Light

Question Paper 8

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 8

Time Allowed: **52 minutes**

Score: **/43**

Percentage: **/100**

1 An IGCSE student is determining the magnification of an image formed by a lens. The experimental set up is shown in Fig. 5.1.

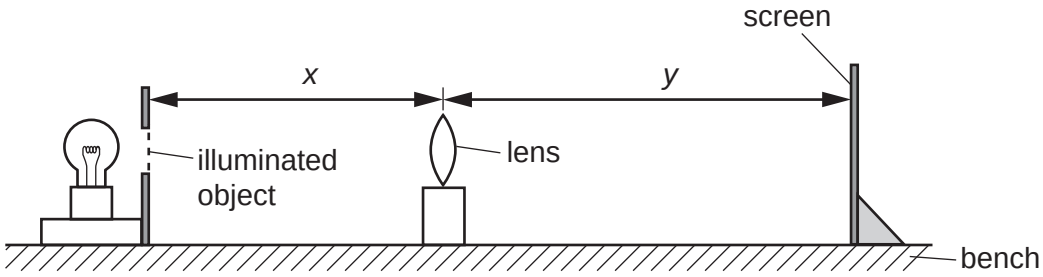

Fig. 5.1

The screen consists of a sheet of white paper stuck to a vertical board.
The position of the screen is adjusted until a focused image of the object is formed on the screen.

(a) **(i)** On Fig. 5.1 measure the distances *x* and *y*.

x = ...

y = ...

(ii) Calculate the magnification *m* using the equation $m = y/x$.

m = ...
[3]

(b) Suggest two precautions that you would take to obtain reliable results in this experiment.

1. .....

.....

2. .....

.....[2]

(c) The student wishes to measure the height of the image on the screen in order to check his result. However he finds that when he tries to do this his hand and the rule prevent the light reaching the screen. Suggest briefly a method he could use to measure the height of the image on the screen that would overcome this problem.

.....

.....[1]

