Light

Question Paper 2

Level	IGCSE
Subject	Physics
Exam Board	CIE
Topic	Properties of Waves. Including Light and Sound
Sub-Topic	Light
Paper Type	Alternative to Practical
Booklet	Question Paper 2

Time Allowed: **62 minutes**

Score: **/51**

Percentage: **/100**

1 The class is investigating the image formed by a converging lens.

Fig. 5.1 shows the experimental set up.

Fig. 5.1

A student positions the illuminated object and the lens and then moves the screen away from the lens until a sharply focused image of the object is formed on the screen.

The student measures the distances *u* and *v*, as shown in Fig. 5.1.

u = 25.8 cm

v = 36.2 cm

(a) Calculate the focal length *f* of the lens using the equation $f = \frac{uv}{(u + v)}$. Give your answer to a suitable number of significant figures for this experiment.

f = ...[2]

(b) State two precautions you would take in the laboratory in order to obtain reliable measurements when doing this experiment.

1. .....

2. .....

[2]

(c) The object in Fig. 5.1 is an illuminated triangle, as shown in Fig. 5.2.

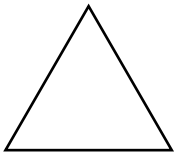

Fig. 5.2

Suggest two differences between the appearance of the illuminated object and the well-focused image on the screen.

1. .....

2. .....

[2]

[Total: 6]

2 A student is determining the focal length of a converging lens by two methods.

First, he uses the apparatus shown in Fig. 4.1.

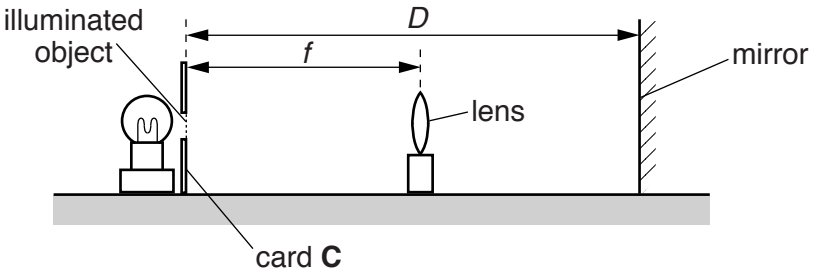

Fig. 4.1

(a) He sets the distance *D* between the mirror and the illuminated object to 30.0 cm.

He then moves the lens until a sharp image appears on card **C** by the side of the illuminated object.

(i) On Fig. 4.1, measure the distance *f* between the illuminated object and the lens.

f = ...[1]

(ii) Fig. 4.1 is drawn to 1/5th scale.

Calculate, and record in Table 4.1, the actual distance *F* between the illuminated object and the lens. *F* is a value for the focal length of the lens in this experiment.

Table 4.1

D/cm	*F*/cm
30.0	
50.0	15.7

[1]

(b) The student repeats the procedure for a distance *D* = 50.0 cm. His result is shown in the table.

Use the results from the table to calculate F_1, an average value of *F*.

F_1 = ...[1]

(c) The student arranges the lens, illuminated object and a screen as shown in Fig. 4.2.

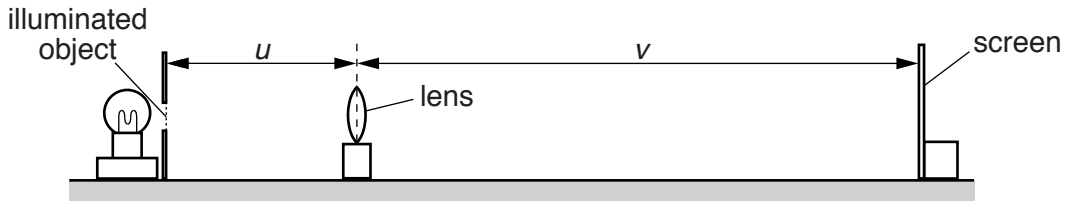

Fig. 4.2

He measures the distance *u* between the illuminated object and the lens.

He moves the screen until a sharp image of the illuminated object appears on the screen, and measures the distance *v* between the lens and the screen.

