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Question	Mark
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General Certificate of Education
Advanced Level Examination
June 2010

Physics PHA6/B6/X

(Specifications A and B)

Unit 6 Investigative and Practical Skills in A2 Physics
Route X Externally Marked Practical Assignment (EMPA)

Section A Task 2

For this paper you must have:
- a calculator
- a pencil
- a ruler.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Show all your working.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for Section A Task 2 is 16.

Do not write outside the box

Section A Task 2

Follow the instructions given below.

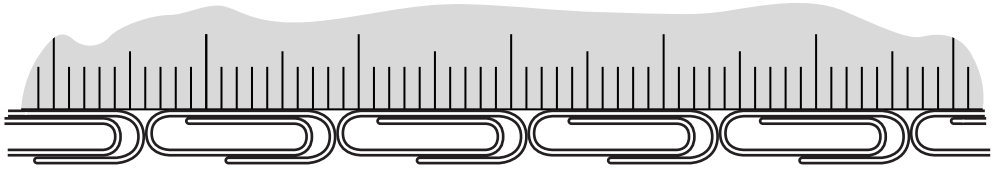
Answer **all** the questions in the spaces provided.

No description of the experiment is required.

In this experiment you are to make measurements on a chain of paper clips, supported at each end, which hangs in equilibrium in a vertical plane above the bench.

1 (a) You are provided with a number of **unconnected** paper clips.
Place a metre ruler on the bench with the graduations uppermost and lay some paper clips against the edge of the ruler so they are aligned in a single row, each paper clip touching the next without overlapping, as shown in **Figure 2.**

Figure 2



Make suitable measurements to determine the mean length, c, of one paper clip.

.....

.....

c = ...

(1 mark)

1 (b) Using the micrometer screw gauge, make suitable measurements to determine the diameter, d, of the wire from which the paper clips have been formed.

.....

.....

d = ...

(1 mark)

1 (c) Adjust the height of the horizontally clamped supports until these are **close to the top** of the stands and the top surface of each is the **same vertical distance** above the bench. Position one metre of paper tape parallel to the edge of the bench, about 20 cm from the edge. Fix this down to the bench with Sellotape.

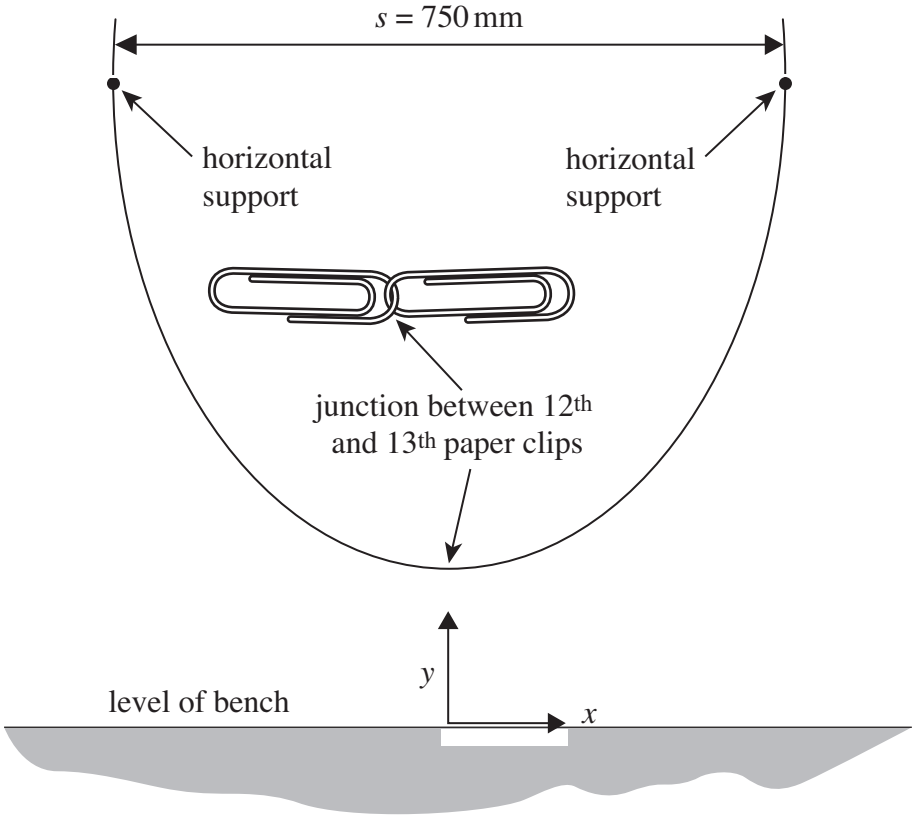
You are also provided with a chain of 24 paper clips.
Suspend one end of the chain from one horizontally-clamped support and the other end from the second horizontally-clamped support, so that the full length of the chain hangs in equilibrium in a vertical plane above the bench.
Adjust the positions of the stands to which the horizontal supports are clamped until the chain lies directly above the length of paper tape and the **horizontal distance**, s, between the ends of the paper clip chain is 750 mm.