2 The IGCSE class is investigating the reflection of light by a mirror as seen through a transparent block.

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

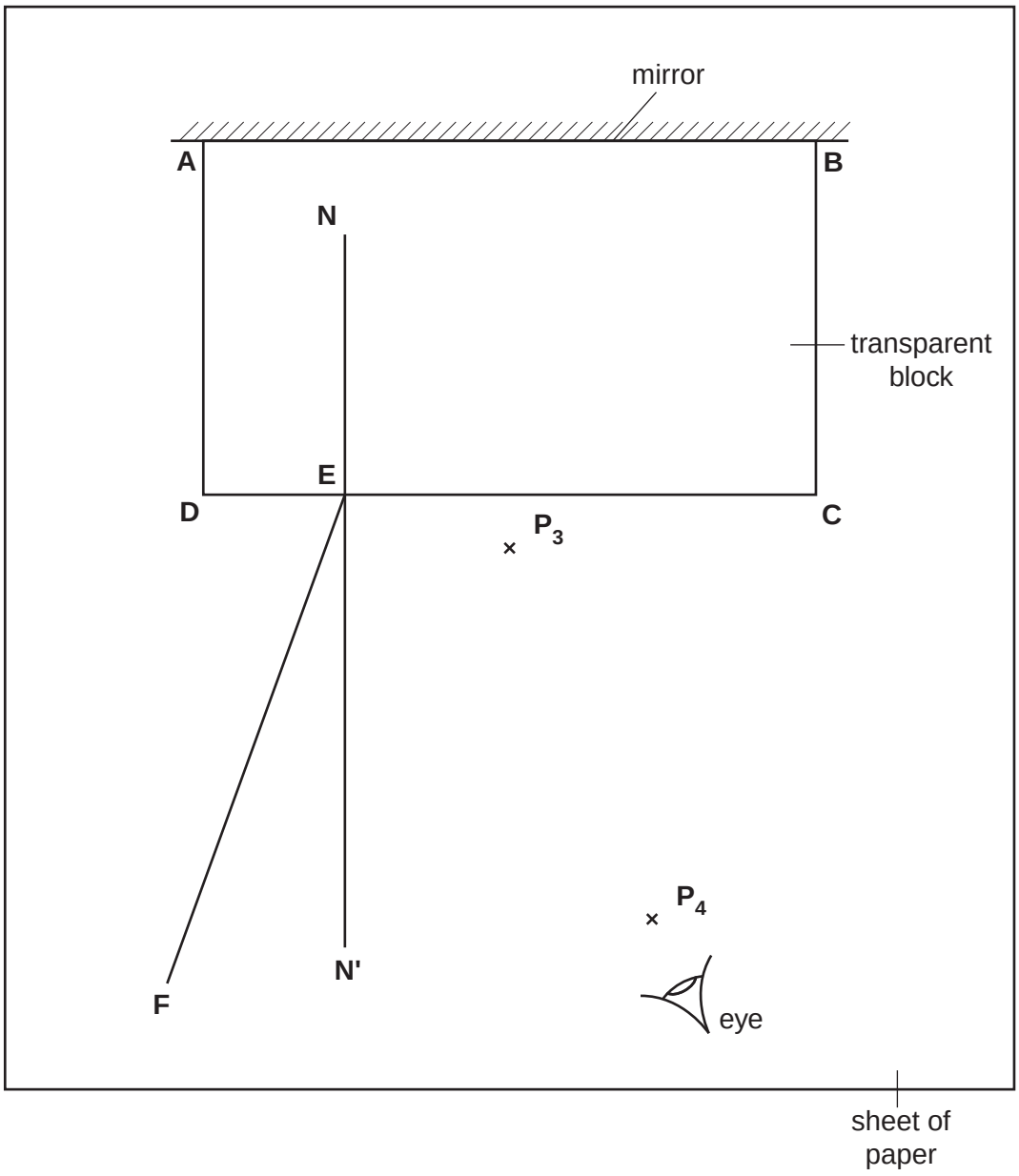

Fig. 4.1

(a) A student draws the outline of the transparent block **ABCD** on the ray-trace sheet. He draws the normal **NN'** to side **CD**. He draws the incident ray **EF** at an angle of incidence i = 20°. He pushes two pins $\mathbf{P_1}$ and $\mathbf{P_2}$ into line **EF** and places the block on the sheet of paper. He then observes the images of $\mathbf{P_1}$ and $\mathbf{P_2}$ through side **CD** of the block from the direction indicated by the eye in Fig. 4.1 so that the images of $\mathbf{P_1}$ and $\mathbf{P_2}$ appear one behind the other. He pushes two pins $\mathbf{P_3}$ and $\mathbf{P_4}$ into the surface, between his eye and the block, so that $\mathbf{P_3}$, $\mathbf{P_4}$ and the images of $\mathbf{P_1}$ and $\mathbf{P_2}$, seen through the block, appear in line. (The plane mirror along side **AB** of the block reflects the light.)

The positions of $\mathbf{P_3}$ and $\mathbf{P_4}$ are marked on Fig. 4.1.

(i) On line **EF**, mark with neat crosses (x) suitable positions for the pins $\mathbf{P_1}$ and $\mathbf{P_2}$.

(ii) Continue the line **EF** so that it crosses **CD** and extends as far as side **AB**.

(iii) Draw a line joining the positions of $\mathbf{P_4}$ and $\mathbf{P_3}$. Continue the line so that it crosses **CD** and extends as far as side **AB**. Label the point **G** where this line crosses the line from $\mathbf{P_1}$ and $\mathbf{P_2}$. [4]

(iv) Measure the acute angle θ between the lines meeting at **G**.

θ = ...

(v) Calculate the difference $(\theta - 2i)$.

$(\theta - 2i)$ = ... [2]

(b) The student repeats the procedure using an angle of incidence i = 30° and records the value of θ as 62°.

(i) Calculate the difference $(\theta - 2i)$.

$(\theta - 2i)$ = ...

(ii) Theory suggests that $\theta = 2i$. State whether the results support the theory and justify your answer by reference to the results.

statement .....

justification .....