His readings are: $u =$ 20.0 cm

$v =$ 72.5 cm

(i) Calculate F_2, another value for the focal length of the lens, using the student's results and the equation $F_2 = \frac{uv}{(u + v)}$.

$F_2 =$ .....[1]

(ii) A student suggests that F_1 and F_2 should be equal.

State whether your findings support this idea. Justify your statement by reference to the results.

statement .....

justification .....

.....

[2]

(d) Describe a precaution that you would take in order to obtain reliable results in this experiment.

.....

.....[1]

[Total: 7]

3 A student is investigating the behaviour of a solar panel.

She is using the apparatus shown in Fig. 5.1.

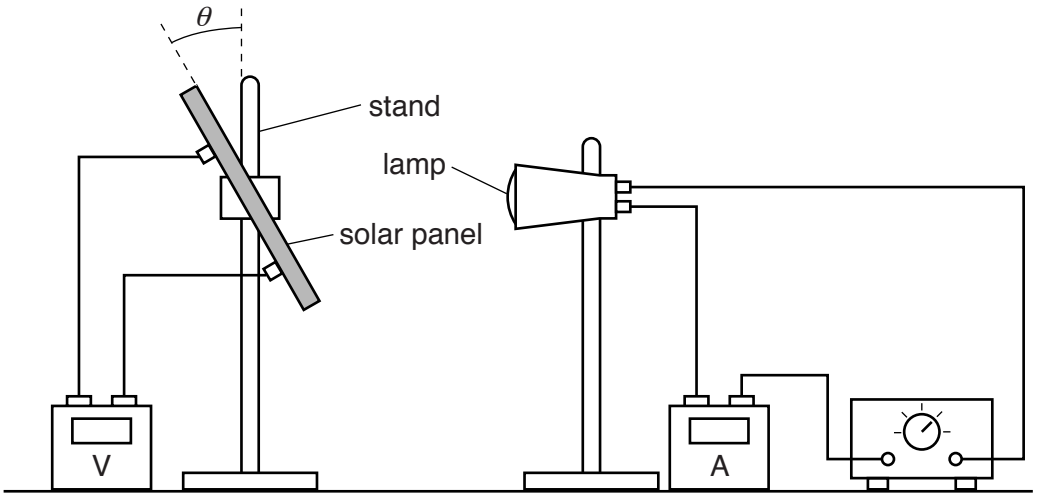

Fig. 5.1

She switches the lamp on. She changes the angle θ between the solar panel and the vertical and measures the voltage produced at each angle.

Figs. 5.2 and 5.3 show the solar panel at two different angles. The voltmeter readings for these angles are shown in Table 5.1.

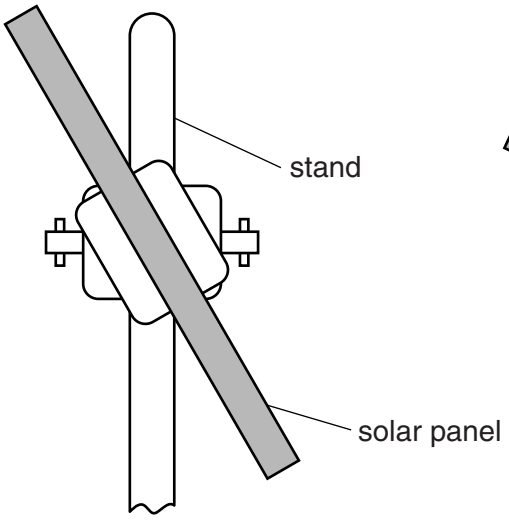

Fig. 5.2

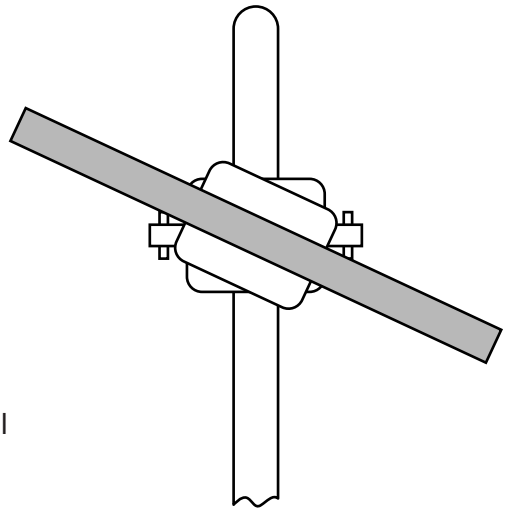

Fig. 5.3

(a) (i) Measure each value of the angle θ and record it in the table.