Mark on the tape the point **directly below** the centre of the chain.

Using the additional apparatus provided, measure and record values of x and y, which are the horizontal and vertical distances respectively, from the point marked on the paper tape to junctions between paper clips in the chain, as shown in **Figure 3**.
Take sufficient readings of x and y to define the shape of the chain from the **centre to the right-hand end** of the chain.

Record all your measurements and observations on **page 4**.

Figure 3



Question 1 continues on the next page

Do not write outside the box

Measurements and observations.

(6 marks)

1 (d) Plot, on the grid opposite, a graph of y on the vertical axis and x on the horizontal axis.

(8 marks)

16

END OF QUESTIONS

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June 2011

Physics PHA6/B6/XPM2
(Specifications A and B)

Unit 6 Investigative and Practical Skills in A2 Physics
Route X Externally Marked Practical Assignment (EMPA)

Section A Part 2

For this paper you must have:
- a calculator
- a pencil
- a ruler.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Show all your working.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for Section A Part 2 is 16.

Do not write outside the box

Section A Part 2

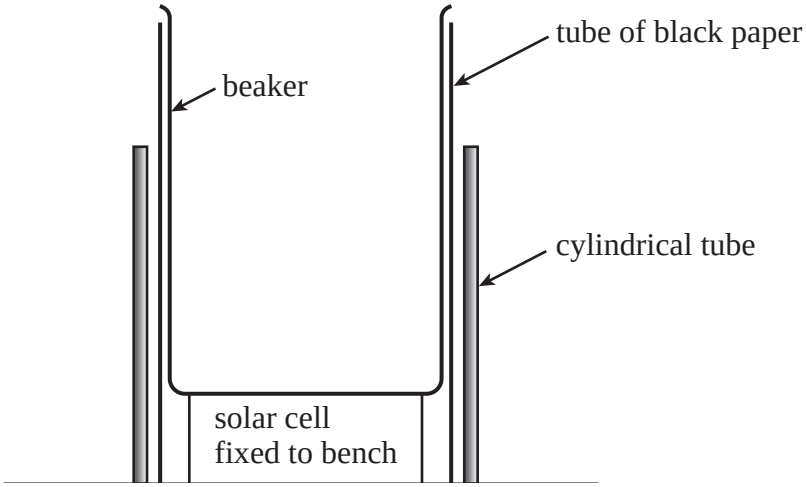
Follow the instructions given below.

Answer **all** the questions in the spaces provided.

No description of the experiment is required.

1 In this experiment you are to investigate the absorption of light as it passes through a solution of ink. The apparatus you will use is shown in **Figure 4**.

Figure 4



The solar cell and the cylindrical tube have been taped to the bench.
Do not remove the beaker or the tube of black paper from within the cylindrical tube.

Position the clamped lamp so that it is coaxial with the beaker.
Do not adjust the height of the lamp or the output voltage of the power supply.

The output voltage of the solar cell is shown on the digital voltmeter.
Do not change the range setting of the voltmeter.

Switch on the lamp and monitor the voltmeter reading over a short interval of time, eg 20 seconds, so that either the reading reaches a steady value or so you can determine the range, and hence the mean value, V_0, of the reading.

1 (a) Read and record V_0.

V_0 = ...

(1 mark)

Do not write outside the box

1 (b) You are provided with approximately 500 ml of a solution of ink and two measuring cylinders of different capacity and resolution.
You are to record the voltmeter reading, *V*, as the volume of ink solution in the beaker, *Q*, is varied.

