

Centre Number	Candidate Number	Name
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CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

**PHYSICS**

**5054/04**

Paper 4 Alternative to Practical

May/June 2003

**1 hour**

Candidates answer on the Question Paper.  
No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.  
Write in dark blue or black pen in the spaces provided on the Question Paper.  
You may use a soft pencil for any diagrams, graphs or rough working.  
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
<b>1</b>	
<b>2</b>	
<b>3</b>	
<b>4</b>	
<b>5</b>	
<b>Total</b>	

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

This document consists of **11** printed pages and **1** blank page.



- 1 In a light experiment, a plane mirror is placed upright at the corner of a piece of graph paper, as shown in Fig. 1.1. A small lamp acts as a bright object. The lamp is placed over a point L on the edge of the graph paper that is adjacent to the mirror. Note that
1. the mirror has a line drawn on its face,
  2. there is a card with a vertical viewing slot.

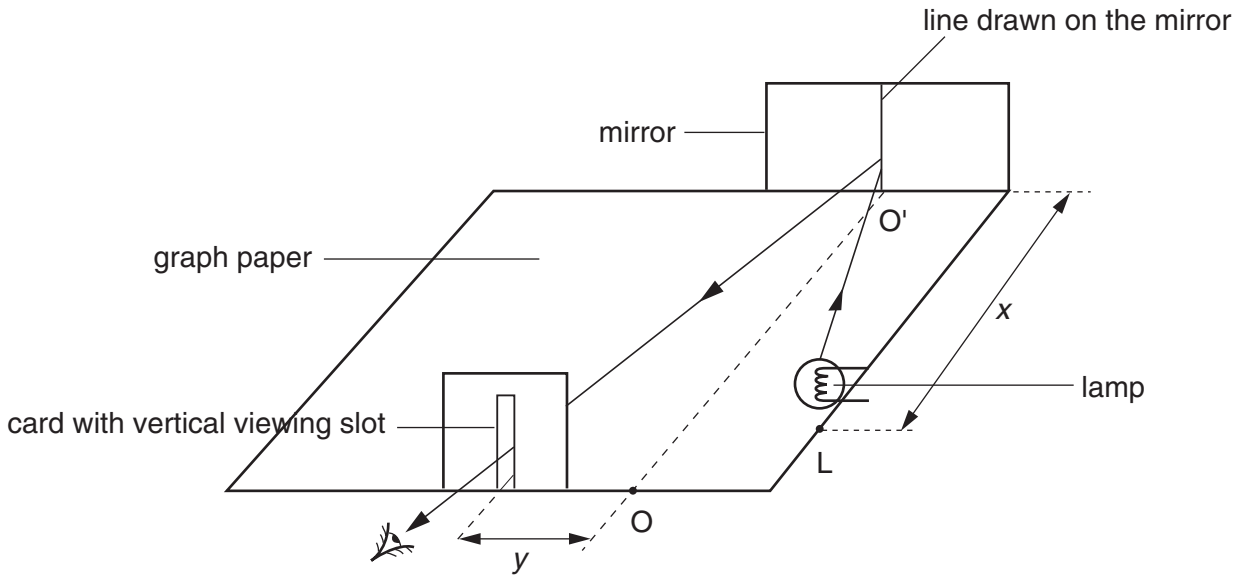


Fig. 1.1

Some of the light rays coming from the lamp are reflected from the line that is drawn on the mirror. These rays are located by looking through the slot in the card. When the card is in the correct position, the slot in the card, the line on the mirror and the lamp appear to be in one straight line.

The distances shown as  $y$  and  $x$  are measured.

In all, the experiment was performed with the lamp in four positions. These are shown in Fig. 1.2 on page 3 and are labelled  $L_1$ ,  $L_2$ ,  $L_3$  and  $L_4$ . The values for  $x$  are 180 mm, 150 mm, 100 mm and 50 mm.

