Cambridge Assessment International Education

Cambridge IGCSE™

1: Light – Topic questions

Paper 6

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
3	2016	June	63
5	2016	June	61
3	2016	March	62

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at www.cambridgeinternational.org/support

3 A student notices that the size of the image produced by a converging lens changes when the lens is moved further away from an object.

Plan an experiment to investigate how the size of the image varies with the object distance for a converging lens suitable for school experiments.

Write a plan for the experiment, including:

- a labelled diagram of the apparatus needed
- instructions for carrying out the experiment
- the factors that will limit the range of object distances
- the graph you will plot
- one precaution you will take to ensure reliable results, explaining what might be the effect of not taking this precaution.

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....[7]

[Total: 7]

5 A student determines the focal length of a lens.

The apparatus is shown in Fig. 5.1.

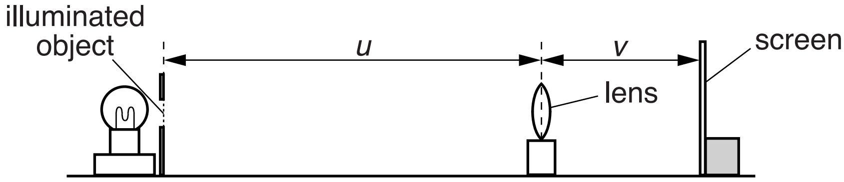

Fig. 5.1

(a) The student places the lens at a distance *u* from the illuminated object. He moves the screen until a sharply focused image of the object is seen on the screen.

On Fig. 5.1,

- measure the distance *u* from the illuminated object to the centre of the lens,

u = ... mm

- measure the distance *v* from the screen to the centre of the lens.

v = ... mm
[1]

(b) Fig. 5.1 is drawn 1/10th actual size.

(i) • Calculate the actual distance *U* from the illuminated object to the centre of the lens.

U = ... mm

- Calculate the actual distance *V* from the screen to the centre of the lens.

V = ... mm
[1]

(ii) Calculate a value f_1 for the focal length of the lens using the equation $f_1 = \frac{UV}{(U+V)}$.

f_1 = ... mm
[2]

(c) A second student repeats the experiment three times using a different lens. His values for the focal length of his lens are shown in Table 5.1.

Table 5.1

	1	2	3
focal length / mm	132	141	135

Calculate the average value f_2 for the focal length of this student's lens.

f_2 = ... mm [1]

(d) A third student, using the same method, finds that the focal length f of her lens is 200 mm.

She reads in a book that when $u = 2f$, the distances u and v, as shown in Fig. 5.1, are equal.

- Calculate $2f$ for this student's lens.

$2f$ = ... mm

The student sets up the apparatus as shown in Fig. 5.2. She adjusts both x and y to be 400 mm.

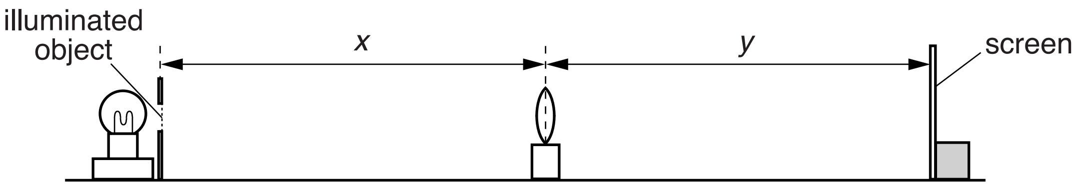

Fig. 5.2

She observes that the image is blurred. The student slowly increases the distance y, and obtains a sharply focused image when y = 406 mm.

Discuss whether the student's results confirm the statement in the book.

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[2]

(e) Suggest two precautions that you would take in this investigation in order to obtain reliable results.

1. ....

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2. ....

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[2]

[Total: 9]

3 A student is investigating the refraction of light by a transparent block. She uses her results to determine a quantity known as the refractive index for the material of the block.

The student's ray-trace sheet is shown in Fig. 3.1.