Table 5.1

	θ/°	V/V
Fig. 5.2		3.62
Fig. 5.3		2.50

[1]

(ii) Explain what practical steps should be taken to obtain accurate measurements of θ in the experiment. You may draw a diagram to show the procedure.

.....

.....

.....[1]

(b) The student finds that a reading of 0.63 V is obtained even when the lamp is switched off.

Suggest a reason for this and explain what she could do to overcome this problem.

reason .....

.....

solution .....

.....

[2]

(c) Suggest two aspects of the apparatus that should be kept constant in order to make the results of the experiment as reliable as possible.

1. .....

.....

2. .....

.....

[2]

[Total: 6]

4 A student is carrying out an experiment with a small converging lens. The student sets up the apparatus as shown in Fig. 4.1. The distances are shown full size.

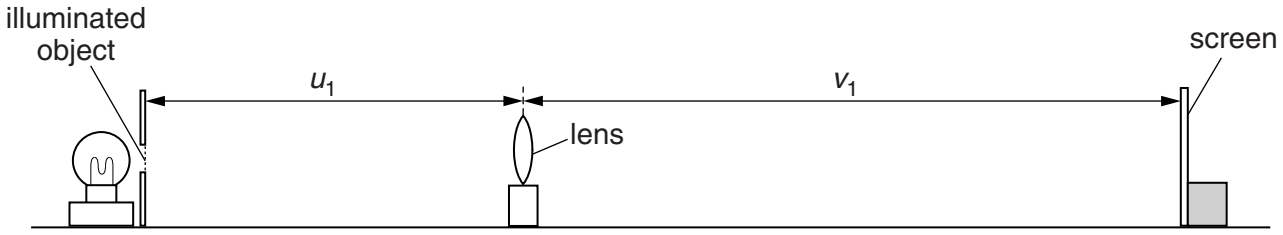

Fig. 4.1

(a) She moves the screen until a sharp image of the illuminated object appears on the screen.

(i) Using Fig. 4.1, measure and record the distance u_1 between the illuminated object and the lens, and the distance v_1 between the lens and the screen.

u_1 = ...

v_1 = ...
[2]

(ii) Calculate a value for the focal length f of the lens, using your results from **(a)(i)** and the equation $f = \dfrac{u_1 v_1}{(u_1 + v_1)}$.

f = ...[2]

(b) Keeping the illuminated object and screen in the same positions, she moves the lens towards the screen until a second sharp image is seen on the screen. The distances are shown full size.

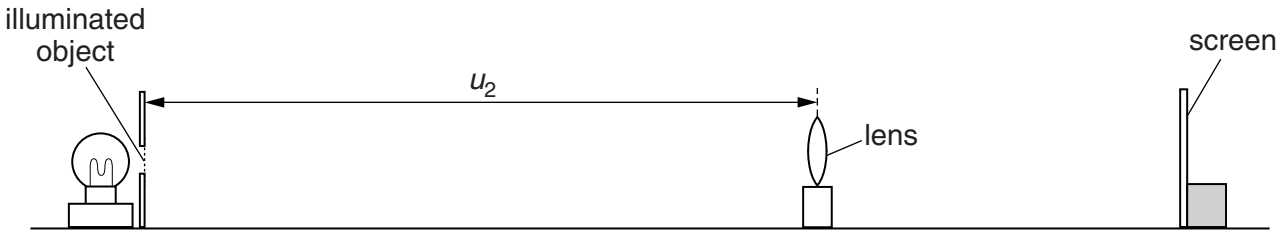

Fig. 4.2

(i) Using Fig. 4.2, measure and record the new distance u_2 between the illuminated object and the lens.

u_2 = ...

(ii) The student suggests that u_2 and v_1 should be equal.

State whether the lens positions obtained by the student support this suggestion. Justify your statement by reference to the results.

statement .....

justification .....

.....

.....