The corresponding positions for the slot are labelled  $S_1$ ,  $S_2$ ,  $S_3$  and  $S_4$ .

- (a) Fig. 1.2 shows the graph paper and the positions of the lamp labelled L and the slot labelled S. Four incident rays and one reflected ray are shown.
- (i) Complete the diagram by drawing the three remaining reflected rays.
  - (ii) For each reflected ray you have drawn, measure and record the value for  $y$ .
  - (iii) Complete the table in Fig. 1.2 by calculating the three missing values of  $xy$ .

[3]

- (b) Explain how the viewing slot enables the student to locate the reflected ray.

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 .....[1]

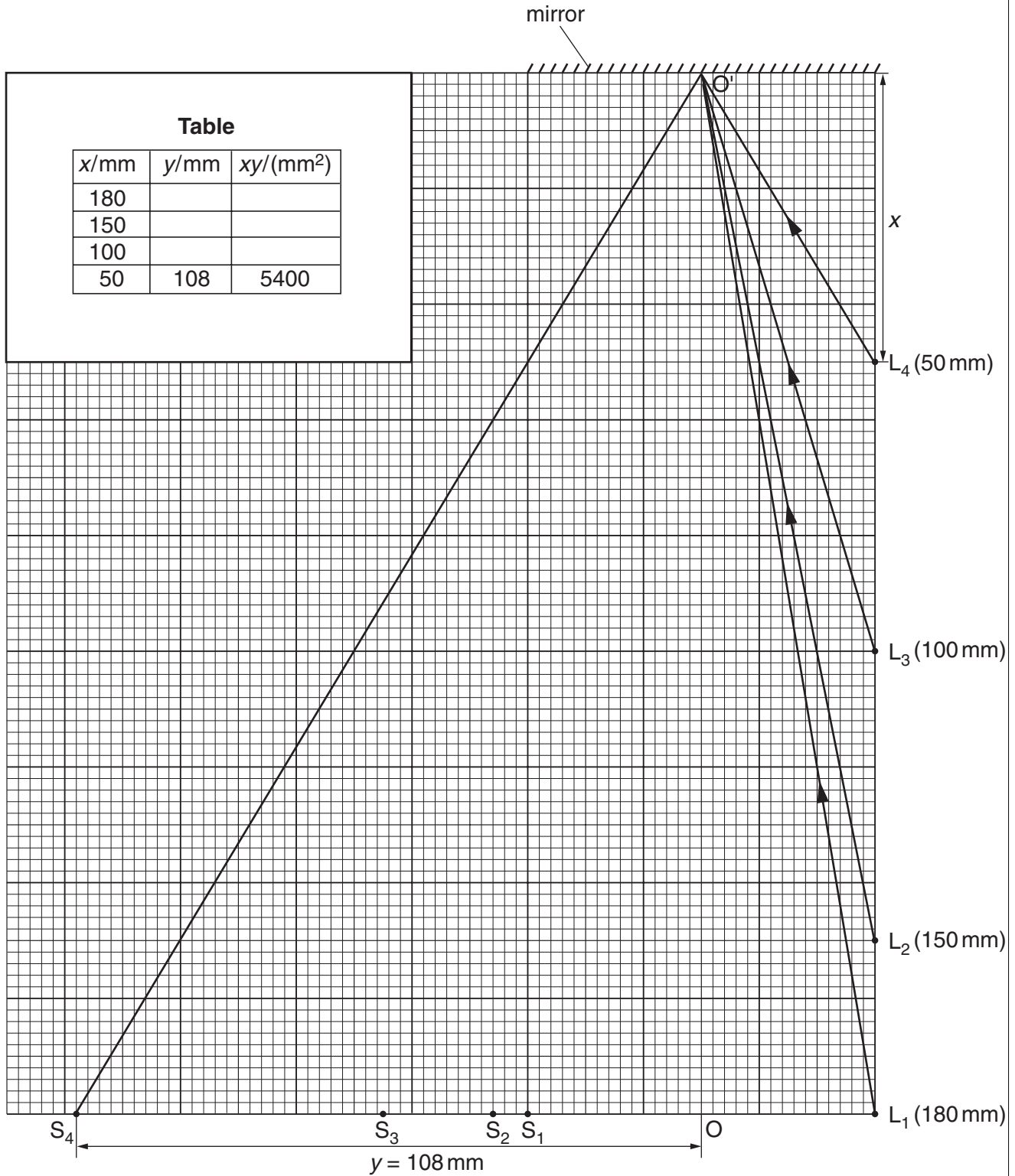


Fig. 1.2

(c) (i) Determine the average value of the product  $xy$ .

average value = .....[1]

(ii) Comment on your values of  $xy$ .

.....

.....[1]

- 2 A bar magnet is placed on a sheet of plain paper and the magnetic field lines of the bar magnet are located using a plotting compass, as shown in Fig. 2.1.

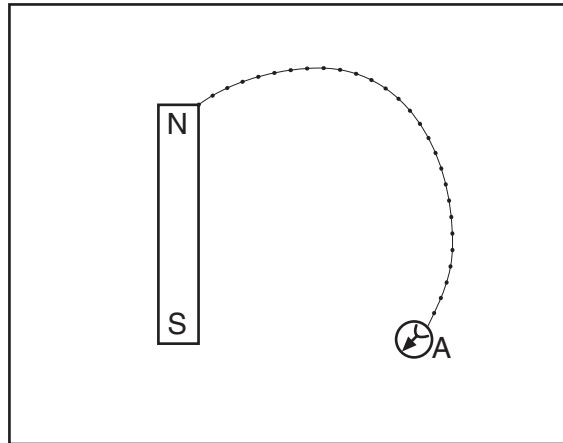


Fig. 2.1

