

CHAPTER 7

1

- Write the word AMBULANCE as it would appear when reflected in a plane mirror.
- Why is it sometimes written in this way on the front of an ambulance?

2

- Draw a diagram to illustrate the law of reflection.
- Which two angles are equal, according to the law?

3

A ray of light passes from air into a block of glass. Does it bend **towards** or **away from** the normal?

4

- Draw a diagram to show how a ray of light passes through a parallel-sided block of glass or Perspex.
- What can you say about its final direction of travel?

5

A vertical ray of light strikes the horizontal surface of some water.

- What is its angle of incidence?
- What is its angle of refraction?

6

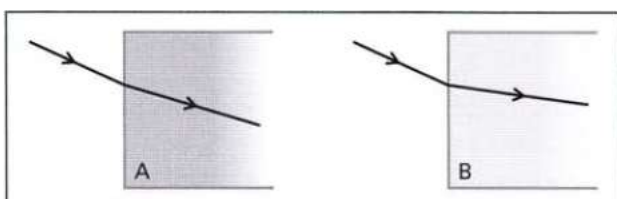
When a ray of light passes from air to glass, is the angle of refraction greater than, or less than, the angle of incidence?

7

Why do we see a distorted view when we look through a window that is covered with raindrops?

8

Figure 13.13 shows what happens when a ray of light enters blocks of two different materials, A and B.



- In which material does the light travel more slowly, A or B? Explain how you can tell from the diagrams.
- Which material, A or B, has the greater refractive index?

9

Light travels more quickly through water than through glass.

- Which has the greater refractive index, water or glass?
- If a ray passes from glass into water, which way will it bend: towards or away from the normal?

10

The speed of light in a block of glass is found to be 1.9×10^8 m/s. Calculate the refractive index of the glass.

11

A solution of sugar in water is found to have a refractive index of 1.38. Calculate the speed of light in the solution.

12

Perspex is a form of transparent plastic. It has a refractive index $n = 1.5$. A ray of light strikes the flat surface of a Perspex block with an angle of incidence of 40° . What will be the angle of refraction?

13

The critical angle for water is 49° . If a ray of light strikes the upper surface of a pond at an angle of incidence of 45° , will it be totally internally reflected? Explain your answer.

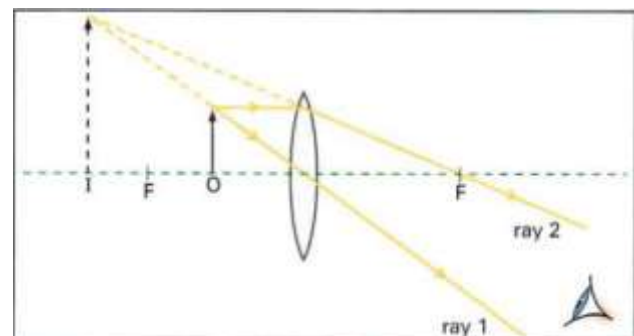
14

Sketch a diagram to show how a ray of light can travel along a curved glass fibre. Indicate the points where total internal reflection occurs.

15

What is the difference between a real image and a virtual image?

16



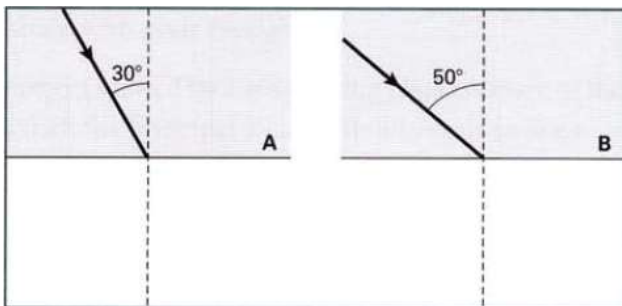
Look at Figure 13.23. How can you tell from the diagram that the object formed by the magnifying glass is a virtual image?

17

- a A converging lens has focal length 5 cm. An object is placed 3 cm from the centre of the lens, on the principal axis. Draw an accurate ray diagram to represent this.
- b Use your diagram to determine the distance of the virtual image formed from the lens.

18

Figure 13.24 shows two blocks of a material whose critical angle is 40° . In block A, the ray strikes the inner surface with an angle of incidence of 30° . In block B, the ray's angle of incidence is 50° .



- a Copy and complete each diagram to show what happens when the ray strikes the surface.
- b Use the diagrams to explain what is meant by **total internal reflection**.

19

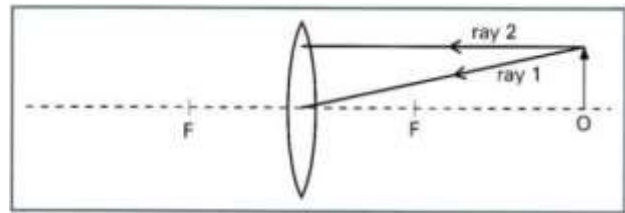
A small lamp is placed at a distance of 4 cm from a plane mirror.

- a Draw an accurate ray diagram to show where the image of the lamp in the mirror is formed.
- b Explain how you have used the law of reflection in drawing your diagram.
- c What does it mean to say that the image of the lamp is a **virtual image**?

20

Figure 13.25 shows an incomplete ray diagram, which represents the following situation.

A converging lens has a focal length of 4 cm. Its principal focuses are marked F. An object O is placed at a distance of 10 cm from the lens. Ray 1 passes through the centre of the lens. Ray 2 is parallel to the axis of the lens.



- a Copy and complete the ray diagram, on squared paper or graph paper, to find the position of the image formed by the lens.
- b Explain whether the diagram shows that the image is real or virtual.
- c Explain whether the diagram shows that the image is magnified or diminished (smaller than the object).
- d Explain whether the diagram shows that the image is upright or inverted.

21

Draw a diagram to show how white light can be dispersed into a spectrum using a glass prism.

22

Why are some colours of light more strongly refracted than others when they enter glass?

23

- a Put the following regions of the electromagnetic spectrum in order, starting with the waves that have the greatest wavelength.
 visible light infrared radio waves
 gamma rays ultraviolet microwaves
 X-rays
- b Which of these waves have the greatest frequency?
- c Which of these waves have the greatest speed in empty space (in vacuum)?