

Light

Question Paper

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|------------|-------------------|
| Course | CIE IGCSE Physics |
| Section | 3. Waves |
| Topic | Light |
| Difficulty | Hard |

| | |
|--------------|------|
| Time Allowed | 80 |
| Score | /61 |
| Percentage | /100 |

Question 1a

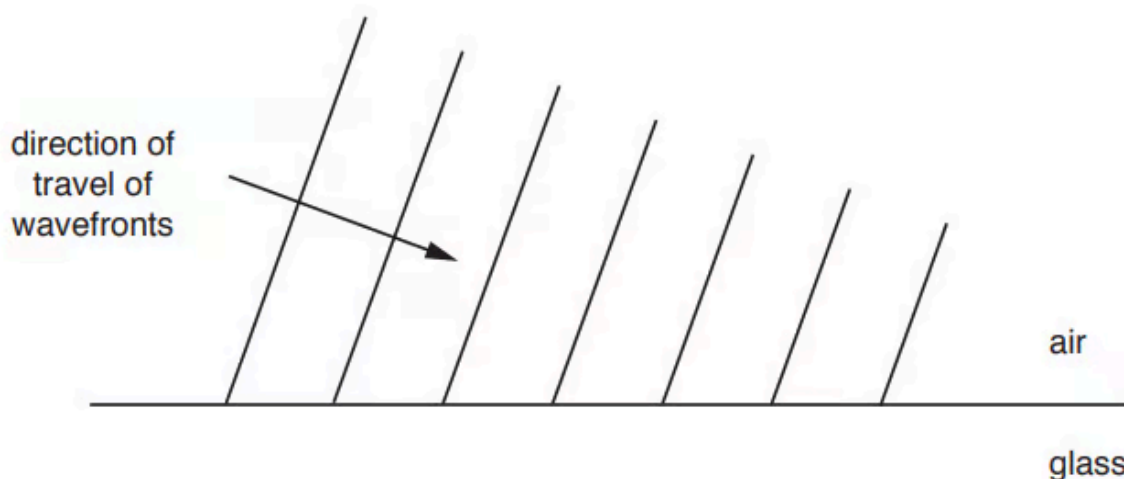
Extended tier only

A laser produces a beam of monochromatic light. State what is meant by the term *monochromatic*.

[1 mark]

Question 1b

A wave, in air, is incident on a glass block. Fig. 7.1 shows the wavefronts at the air-glass boundary. The arrow shows the direction of travel of the wavefronts.



The wave undergoes reflection and refraction at the air-glass boundary.

On Fig. 7.1 draw:

- the wavefronts of the reflected wave
- the wavefronts of the refracted wave.

[3]

[3]

[6 marks]

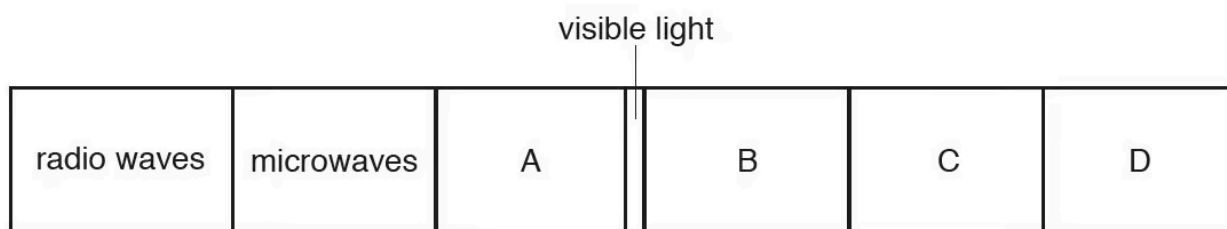
Question 1c

A transverse wave is produced in a long, horizontal rope. The rope is much longer than the wavelength of the wave.

In the space below, sketch a diagram to show the appearance of the rope as the wave passes along it. Label **two** important features of the wave.

[2 marks]**Question 2a**

Fig. 6.1 represents the electromagnetic spectrum.

**Fig. 6.1**

State the radiation in each of the regions represented by A, B, C and D in Fig. 6.1.