1 (b) (i) Transfer **between 90 ml and 100 ml** of the solution to the **larger** measuring cylinder.
Note the volume of the solution in this measuring cylinder before carefully pouring this into the beaker.
Record *Q*, the volume of the solution in the beaker.
Read and record the (mean) voltmeter reading, *V*.

1 (b) (ii) Transfer between **20 ml and 25 ml** of the solution to the **smaller** measuring cylinder.
Note the volume of the solution in the measuring cylinder before carefully pouring this into the beaker.
Record *Q*, the new volume of the solution in the beaker then read and record the corresponding (mean) voltmeter reading, *V*.
Increase *Q* in increments of between 20 ml and 25 ml, recording the voltmeter reading, *V*, at each stage, until *Q* is about 200 ml.

1 (b) (iii) Transfer between **40 ml and 70 ml** of the solution to the **larger** measuring cylinder.
Note the volume of the solution in this measuring cylinder before carefully pouring this into the beaker.
Record *Q* and *V* then continue, increasing *Q* in increments of between 40 ml and 70 ml, measuring the voltmeter reading, *V*, at each stage, until all the solution has been transferred to the beaker.

You should record all the data required to complete part (b) of this question on **page 4** of this booklet.
Note that you will not be expected to record repeat readings of the measurements made in part (b).

Question 1 continues on the next page

Measurements and observations.

(6 marks)

1 (c) Plot, on the grid on **page 5**, a graph with ln(V/mV) on the vertical axis and Q on the horizontal axis. You should draw a straight line of best fit through the plotted points. Record below the data you will plot on your graph.

(9 marks)

END OF SECTION A PART 2

16

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June 2012

Physics PHA6/B6/XPM2

(Specifications A and B)

Unit 6 Investigative and Practical Skills in A2 Physics
Route X Externally Marked Practical Assignment (EMPA)

Section A Part 2

For this paper you must have:
- a calculator
- a pencil
- a ruler.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Show all your working.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for Section A Part 2 is 16.

Do not write outside the box

Section A Part 2

Follow the instructions given below.

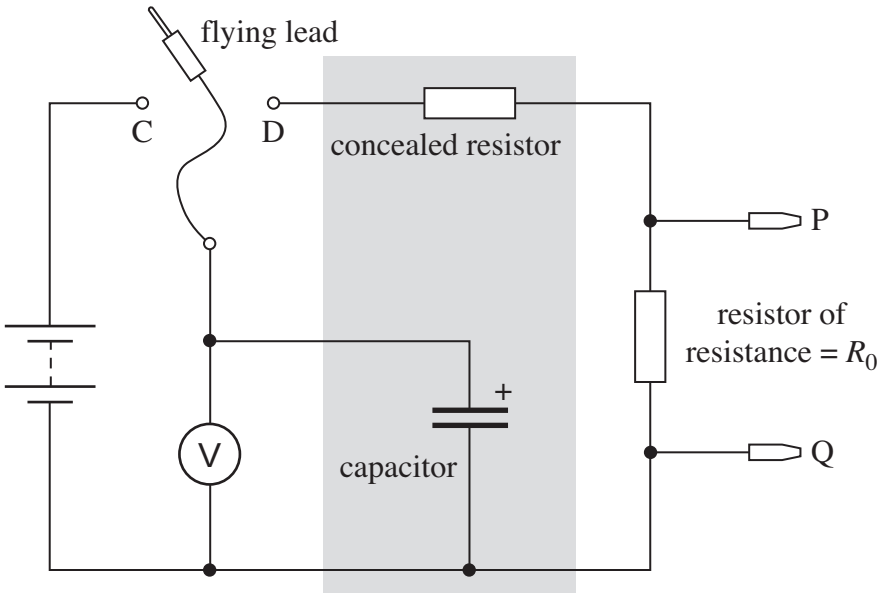
Answer **all** the questions in the spaces provided.

No description of the experiment is required.

1 In this experiment you are to investigate the discharge of a capacitor through different combinations of resistors.

You are provided with the circuit shown in **Figure 4**, part of which is concealed, as shown by the shaded region on the diagram.

Figure 4



concealed part of the
circuit shown shaded

1 (a) Charge the capacitor by connecting the flying lead to terminal C.
The voltmeter will show a steady reading.

Connect the flying lead to terminal D so that the capacitor discharges through the concealed resistor and the resistance R_0.
The voltmeter reading will be seen to fall exponentially.