.....[3]

(c) To place the pins as accurately as possible, the student views the bases of the pins. Explain briefly why viewing the bases of the pins, rather than the tops of the pins, improves the accuracy of the experiment.

.....

.....

.....[1]

[Total: 10]

3 An IGCSE student carries out a lens experiment to investigate the magnification of an image.

The apparatus is shown in Fig. 4.1.

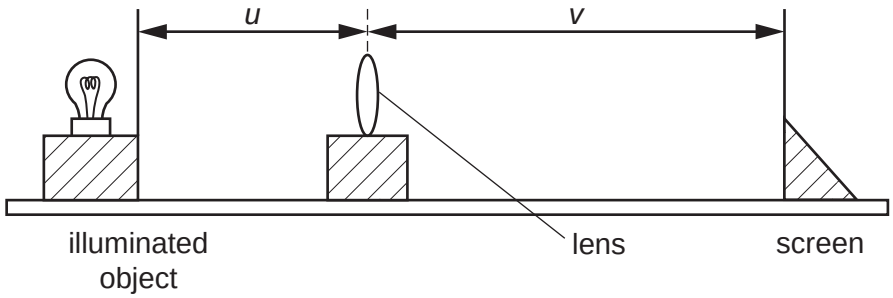

Fig. 4.1

The object is a rectangular hole in a piece of card. There is a thin wire across the hole. Fig. 4.2 shows the rectangular hole and the wire.

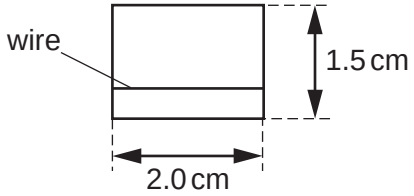

Fig. 4.2

The student sets the distance u at 32.0 cm and moves the screen to obtain a sharply focused image. The image distance v is 58.9 cm.

(a) (i) Calculate the magnification m using the equation $m = v/u$.

m = ...[2]

(ii) Draw a diagram of the image, actual size, for a magnification m = 2.0.

[3]

(b) The object distance *u* is the distance from the object to the centre of the lens.

Explain briefly how you would position a metre rule to obtain an accurate value for *u*. You may draw a diagram.

.....

.....

..... [1]

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

1. .....

2. ..... [2]

[Total: 8]

4 The IGCSE class is investigating shadows formed on a screen.

Fig. 4.1 shows the apparatus.

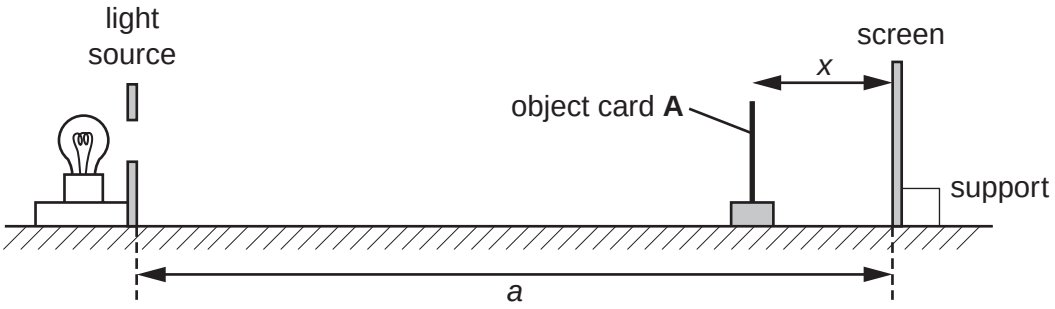

Fig. 4.1

The lamp is behind a piece of card. The card has a circular hole which, in this experiment, is referred to as the light source.

(a) On Fig. 4.1, measure the distance *a* between the light source and the screen.

a = ... cm [1]

(b) The diagram is drawn one third of actual size. Calculate the actual distance *y* between the light source and the screen.

y = ... cm [1]

(c) A student places a circular object card **A** in a holder between the light source and the screen. Fig. 4.2 shows the card and holder.