[2 marks]

Question 2b

Extended tier only

A source emits visible light.

Fig. 6.2 shows a ray of red light from the source incident on the face XY of a glass prism at point S.

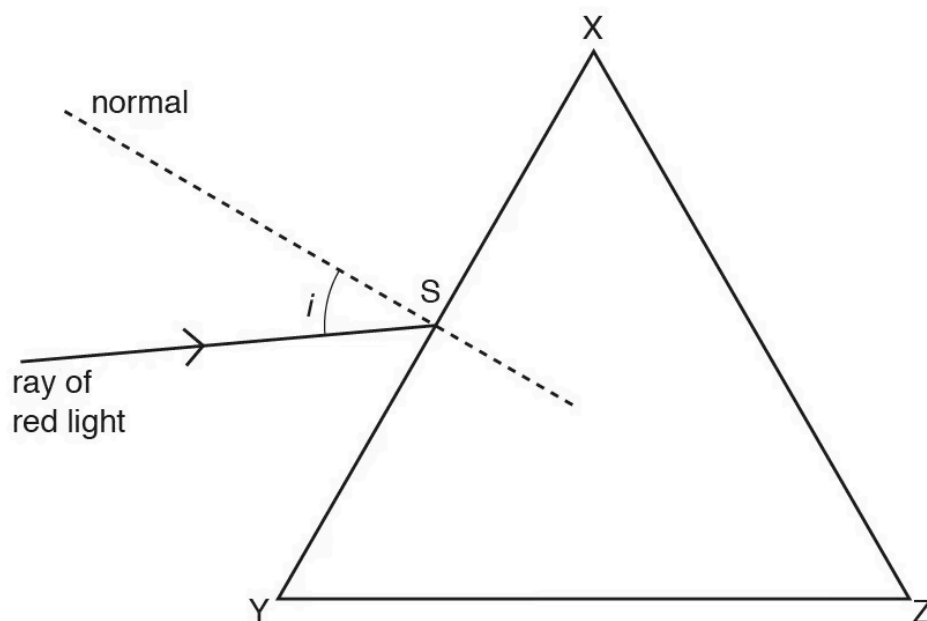


Fig. 6.2

The angle of incidence i of the ray is 35° . The refractive index of the glass for red light is 1.5.

- (i) Calculate the angle of refraction in the glass at S.

angle of refraction = [2]

- (ii)

On Fig. 6.2, draw the refracted ray at face XY and the ray emerging from face XZ of the prism. Label this ray R.

[2]

- (iii) A ray of blue light follows the same path as the ray of red light incident on the face XY.

On Fig. 6.2, draw the path of this ray in the prism and emerging from the prism.

Label this ray B.

[2]

[6 marks]

Question 3a

Extended tier only

Fig. 7.1 shows red light travelling from air into a prism made of diamond. The path of the red light is incomplete.

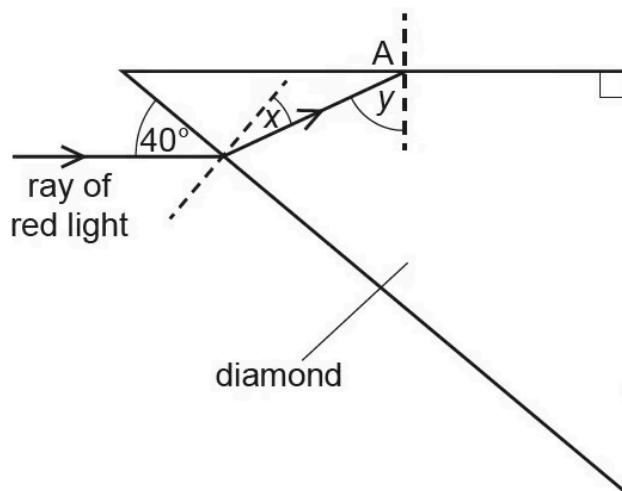


Fig. 7.1 (not to scale)

The refractive index of diamond is 2.42.

Calculate angle x .

angle x =

[2 marks]

Question 3b

Explain the term total internal reflection.

