

Candidate  
Number

Centre Number

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Candidate Name \_\_\_\_\_

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
**General Certificate of Education Ordinary Level**

**PHYSICS**

PAPER 4 Alternative to Practical

**5054/4**

**MAY/JUNE SESSION 2002**

1 hour

Candidates answer on the question paper.  
No additional materials required.

**TIME** 1 hour

**INSTRUCTIONS TO CANDIDATES**

Write your name, Centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

**INFORMATION FOR CANDIDATES**

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

| <b>FOR EXAMINER'S USE</b> |  |
|---------------------------|--|
| <b>1</b>                  |  |
| <b>2</b>                  |  |
| <b>3</b>                  |  |
| <b>4</b>                  |  |
| <b>5</b>                  |  |
| <b>TOTAL</b>              |  |

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



1 (a) In a ray-drawing experiment, a student draws some rays that come from an object O. This object is within a cylindrical mirror, as shown in Fig 1.1. The line AB is a diameter of the cylinder and the point C is its centre.

- (i) On Fig. 1.1, draw a line perpendicular to AB at point C. Continue this line to meet the circle that represents the glass mirror. Label, with the letter P, one of the points of intersection of your line and the circle. The line CP is a normal to the glass at point P.
- (ii) Draw the line OP. This line represents the ray of light from O that is incident at P. Measure and record the angle of incidence  $i$  at P.

angle of incidence  $i =$  .....

(iii) Draw a line to represent the reflected ray from P and continue this line to cut the diameter AB. Label with the letter I the point where the line AB and the reflected ray meet.

Explain how you drew the reflected ray at the correct angle.

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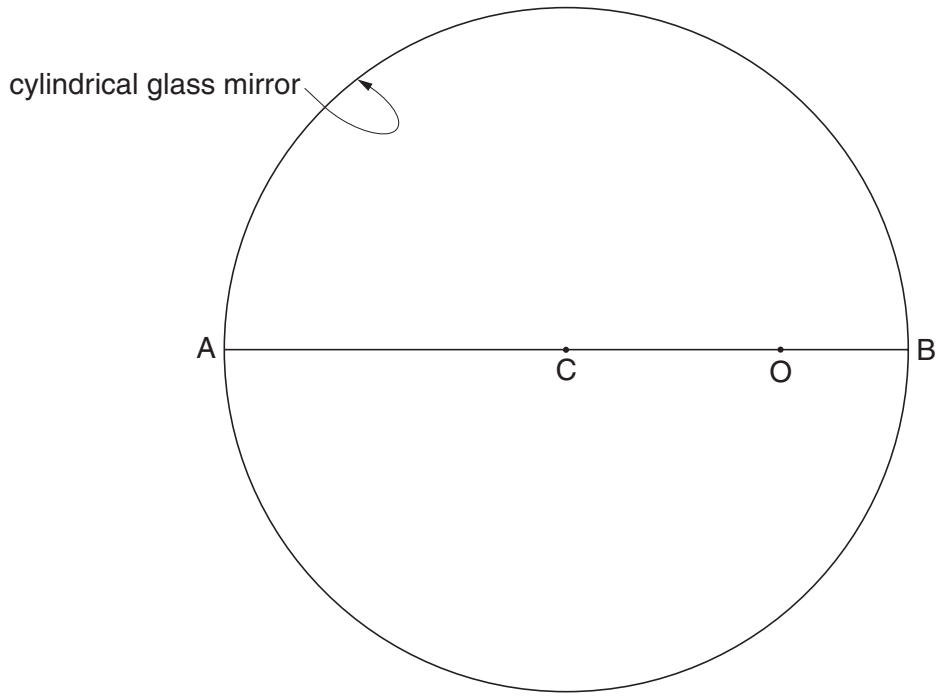
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[4]

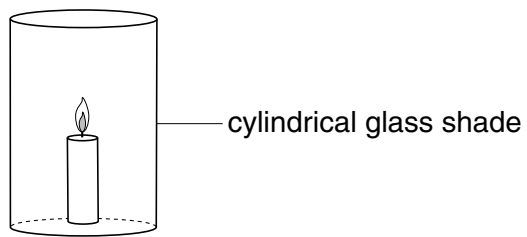
(b) A cylindrical glass shade is placed around a candle. The candle lies along the axis of the shade, as shown in Fig. 1.2.