[2]

(c) Describe two precautions that should be taken in order to obtain reliable results in this type of experiment.

1. .....

.....

2. .....

.....

[2]

[Total: 8]

5 The class is investigating reflection using a plane mirror.

Fig. 3.1. shows a student's ray-trace sheet.

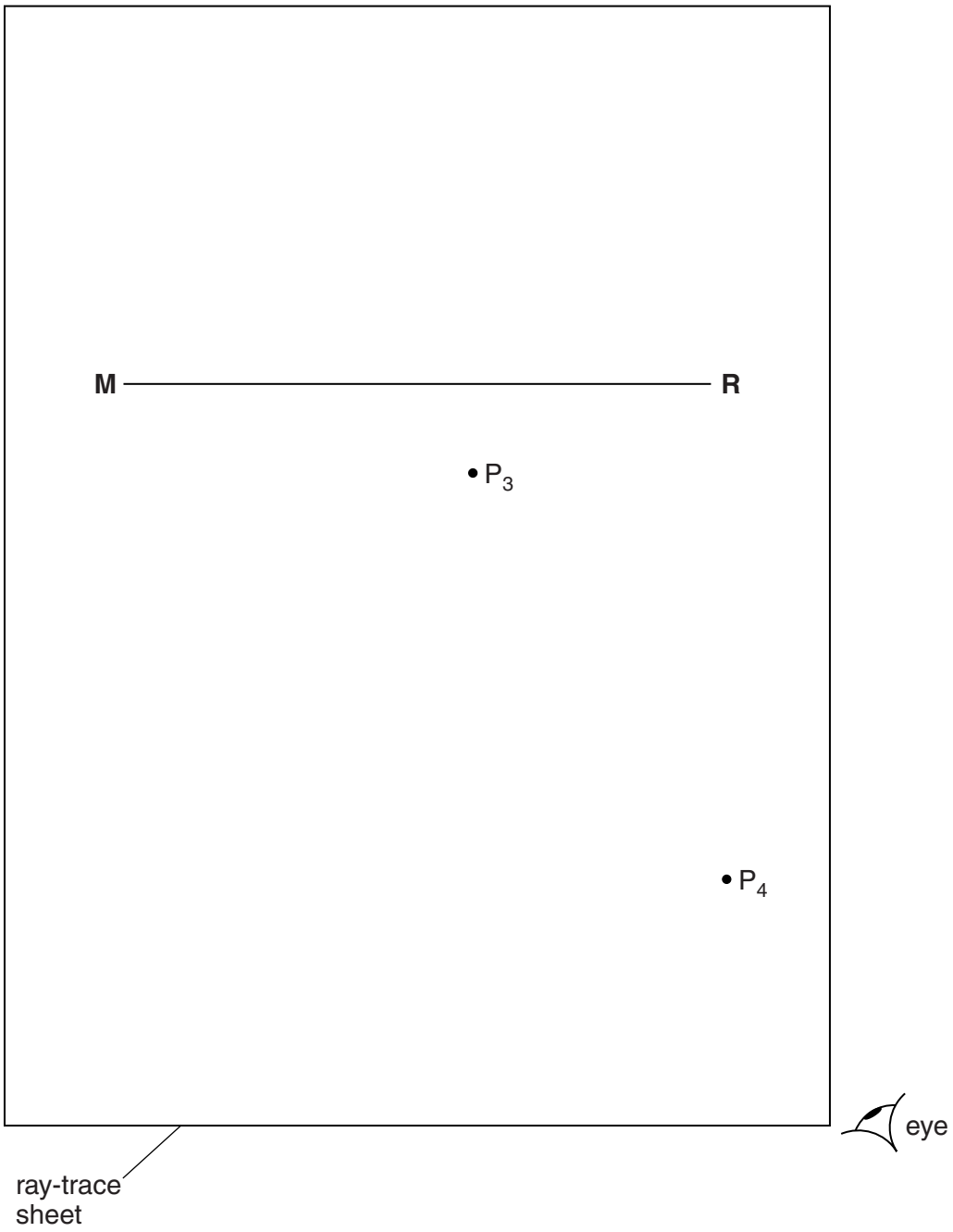

Fig. 3.1

(a) The student draws the line **MR** to mark the position of a plane mirror.