[3 marks]

Question 3c

The angle y is greater than the critical angle of diamond.

On Fig. 7.1, draw the path of the red light through and out of the prism after point A.

[2 marks]

Question 4a

Fig. 7.1 shows a ray of light in water that is incident on a submerged, transparent plastic block.

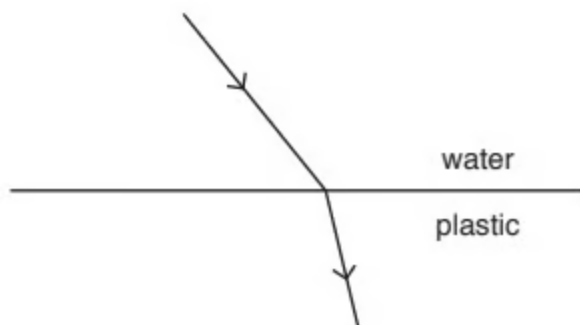


Fig. 7.1

State what happens to the speed of light as it enters the plastic block. Explain your answer.

[2 marks]

Question 4b

Extended tier only

Fig. 7.2 shows the two principal focuses F_1 and F_2 of a thin converging lens.

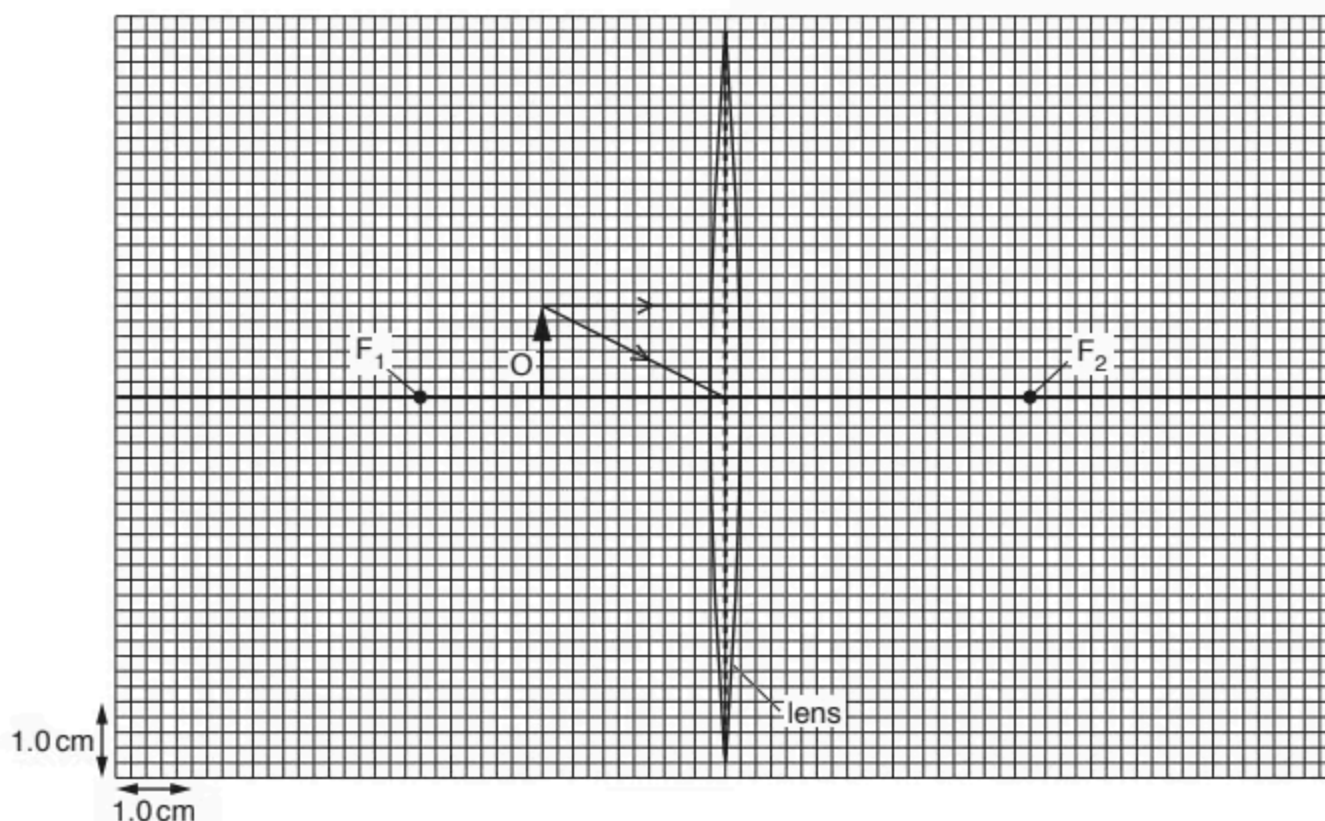


Fig. 7.2

Fig. 7.2 also shows an object O of height 1.2 cm placed close to the lens. Two rays from the tip of the object O are incident on the lens.

- (i) On Fig. 7.2, continue the paths of these two rays for a further distance of at least 5 cm.