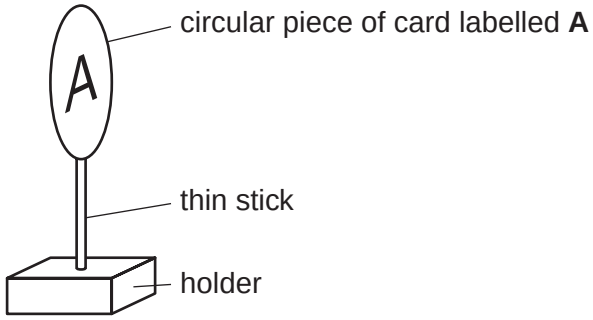

Fig. 4.2

Fig. 4.3 shows the object card drawn actual size.

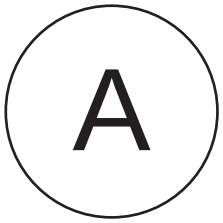

Fig. 4.3

Take and record measurements from Fig. 4.3 to determine the average diameter *d* of the object card.

d = ... cm [2]

(d) The student places the object card at different distances x from the screen, as shown in Fig. 4.1. He switches on the light source and measures the diameter s of the shadow of the object card formed on the screen. The readings are shown in Table 4.1.

Table 4.1

x/cm	s/cm	s^2/cm^2
2.0	2.2	
4.0	2.4	
6.0	2.6	
8.0	2.8	
10.0	3.1	

(i) Calculate the values of s^2 and enter them in the table. [2]

(ii) A student suggests that the value of s^2 when x = 10.0 cm should be twice the value of s^2 when x = 2.0 cm. State whether the experimental results support this suggestion and justify your statement by reference to the results.

statement .....

justification .....

.....

[2]

(e) State two precautions you would take in order to obtain reliable measurements when carrying out this experiment.

1. .....

2. ..... [2]

[Total: 10]

5 An IGCSE student is determining the focal length of a lens.

Fig. 4.1 shows the experimental set-up. The 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.

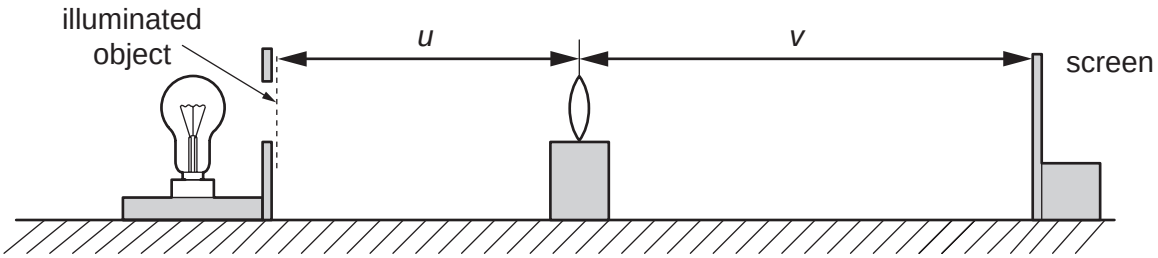

Fig. 4.1

(a) Using your rule, measure on Fig. 4.1 the distance *u*, in cm, from the centre of the lens to the illuminated object and the distance *v* from the centre of the lens to the screen.

u = ...

v =..... [2]

(b) **(i)** Fig. 4.1 is drawn one fifth actual size. Calculate the actual distance *x* from the illuminated object to the centre of the lens and the actual distance *y* from the centre of the lens to the screen.

Record these values in Table 4.1. The first pair of readings obtained by the student has already been entered in the table.

Table 4.1

x / cm	*y* / cm	*f* / cm
57.0	15.0	

[3]

(ii) Calculate for both pairs of readings the focal length *f* of the lens using the equation

$$f = \frac{xy}{(x+y)} .$$

Record the values of *f* in Table 4.1.

(c) Calculate the average value of the focal length.

average value for the focal length = ... [2]

(d) State two precautions you would take in the laboratory in order to obtain reliable measurements.

1. .....

2. ..... [2]

[Total: 9]