Make suitable measurements to determine T_0, the time for the voltmeter reading to decrease by 50%.

.....

.....

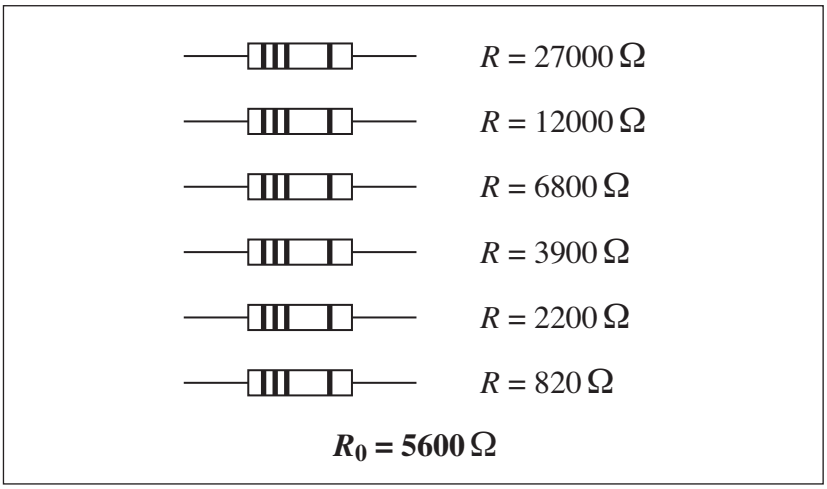
T_0 = ...

(1 mark)

Do not write outside the box

1 (b) You are provided with a postcard to which six resistors have been attached; the resistance, R, of each of these is printed on the card, as shown in **Figure 5**.

Figure 5



Connect the resistor with $R = 27000\,\Omega$ between clip P and clip Q so that it is in parallel with resistor R_0.

Using the same procedure for charging and then discharging the capacitor as before, make suitable measurements to obtain T, the time for the voltmeter reading to decrease by 50%.

Repeat the procedure using each resistor, in turn, between P and Q, until you have obtained values of T for all six resistors.

Record your measurements and observations below.

(4 marks)

Turn over ▶

1 (c) Use the value of R_0 printed on the postcard to calculate values of $\frac{R}{R+R_0}$ that correspond to each of your values for T.

Record these data below.

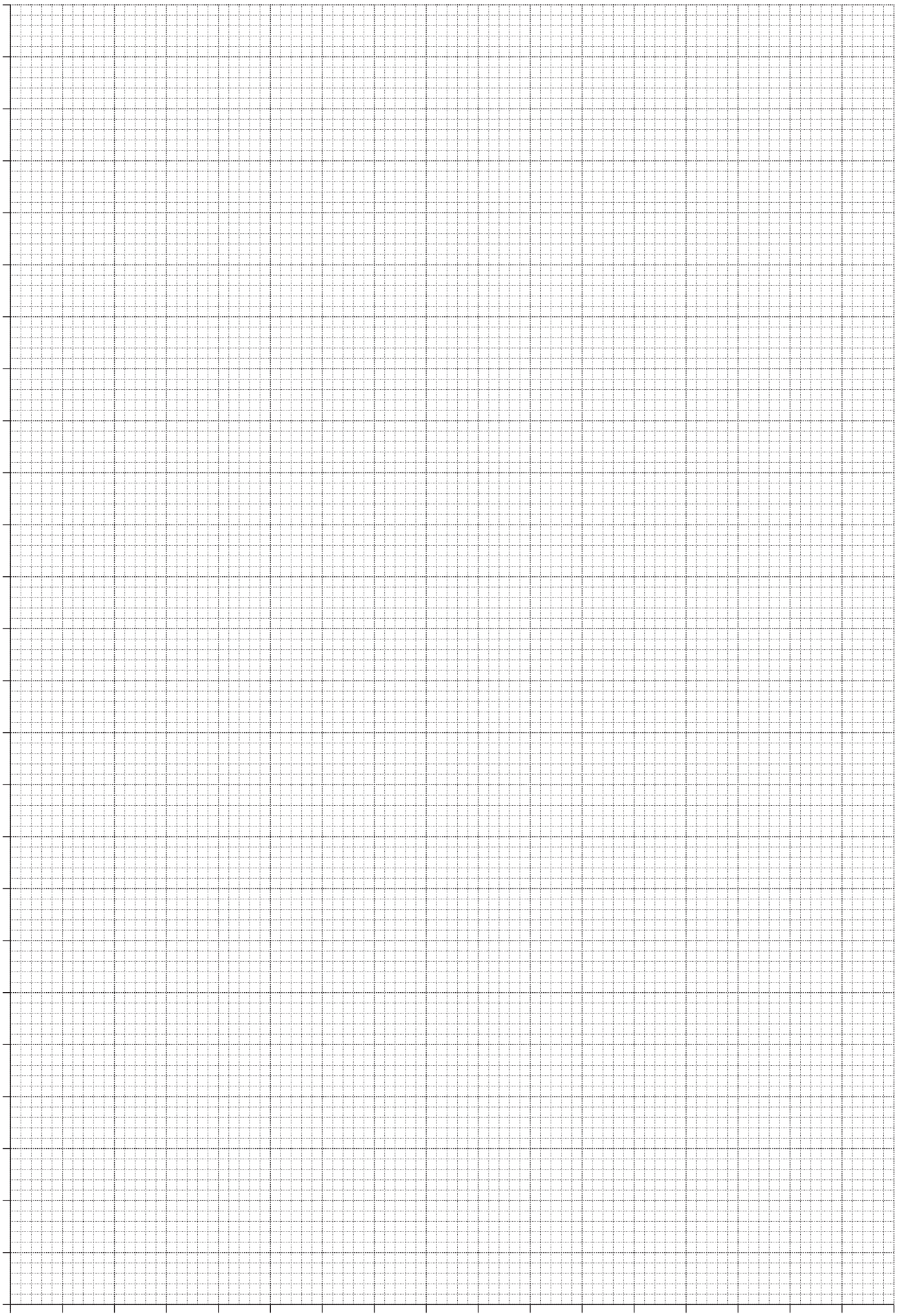
(2 marks)