- (ii) Using your answer to **(b)(i)**, find and mark on Fig. 7.2 the image I of object O and label this image.

[2]

[2]

(iii) Determine the height of image I.

height =[1]

(iv) State and explain whether I is a real image or a virtual image.

[1]
[6 marks]

Question 5a

Fig. 7.1 shows a ray of light striking a plane mirror at point P.

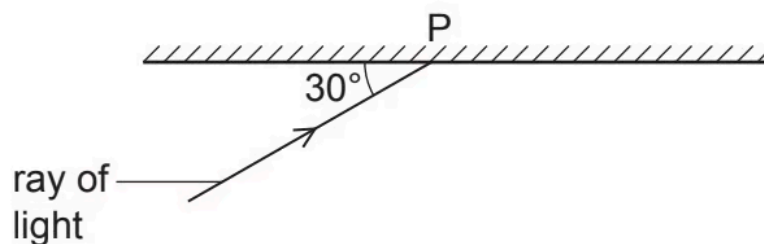


Fig. 7.1 (not to scale)

- (i) Determine the value of the angle of incidence for the ray of light at point P.

angle of incidence = ° [1]

- (ii) On Fig. 7.1,

- draw a normal at point P
- draw the ray reflected at point P
- determine the angle of reflection at point P.

angle of reflection = ° [3]

[4 marks]

Question 5b

Fig. 7.2 shows an object OB positioned 20cm from a thin converging lens. Both principal foci of the lens are labelled F.