(i) Draw a normal to this line that passes through its centre. Label the normal **NL**. Label the point at which **NL** crosses **MR** with the letter **A**.

(ii) Draw a line 8.0 cm long from **A** at an angle of incidence $i = 30°$ to the normal, below **MR** and to the left of the normal. Label the end of this line **B**.

[3]

(b) The student places a pin P_1 at point **B**. He places a second pin P_2 on line **AB**.

Label a position **X** on line **AB** to show a suitable position for pin P_2. [1]

(c) He views the images of pins P_1 and P_2 from the direction indicated by the eye in Fig. 3.1. He places two pins P_3 and P_4, a suitable distance apart, so that pins P_3 and P_4, and the images of P_2 and P_1, all appear exactly one behind the other. The positions of P_3 and P_4 are shown in Fig. 3.1.

(i) Draw the line joining the positions of P_3 and P_4. Extend the line until it meets **NL**.

(ii) Measure the angle *r* between **NL** and the line joining the positions of P_3 and P_4.

r = ...

[2]

(d) State two precautions that you would take in this experiment in order to obtain reliable readings.

1. .....

.....

2. .....

.....

[2]

(e) A student has done this experiment very carefully, taking these precautions.

She is disappointed to find that her line for the reflected ray is not exactly where she predicts from the theory.

Suggest a practical reason for this.

.....

.....[1]

[Total: 9]

6 The class is doing a lens experiment.

Fig. 5.1 shows some of the apparatus used.

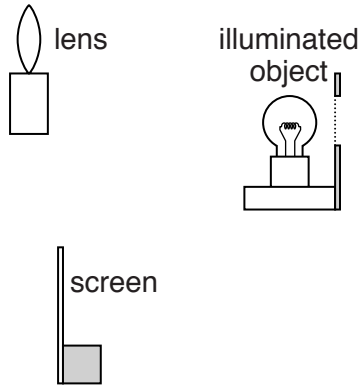

Fig. 5.1

(a) Draw a diagram to show how the apparatus shown in Fig. 5.1 is arranged for an experiment to determine the focal length of the lens. The laboratory bench is drawn for you.

[2]

(b) The focal length of the lens is known to be approximately 15 cm.

Suggest a suitable distance *d* between the illuminated object and the screen so that a well-focused image can be seen on the screen.

d = ... cm [1]

(c) Suggest two practical difficulties that may cause inaccuracy in the value of focal length obtained.

1. .....

.....

2. .....

.....

[2]

(d) Fig. 5.2 shows the shape of the illuminated object.

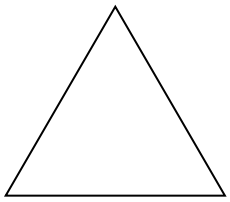

Fig. 5.2

In the space below, draw a diagram to show the focused image that you would expect to see on the screen. [1]

[Total: 6]

7 The class is investigating reflection using a plane mirror.

Fig. 4.1 shows a student's ray-trace sheet.