1 (d) Plot, on the grid opposite, a graph with $\frac{R}{R+R_0}$ on the vertical axis and T on the horizontal axis.

(9 marks)

16

END OF QUESTIONS



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General Certificate of Education
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June 2013

Physics PHA6/B6/XPM2

(Specifications A and B)

Unit 6 Investigative and Practical Skills in A2 Physics
Route X Externally Marked Practical Assignment (EMPA)

Section A Task 2

For this paper you must have:
- a calculator
- a pencil
- a ruler.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Show all your working.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for Section A Task 2 is 16.

Do not write outside the box

Section A Task 2

Follow the instructions given below.

Give the information required in the spaces provided.

No description of the experiment is required.

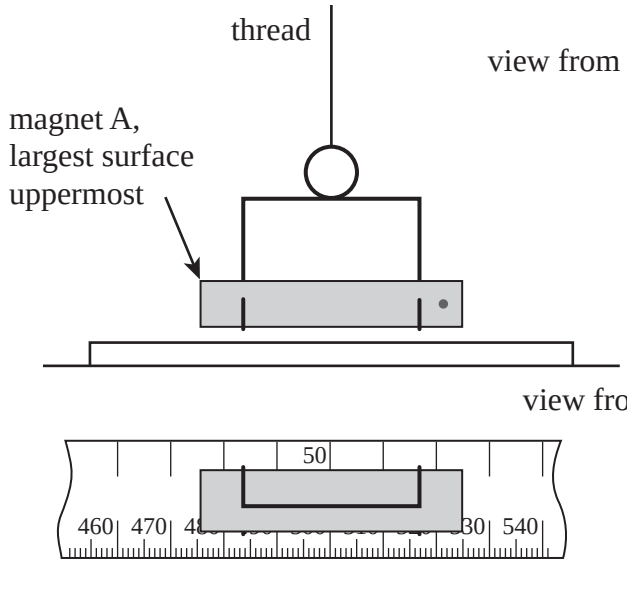
1 In this experiment you are to investigate the oscillation of a bar magnet suspended in a magnetic field of variable magnetic flux density.

You are provided with a bar magnet, supported in a stirrup suspended from a retort stand. Do not remove the stand or adjust the height of the clamp to which the stirrup is attached. Place the metre ruler on the bench with the graduated face uppermost and the centre of the magnet directly above the 50 cm graduation on the ruler.