- (a) Magnetic field lines are from the N pole to the S pole. The dots in Fig. 2.1 represent the positions of the pivot of the plotting compass as the compass is moved along a field line. The compass is at the point A.

Explain how you would complete the field line from the point A to the S pole. You should say how you would use the compass to help you mark the paper and how you would proceed from one dot to the next dot. You may draw a diagram if you wish.

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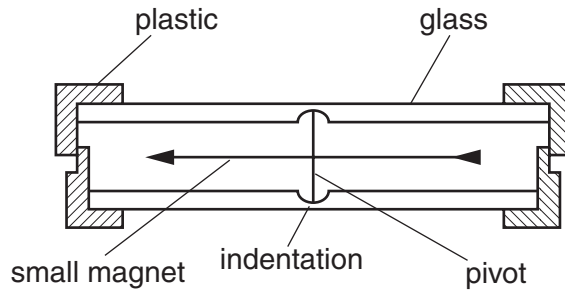
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- (b) The plotting compass is a small magnet that is pivoted between two glass plates. The compass is illustrated in Fig. 2.2. It is quite small. Its diameter is about 12 mm and its height about 6 mm.



**Fig. 2.2**

- (i) The glass plates are held together by two plastic rings. Why is steel an unsuitable material to use for the rings?

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- (ii) Give one reason why the compass should be small.

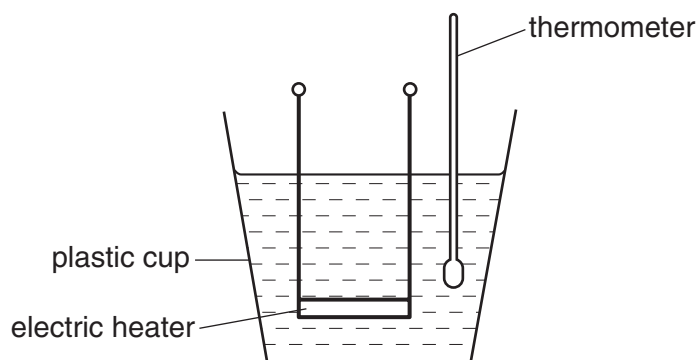
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- (iii) The pivot rests in two indentations, as shown in Fig. 2.2. Suggest a reason for this arrangement.