- (i) Fig. 1.3 represents the candle when a wind moves the flame of the candle to the right. F is a point on the flame. On Fig. 1.3, mark and label with the letter G the point where the image of F is formed.
- (ii) On Fig. 1.3, draw a sketch of the image of the flame.

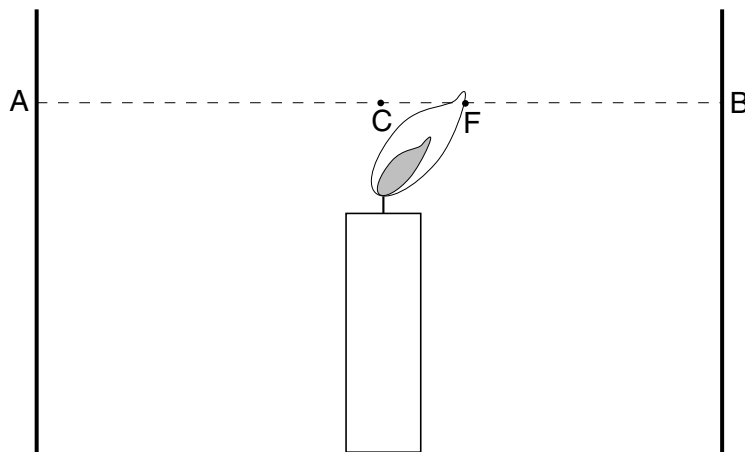
[2]



**Fig. 1.1**



**Fig. 1.2**



**Fig. 1.3**

- 2 A student calibrates a plastic bottle by pouring water into the bottle. Several volumes, each of  $25 \text{ cm}^3$  of water, are poured into the bottle. After each volume, the screw cap is replaced and the bottle turned upside down and placed on the bench, as shown in Fig. 2.1.

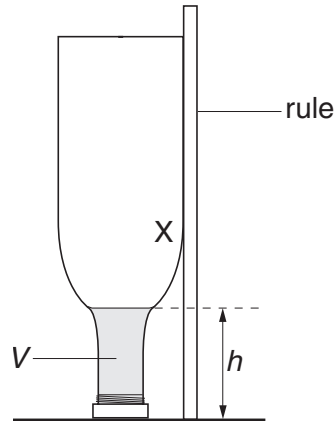


Fig. 2.1

- (a) The height  $h$  of water is measured and recorded in a table, together with the **total** volume  $V$  of water in the bottle.

In the space below, draw a table in which you could record the measurements made by the student. [2]

- (b) The student uses a rule that has a length equal to 300 mm. The zero end of the rule is shown in Fig. 2.2. It is not possible to place the 0 mm mark on the bench.

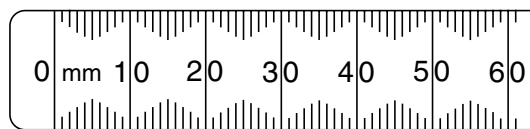


Fig. 2.2

What would you do in order to measure  $h$  with this rule? You may draw a diagram if you wish.

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.....

[1]

(c) The rule is placed vertically alongside the bottle and cannot touch the sides below the point X, as shown in Fig. 2.1. What would you do to help you to take the readings below X on the rule? You may draw a diagram if you wish.

.....  
.....  
.....  
.....  
.....

[1]

(d) On the axes given in Fig. 2.3, sketch the shape of the graph you would expect to obtain if the values for  $h$  are plotted against the values for  $V$ .



Fig. 2.3

[2]

- 3 (a) The thermometer shown in Fig. 3.1 is held vertically and records a temperature of  $50\text{ }^{\circ}\text{C}$ .

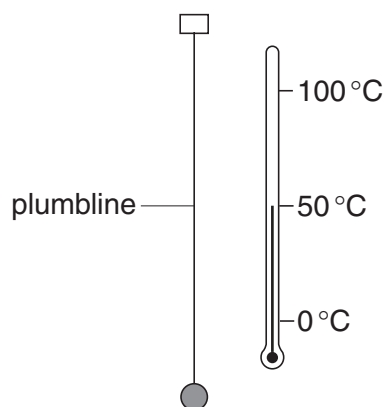


Fig. 3.1

- (i) What is meant by  $^{\circ}\text{C}$ ?