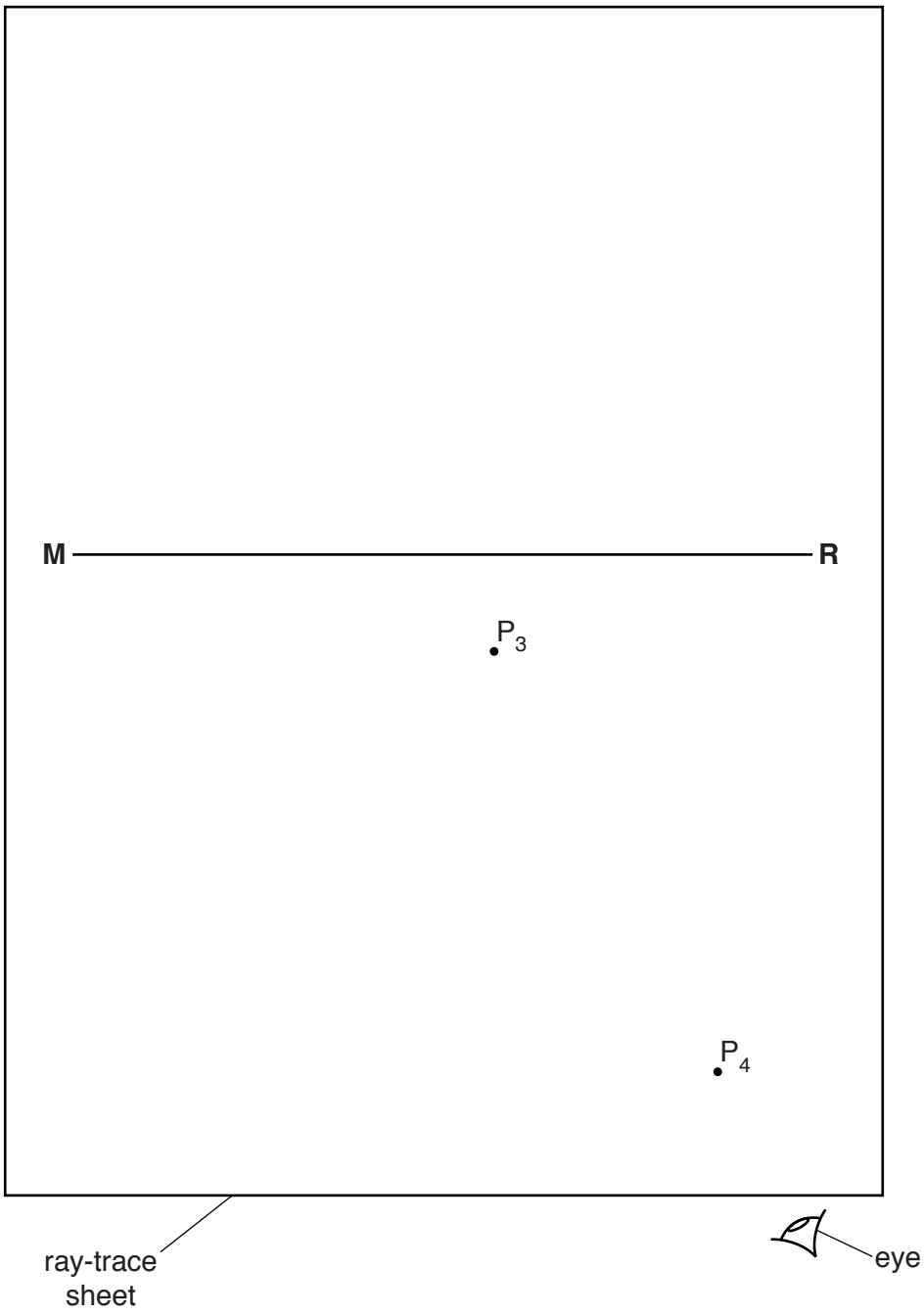

Fig. 4.1

(a) The student draws the line **MR** to mark the position of a plane mirror.

(i) On Fig. 4.1, draw a normal to this line that passes through its centre. Label the normal **NL**. Label the point at which **NL** crosses **MR** with the letter **A**.

(ii) Draw a line 8.0 cm long from **A** at an angle of incidence $i = 30°$ to the normal, below **MR** and to the left of the normal. Label the end of this line **B**.

[3]

(b) The student places a pin P_1 at point **B**. She places a second pin P_2 on line **AB**.

Label a position **X** on line **AB** to show a suitable position for pin P_2. [1]

(c) She views the images of pins P_1 and P_2 from the direction indicated by the eye in Fig. 4.1. She places two pins P_3 and P_4, some distance apart, so that pins P_3 and P_4, and the images of P_2 and P_1, all appear exactly one behind the other. The positions of P_3 and P_4 are shown in Fig. 4.1.

(i) Draw the line joining the positions of P_3 and P_4. Extend the line until it meets **NL**.

(ii) Measure the angle *r* between **NL** and the line joining the positions of P_3 and P_4.

r = ...
[2]

(d) State two precautions that you would take with the pins in this experiment in order to obtain reliable readings.

1. .....

.....

2. .....

.....
[2]

(e) The student turns the ray-trace sheet through 180°. She draws a line **AC** at an angle of incidence $i = 30°$ to the normal, below **MR** and to the right of the normal.

She repeats the procedure described in parts **(b)** and **(c)**. Her ray-trace is shown in Fig. 4.2.