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[3]

- 3 Fig. 3.1 shows some of the apparatus used to determine the heat capacity of some liquid contained in a plastic cup. The temperature of the liquid is raised by an electric heater.



**Fig. 3.1**

- (a) The electric heater requires a power supply. In order to determine the power of the heater, the appropriate current and potential difference must be measured. Complete Fig. 3.1 to show a suitable electric circuit. Include in your circuit
- (i) a power supply, with the positive terminal marked,
  - (ii) a switch,
  - (iii) a voltmeter, with the positive terminal marked,
  - (iv) an ammeter.

[3]

(b) The scale of the voltmeter used in the experiment is shown in Fig. 3.2.

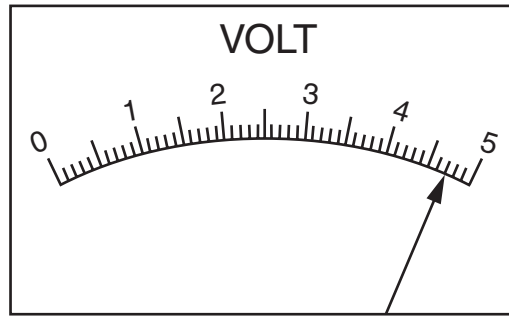


Fig. 3.2

(i) State the maximum potential difference that may be measured with this voltmeter.

.....

(ii) State what each small division between 4 V and 5 V represents.

.....

(iii) Give one reason why you would not choose this voltmeter to measure a potential difference of about 0.2 V.

.....

.....

[3]

- 4 (a) The temperature of some water is 38.5 °C. A student is looking at a thermometer from the position marked by the eye in Fig. 4.1.

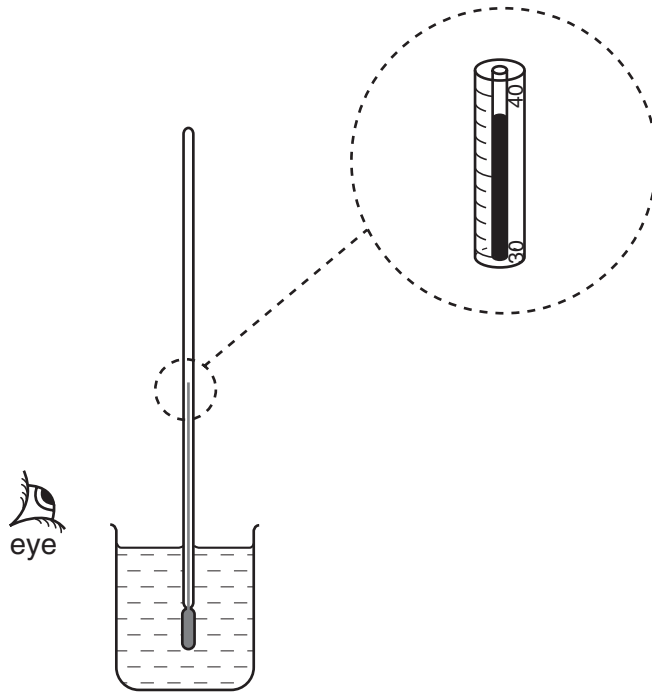


Fig. 4.1

Explain why the temperature appears to be **lower** than 38.5 °C when seen by the student. You may draw on the diagram.