.....

.....

.....

- (ii) When you use the thermometer to read the temperature of  $50\text{ }^{\circ}\text{C}$ , where should you place your eye? Show the position on Fig. 3.1 using a dot labelled **E**.
- (iii) On Fig. 3.1, draw a line from **E** to show the direction in which you would look when you take the temperature reading.
- (iv) Which of the following **best** describes the direction you would look when you take the reading? Tick one box.

- on the same line as the meniscus
- parallel to the temperature scale
- perpendicular to the temperature scale
- vertical to the thermometer

[4]

- (b) A section of a thermometer is shown in Fig. 3.2. The degree divisions are a full-size representation.

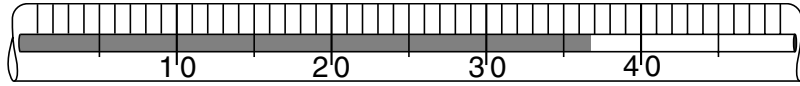


Fig. 3.2

- (i) Complete the following statements using suitable words or a number.

The meniscus is between the temperatures 36.0 °C and ..... .0 °C.

The temperature reading is ..... than 36.5 °C.

- (ii) In Fig. 3.3, the thermometer is positioned so that the mercury thread appears to touch the scale.  
In Fig. 3.4, the thread is positioned so that it does **not** appear to touch the scale marks.

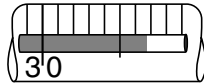


Fig. 3.3

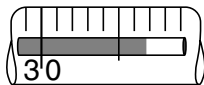


Fig. 3.4

Suggest a reason why the thread of the thermometer in Fig. 3.2 is positioned so that it appears to touch the scale marks.

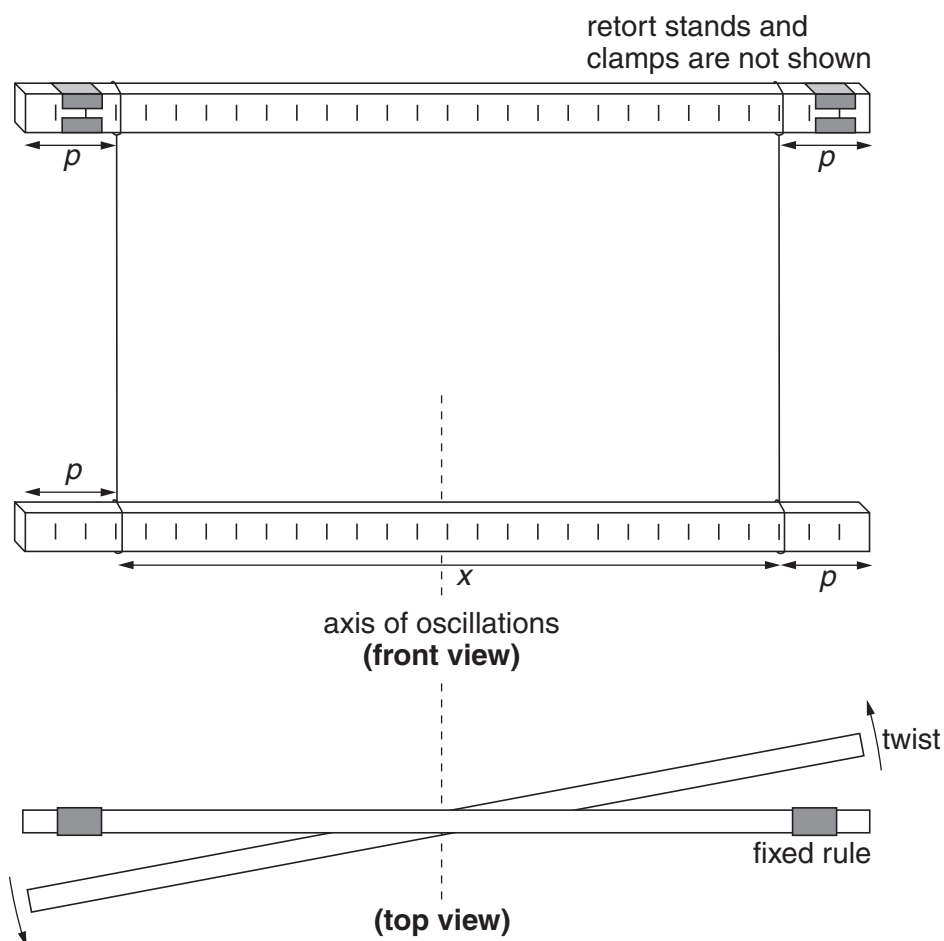
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[2]