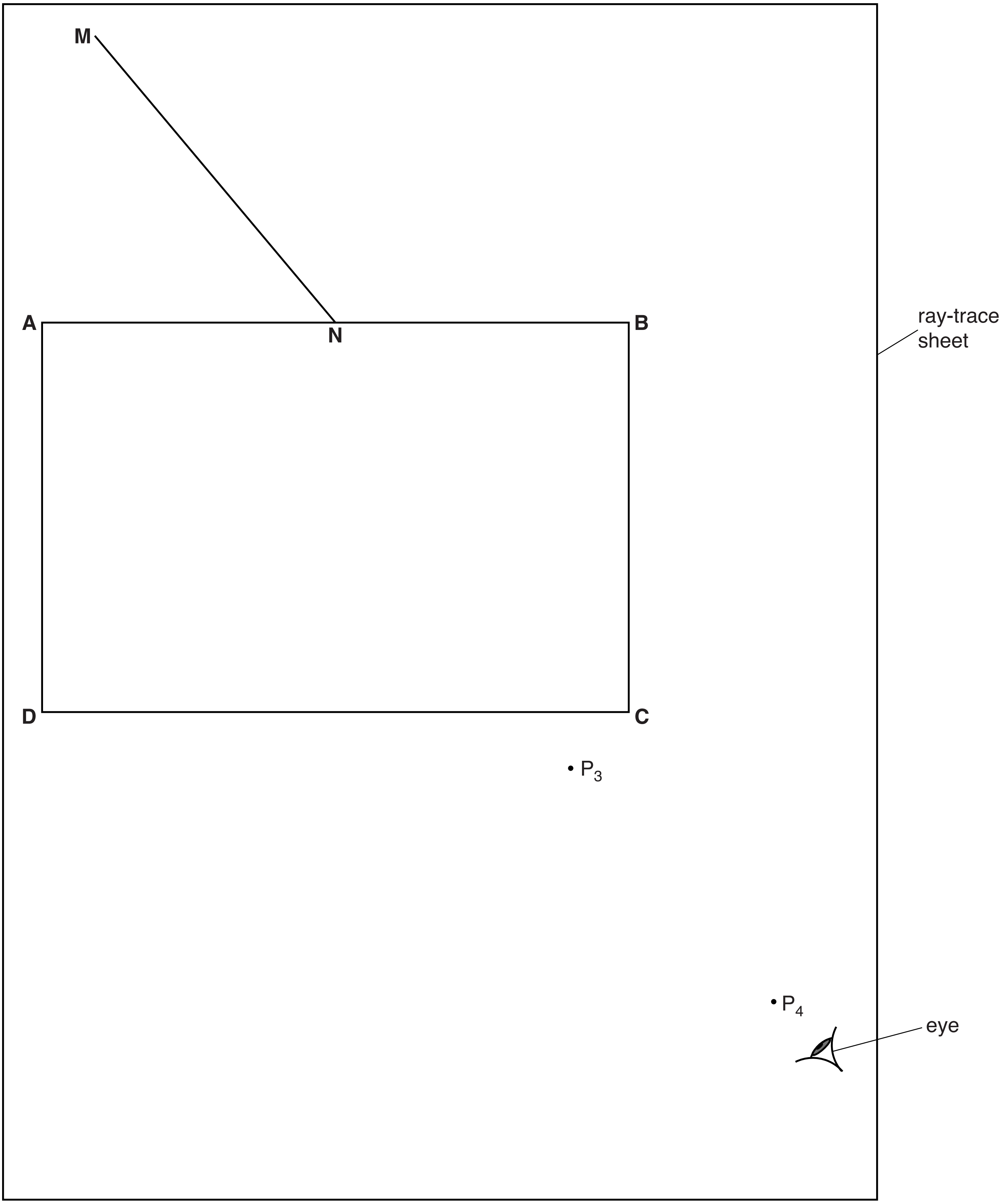

Fig. 3.1

(a) The student places a transparent block **ABCD** on the ray-trace sheet, as indicated in Fig. 3.1. She draws a line **NM**.