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.....[2]

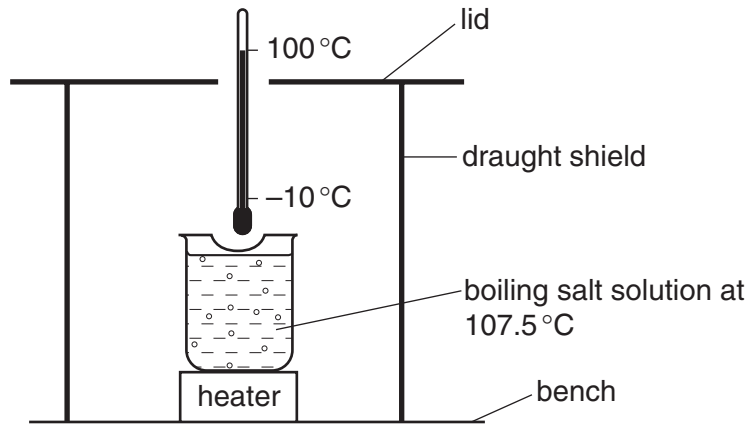
- (b) To describe the correct use of a thermometer, a student wrote “The line of sight must be vertical to the thermometer”. This is a carelessly-worded description. Rewrite the description, correcting the mistake.

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.....  
.....[1]



(c) The boiling point of saturated salt solution is 107.5 °C.

A -10 °C to +100 °C thermometer held in the steam above a boiling salt solution records a temperature of 100 °C, as shown in Fig. 4.2.



**Fig. 4.2**

Explain why there is a difference between the temperature of the solution and the reading on the thermometer. In your answer, refer to the steam that condenses as water on the thermometer.

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.....

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.....[2]

- 5 Fig. 5.1 shows a pendulum bob supported by two threads. The two threads are suspended from jaws of clamps held in separate retort stands. The two points of suspension are the same height above the bench and at a distance  $x$  apart. The length  $L$  of each thread is made the same such that  $L = 457$  mm. Initially  $x = 30$  mm.

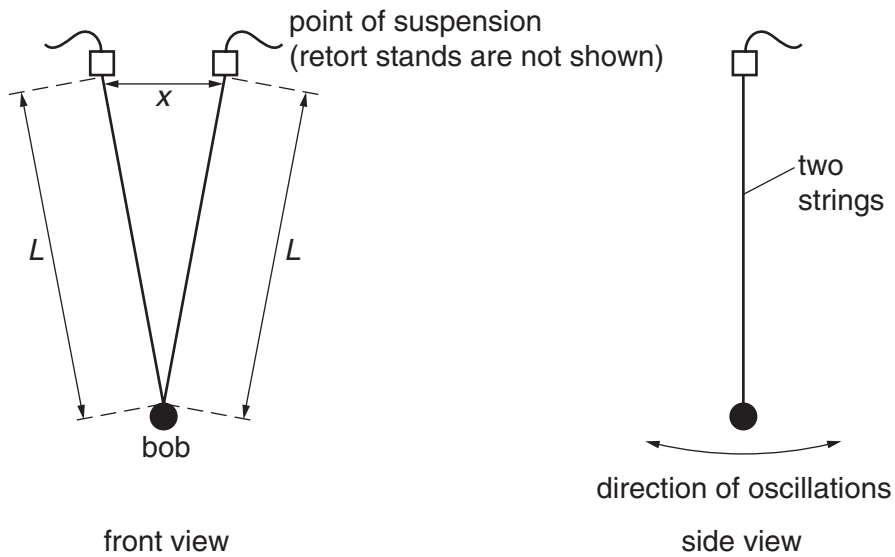


Fig. 5.1

The pendulum is made to oscillate as shown in the side view of Fig. 5.1.

- (a) Describe how you would determine the time  $T$  for one complete oscillation.