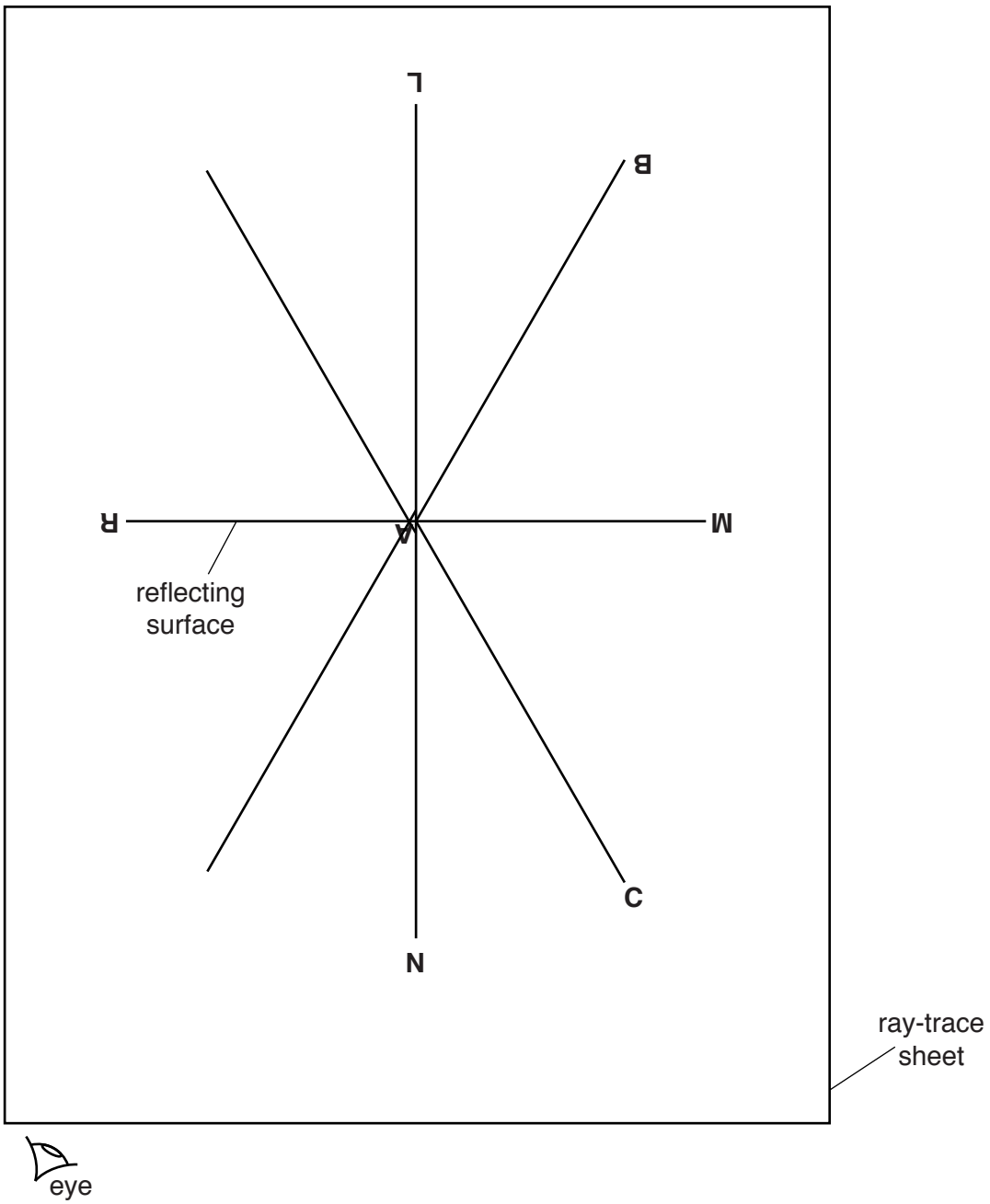

Fig. 4.2

She carried out the experiment very carefully. She expected that the results would show all the incident rays and reflected rays meeting at point **A**.

Suggest a practical reason why the lines may not meet exactly at point **A**.

.....

.....[1]

[Total: 9]