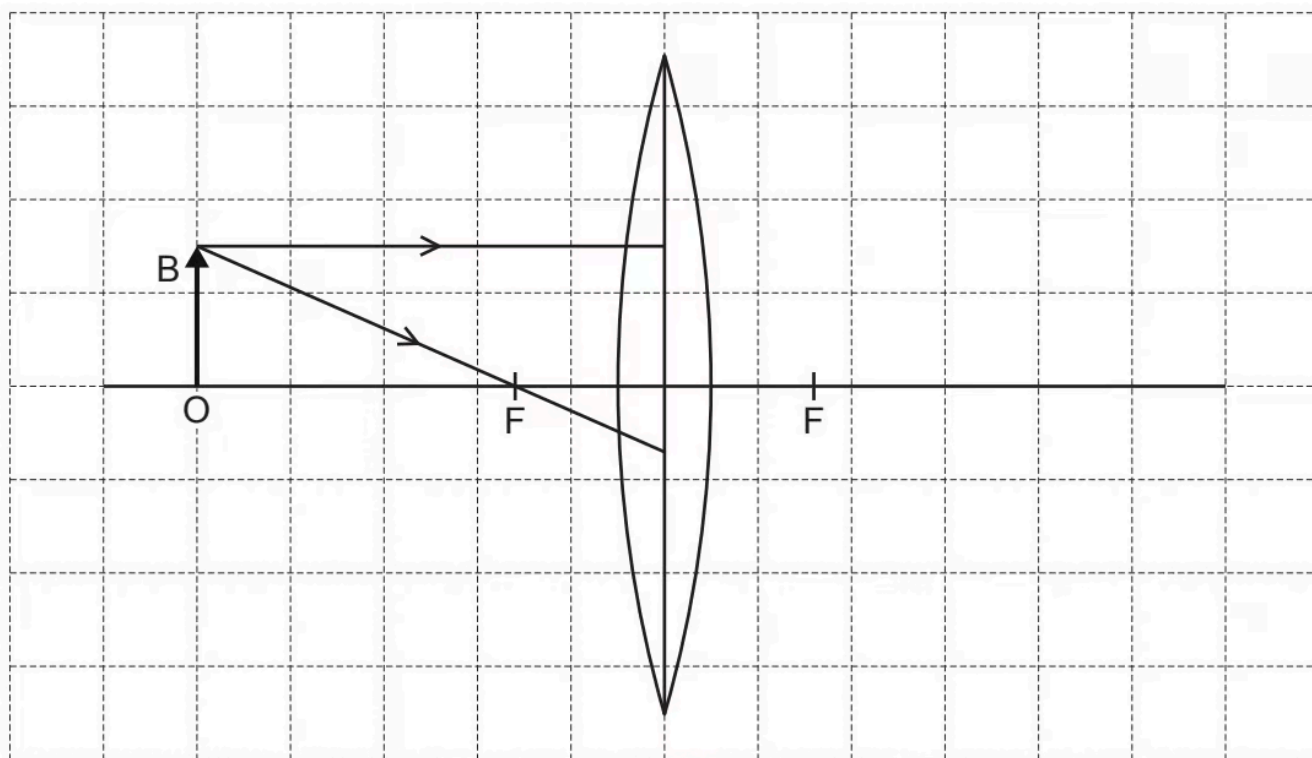


Fig. 7.2

Two rays from the tip B of the object are incident on the lens, as shown in Fig. 7.2.

On Fig. 7.2, continue the paths of these two rays to show the position of the image of OB formed by the lens. Draw an arrow to show the size, position and orientation of the image of OB.

[4 marks]

Question 6a

Fig. 6.1 shows a ray of red light incident on part of a lens.

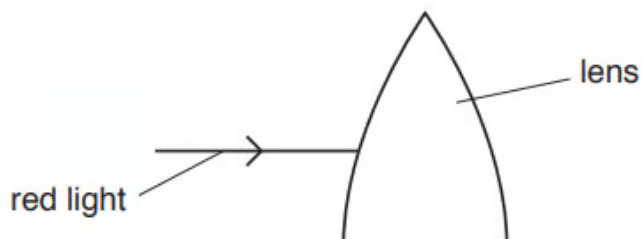


Fig. 6.1

- (i) On Fig. 6.1, continue the path of the ray as it passes through the lens and emerges from it.

[2]

- (ii) State the term used to describe the process as the ray enters and leaves the lens.

[1]

[3 marks]

Question 6b

Fig. 6.2 shows two parallel rays of light travelling towards another lens.

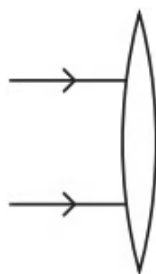


Fig. 6.2

The two rays of light pass through the lens to form an image.

On Fig. 6.2, continue the path of the rays. Extend the rays for at least 5 cm beyond the lens.

[2 marks]

Question 7a

A ray of light in air is incident on a glass block. The light changes direction.

State

(i) the name of this effect.

[1]

(ii) the cause of this effect.

[1]

[2 marks]

Question 7b

Fig. 5.1 shows a thin converging lens of focal length 3.5 cm.

