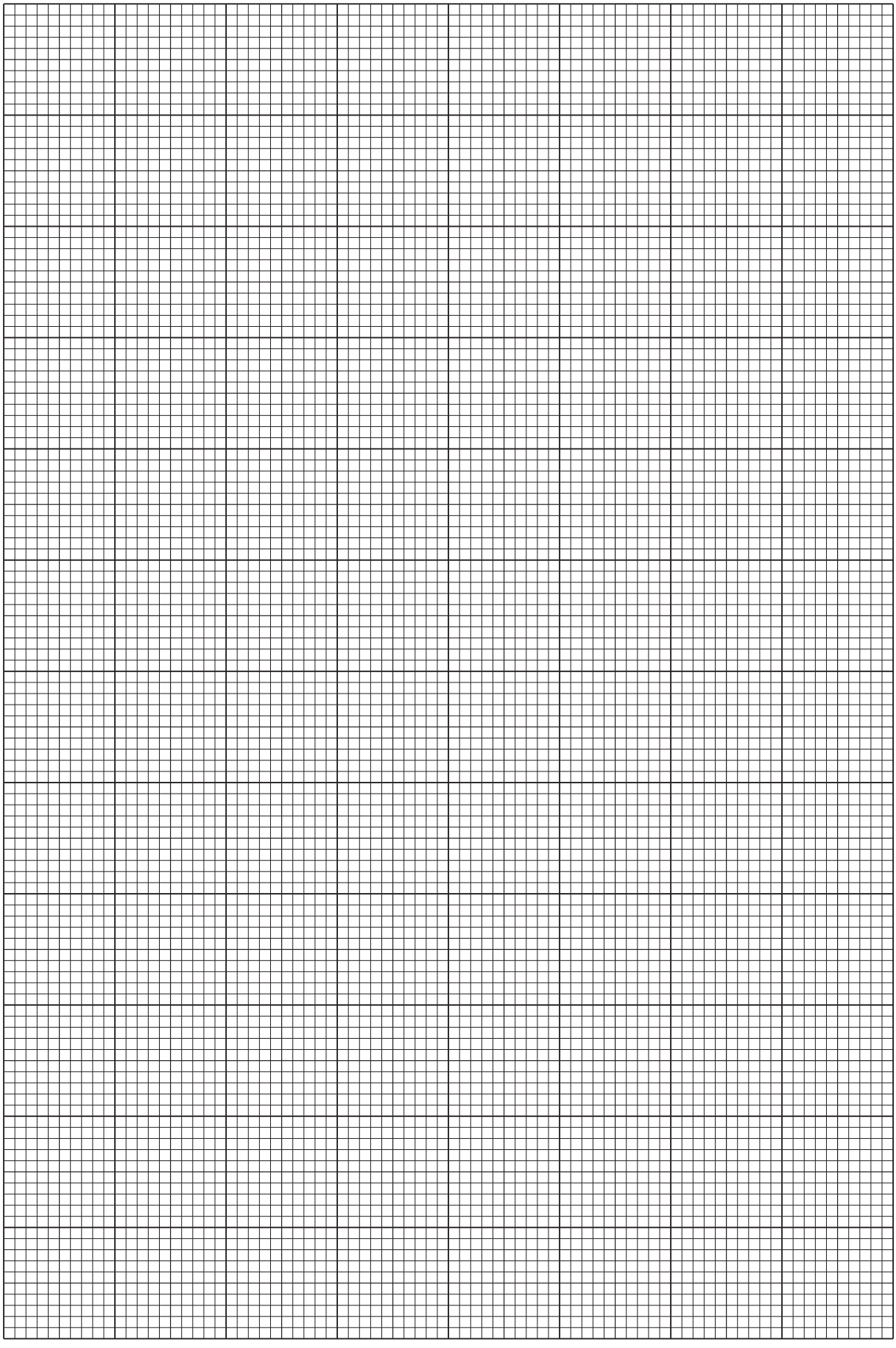
(iii) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...

[2]

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(e) It is suggested that the quantities T and h are related by the equation

$$\frac{T}{T_0} = Ph + Q$$

where P and Q are constants.

Using your answers in **(d)(iii)**, 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 behaviour of suspended cardboard sheets.

You have been provided with two cardboard sheets labelled A and B.

(a) • The thickness of sheet A is *t*. Use the micrometer to measure *t*.

• Record *t*.

t = ... mm [1]

(b) (i) • Use the nail to make holes in two corners of sheet A as shown in Fig. 2.1.

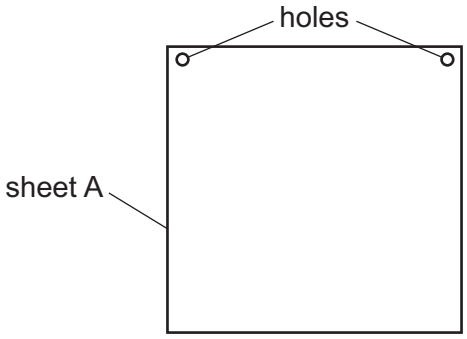


Fig. 2.1

• Ensure that the sheet is able to swing freely on the nail when the nail is placed in either hole.