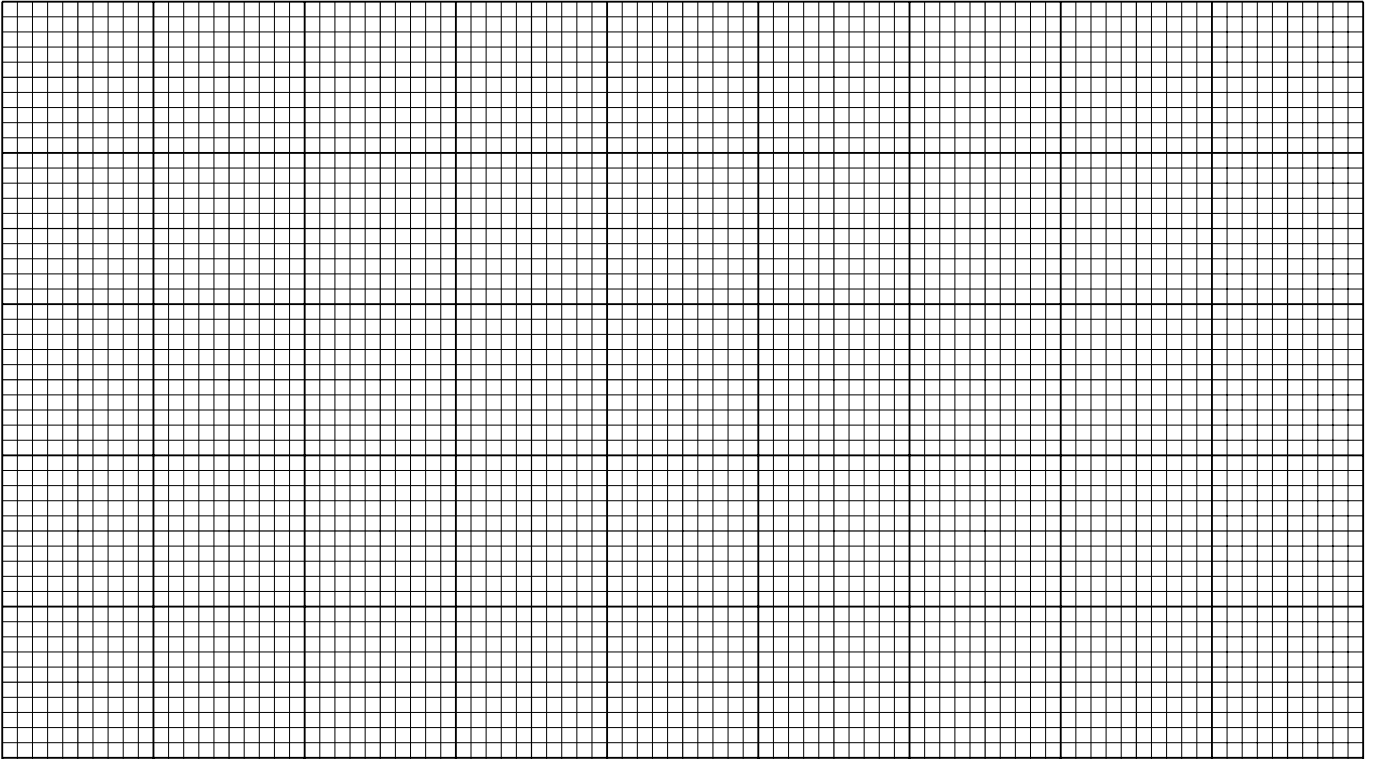
.....  
 .....  
 .....[2]

- (b) By moving one of the stands, the value of  $x$  is increased. The experiment is then repeated without changing the value of  $L$ . In all, five pairs of values of  $T$  and  $x$  are obtained. These are shown in Fig. 5.2.

$x/\text{mm}$	815	740	457	200	30
$T/\text{s}$	0.95	1.06	1.26	1.34	1.36

Fig. 5.2

On the graph grid on page 11, plot the graph of  $T/\text{s}$  ( $y$ -axis) against  $x/\text{mm}$  ( $x$ -axis). Start your  $T$  scale at the value  $T/\text{s} = 0.9$ . The graph line is curved. [4]



- (c) From your graph, estimate the value of  $T$  for  $x = 0$ . Mark the graph to show how you obtained your value.

$T = \dots\dots\dots [1]$