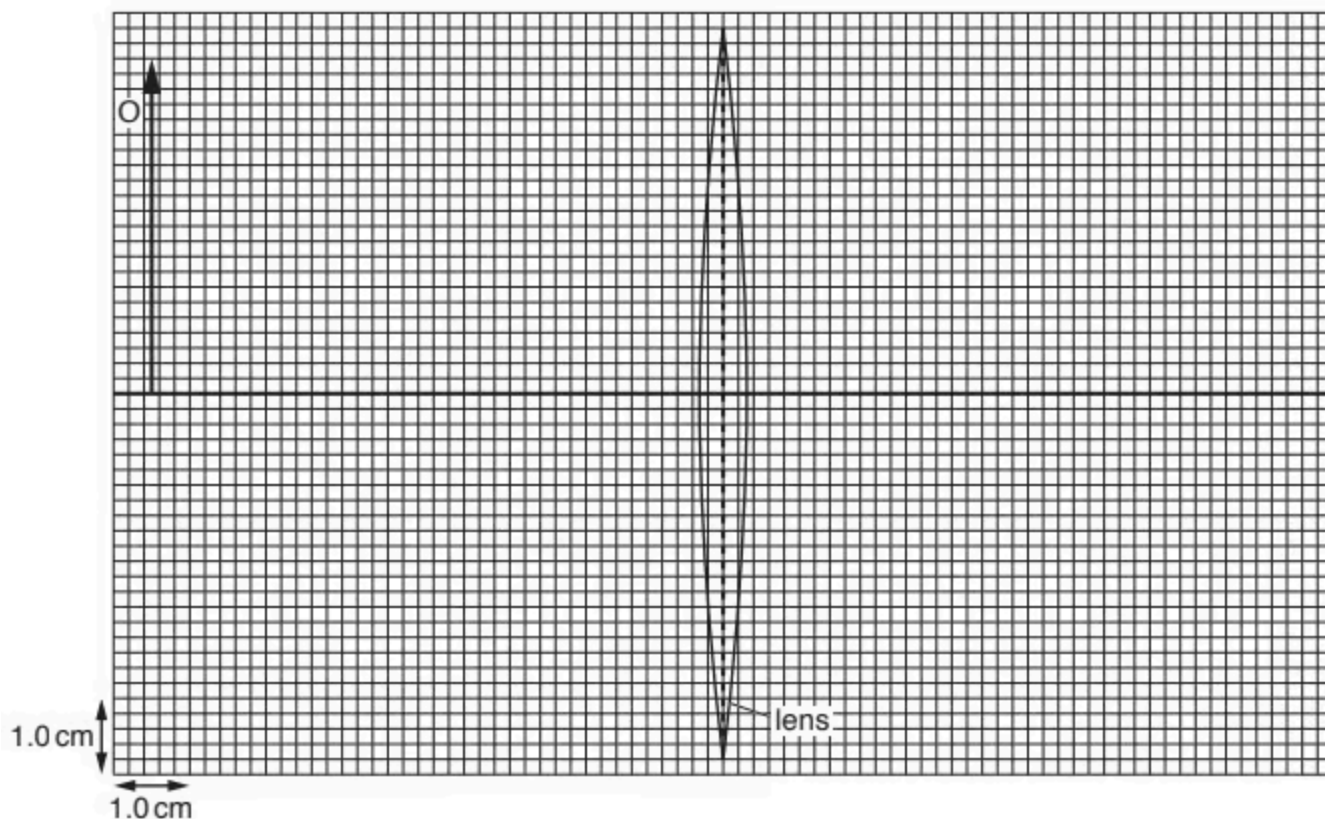


Fig. 5.1

- (i) On Fig. 5.1, mark each of the two principal foci and label each with the letter F.

[1]

- (ii) An object O of height 4.4 cm is placed a distance of 7.5 cm from the lens.

On Fig. 5.1, draw rays from the tip of the object O to locate the image. Draw and label the image.

[3]

- (i) Determine the height of the image.

height of the image =[1]

- (iv) State and explain whether the image is real or virtual.

[1]

[6 marks]

Question 8a

Fig. 5.1 shows a visible spectrum focused on a screen by passing light from a source of white light through a lens and a prism.