- 4 Two retort stands and clamps hold a horizontal metre rule. By using thin strings, a second horizontal metre rule is hung below the fixed rule. The string is tied by fairly tight loops around both rules. The position of each loop is arranged so that the four values of the distance shown as  $p$  are equal. The arrangement is shown in Fig. 4.1.



**Fig. 4.1**

The distance shown as  $x$  is measured and the value recorded. The lower rule is made to oscillate in a horizontal plane by gently twisting it about its centre as shown in Fig. 4.1 (top view). The number  $N$  of oscillations made in one minute is counted and recorded to the nearest complete oscillation.

The value of  $x$  is changed and the new value of  $N$  determined. Five sets of values are shown in the table below.

|               |     |     |     |     |     |
|---------------|-----|-----|-----|-----|-----|
| $x/\text{mm}$ | 200 | 400 | 500 | 600 | 800 |
| $N$           | 14  | 29  | 36  | 43  | 57  |



(a) On Fig. 4.1 (front view), draw an eye to show the best position to view the oscillations when you are counting them. [1]

(b) Why is it a good procedure to repeat each count when obtaining a value of  $N$ ?

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

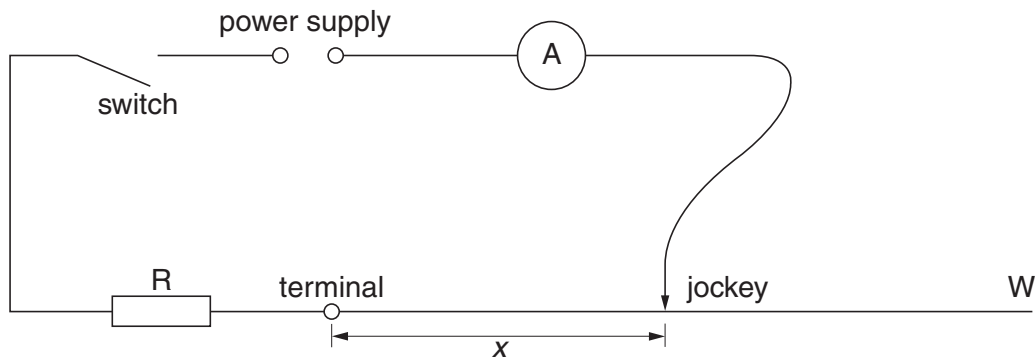
(c) Describe what happens to the values of  $N$  as the values of  $x$  increase.

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

(d) Use the values in the table to help you obtain the expected value of  $N$  when  $x$  is 250 mm.

$N =$  ..... oscillations [1]

- 5 The series circuit shown in Fig. 5.1 includes an ammeter, a fixed resistor R and a length of resistance wire labelled W.



**Fig. 5.1**

The circuit is used to investigate how the current  $I$  in the circuit varies with the length  $x$  of resistance wire used. The jockey is placed on the wire W. The length  $x$  of the wire and the ammeter reading  $I$  are recorded in the table below.

|               |      |      |      |      |      |
|---------------|------|------|------|------|------|
| $x/\text{mm}$ | 0.2  | 0.4  | 0.6  | 0.8  | 1.0  |
| $I/\text{A}$  | 1.47 | 1.09 | 0.83 | 0.68 | 0.56 |

- (a) Using the graph paper on page 11, plot the graph of  $I/\text{A}$  ( $y$ -axis) against  $x/\text{m}$  ( $x$ -axis). [3]
- (b) (i) From your graph obtain values to complete the table below.

| $x/\text{m}$ | $I/\text{A}$ | $xI/\text{Am}$ |
|--------------|--------------|----------------|
| 0.3          |              |                |
|              | 0.8          |                |

- (ii) How do you know that the values of  $I$  are not inversely proportional to the values of  $x$ ?

.....  
 .....

[3]