• Set up the apparatus as shown in Fig. 2.2.

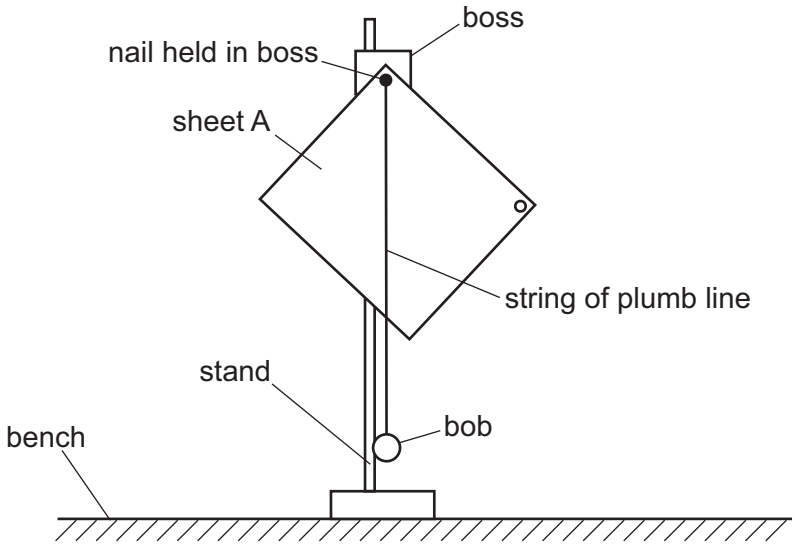


Fig. 2.2

• Place the nail through one of the holes in A and place the string loop of the plumb line over the nail.

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- Draw a line on A along the length of the string of the plumb line.
- Place the nail through the other hole in A and draw a line on A along the length of the string of the plumb line.
- The two lines will cross at a point called the centre of gravity. Label this point P as shown in Fig. 2.3.

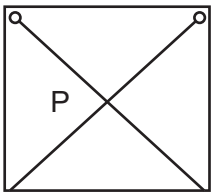


Fig. 2.3

- Use adhesive putty to attach the two 10 g masses to A at the edge of the sheet as shown in Fig. 2.4.

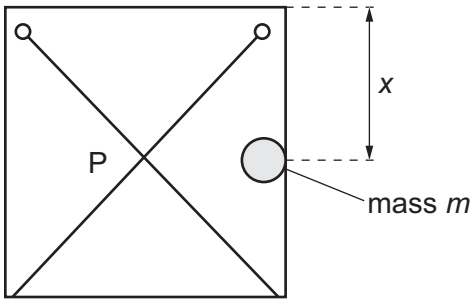


Fig. 2.4

- The distance between the top edge of the sheet and the centre of the masses is *x*, as shown in Fig. 2.4.

  The total mass attached to the sheet is *m*.

  Adjust the position of the masses until *x* is approximately 10 cm.

- Record *m* and *x*.

m = ... g

x = ... cm

[1]

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(ii) • Repeat the same process to determine the new centre of gravity of A. Label this point Q.

• The distance between P and Q is *y*, as shown in Fig. 2.5.

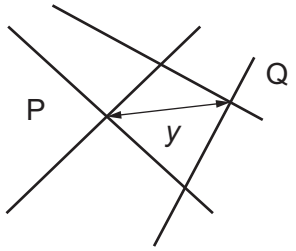


Fig. 2.5

Measure and record *y*.

y = ... cm [2]

(iii) Estimate the percentage uncertainty in your value of *y*. Show your working.

percentage uncertainty = ... % [1]

(iv) Calculate $\frac{y^2}{m^2}$.

$\frac{y^2}{m^2}$ = ... $cm^2 g^{-2}$ [1]

(v) Justify the number of significant figures that you have given for your value of $\frac{y^2}{m^2}$.

.....

.....

..... [1]

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(c) Using sheet B, repeat **(a)**, **(b)(i)**, **(b)(ii)** and **(b)(iv)** with a value of m of 10 g and a value of x of approximately 5 cm.

t = ... mm

m = ... g

x = ... cm

y = ... cm

$\frac{y^2}{m^2}$ = ... $cm^2 g^{-2}$ [3]

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(d) It is suggested that the relationship between y, m, x and t is

$$\frac{y^2}{m^2} = \frac{k}{xt}$$

where k is a constant.

Using your data, calculate **two** values of k.

first value of k = ...

second value of k = ...

[1]

(e) 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 **(d)**.

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..... [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 .....

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2 .....

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3 .....

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4 .....

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[4]

(ii) Describe **four** improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

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[4]

[Total: 20]

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