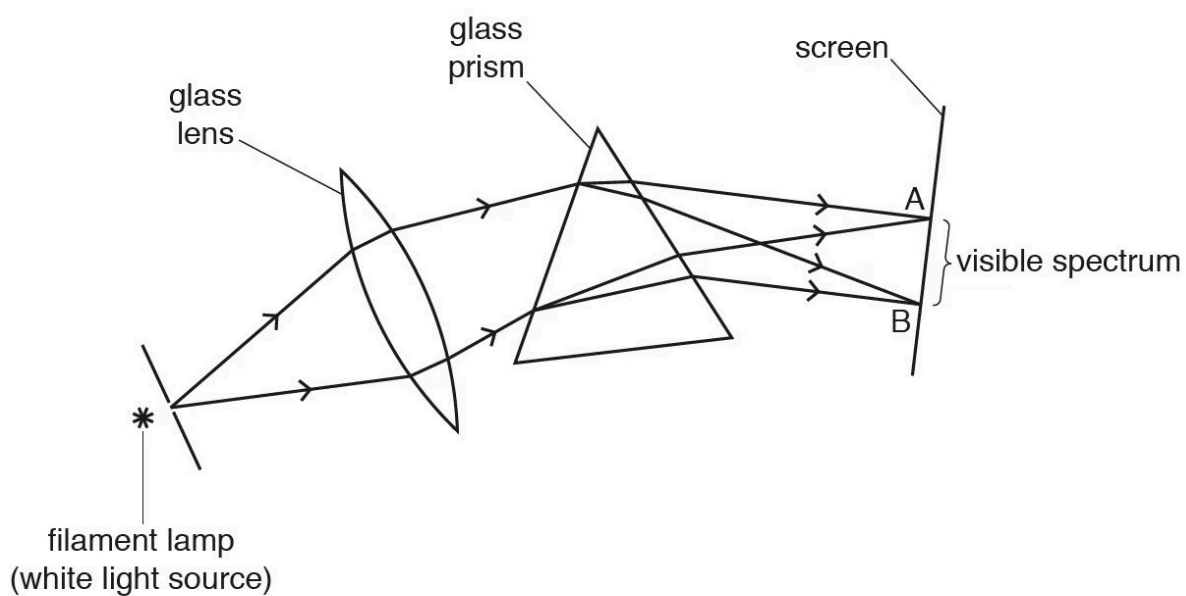


Fig. 5.1

- (i) State the name of the process that separates the colours in white light. [1]
- (ii) State the colour of the light on the screen at points A and B. [1]
- (iii) State the property of the glass of the prism that causes white light to be split into the different colours of the spectrum. [1]

[3 marks]

Question 8b

Extended tier only

Fig. 5.2 shows a section of an optical fibre in air. A ray of light is incident on the fibre wall at X.

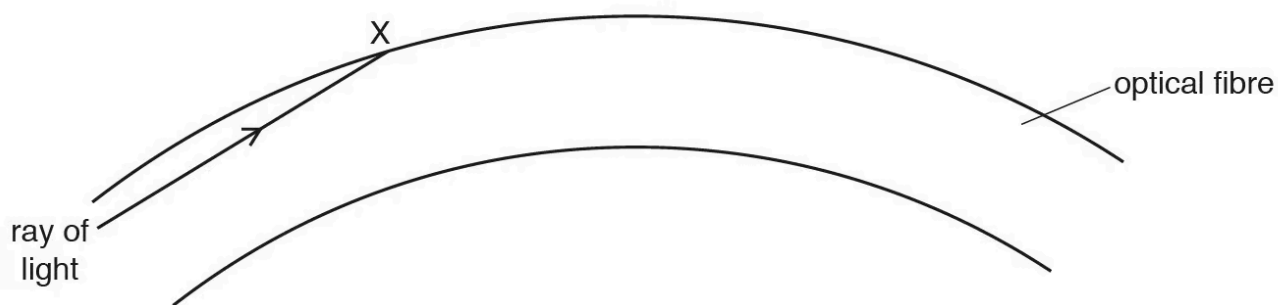


Fig. 5.2

- (i) On Fig. 5.2, continue the path of the ray of light up to the end of the fibre. [1]
- (ii) The refractive index of the material of the fibre is 1.46. Calculate the critical angle of the material of the fibre.

critical angle =[2]

- (iii) State two uses of optical fibres.

[2]
[5 marks]



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