Turn the metre ruler about its mid-point until it is aligned with the long axis of magnet A, as shown in **Figure 5a**.

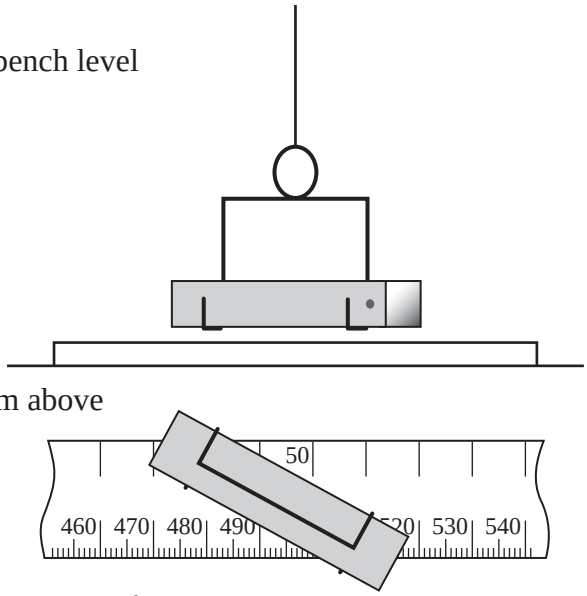
Keeping the largest surface of the magnet uppermost, the long axis of the magnet parallel to the bench and the thread supporting the magnet vertical, displace each end of the magnet in opposite directions so the magnet is rotated through a small angle, as shown in **Figure 5b**.

Figure 5a



ruler aligned with long axis of magnet A

Figure 5b



ends of magnet A displaced in opposite directions and thread kept vertical

1 (a) Simultaneously release both ends of magnet A so that it performs small-amplitude torsional oscillations. Make suitable measurements to determine T_0, the period of these oscillations.

.....

.....

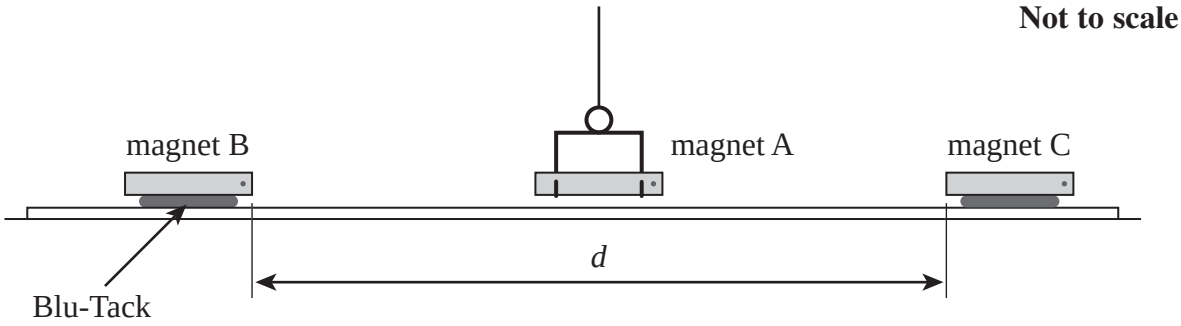
T_0 = ...

(1 mark)

1 (b) Position magnets B and C on the ruler, so that each attracts the nearest pole of magnet A. Use Blu-Tack below magnets B and C until all three magnets lie approximately in the same horizontal plane with their largest faces uppermost.
Do not alter the length of the thread supporting magnet A.

Adjust the positions of magnets B and C until they are equidistant from the nearer ends of magnet A, and the separation, d, is between 50 cm and 60 cm, as shown in **Figure 6**, which is not to scale.

Figure 6



Displace magnet A as before, then release it so that it performs small-amplitude torsional oscillations.
Measure and record the period, T, of these oscillations, then repeat the procedure for **four smaller** values of d: **do not** use values of d less than 25 cm.

Record your measurements below.
Note that the independent variable should be recorded in the **left-hand** column of your table.

(4 marks)

Do not write outside the box

1 (c) Plot, on the grid opposite, a graph with $\log\left(\left(\frac{1}{T^2} - \frac{1}{T_0^2}\right)/\mathrm{s}^{-2}\right)$ on the vertical axis and $\log\,(d/\mathrm{cm})$ on the horizontal axis.

Tabulate below the data you will plot on your graph.

(11 marks)

16

END OF QUESTIONS