(i)
- Draw a normal to line **AB** at point **N**. The normal should start above **AB** and extend below **AB** so that it crosses line **CD**.
- Label the point at which the normal crosses **CD** with the letter **L**.

[1]

(ii) Measure the angle θ between the normal and line **NM**.

θ = ...[1]

(b) The student places two pins P_1 and P_2 on line **NM**, a suitable distance apart.

On Fig. 3.1, mark and label appropriate positions for P_1 and P_2. [1]

(c) The student views the images of P_1 and P_2 through the block, from the direction indicated by the eye in Fig. 3.1.

She places two pins P_3 and P_4, as shown in Fig. 3.1, so that pins P_3 and P_4, and the images of P_1 and P_2, all appear exactly one behind the other.

(i)
- Draw a line joining P_3 and P_4. Extend this line until it meets **NL**.
- Label the point at which this line crosses **CD** with the letter **E**, and the point at which it meets **NL** with the letter **F**.
- Draw a line joining points **N** and **E**.
- Measure the length *a* of line **NE**.

a = ...

- Measure the length *b* of line **FE**.

b = ...

[2]

(ii) Calculate a value *n* for the refractive index, using the equation $n = \frac{a}{b}$.

n = ...[2]

(d) Describe two precautions that you would take in order to obtain reliable results in this type of experiment.

1. ....

....

2. ....

....

[2]

[Total: 9]

Question	Answer	Mark
3	**apparatus:** diagram – lens, (illuminated) object, screen in suitable order for experiment in line on flat surface **instructions:** set / measure object distance, move screen to get image, measure image height, repeat for different object distances **limiting factor for range of object distances – one from:** • image virtual / too big for screen, • image too dim / too small to measure, • must be greater than focal length **graph:** image size / magnification against object distance **precaution:** any one suitable precaution and consequence of not taking it, e.g. • dark room / bright light – image might not be distinct, • lens and object at same height – image might not appear on screen • lens, object and screen perpendicular – image might be distorted, • fix rule – may move and give incorrect distances • mark position of lens on holder – cannot judge correct measurements / owtte • detailed means of obtaining a sharp image – might not be correctly focused • means of measuring image height accurately – might be obscured	 1 1 1 1 1 1 1
		Total: 7

Question	Answer	Mark
5 (a)	*u* = 50, *v* = 21	1
5 (b) (i)	*U* = 500, *V* = 210 e.c.f from **(a)**	1
5 (b) (ii)	f_1 = 148 or 150 or 147.9 (mm) e.c.f from **(i)** 2 or 3 significant figures	1 1
5 (c)	f_2 136 (mm) c.a.o	1
5 (d)	Yes / statement is correct, owtte (6 mm) difference is very small / within limits of experimental error / Difference explained by uncertainty in her focal length measurement	1 1
5 (e)	Any two from: Use of darkened room / brighter lamp Mark position of centre of lens on holder Place metre rule on bench (or clamp in position) Ensure object and (centre of) lens are same height (from the bench) Object and lens and screen perpendicular to bench Move <u>screen</u> (slowly) back and forth to obtain best image (owtte) Ensure rule is touching object / lens / holder / screen or look perpendicular to ruler	2
		Total: 9
3 (a) (i)	normal correct	1
3 (a) (ii)	θ = 40(°)	1
3 (b)	P_1, P_2 marked on line NM and separation >5.0 cm	1
3 (c) (i)	thin lines all in correct place a = 8.1 to 8.3 (cm) <u>and</u> b = 5.2 to 5.5 (cm)	1 1
3 (c) (ii)	*n* correctly calculated 2/3 sig figs <u>and</u> no unit	1 1
3 (d)	any two suitable precautions, e.g. • view pins from base/ensure pins upright • large pin separations • use of thin pencil lines/sharp pencil/thin pins • repeat with different angles	2
		Total: 9

Notes about the mark scheme are available separately.