10 Light: Mirrors and Lenses

Textbook Questions and Answers

1. A light ray is incident on a mirror and gets reflected by it (Fig. 10.21). The angle made by the incident ray with the normal to the mirror is 40°. What is the angle made by the reflected ray with the mirror?

(i) 40° (ii) 50° (iii) 45° (iv) 60°

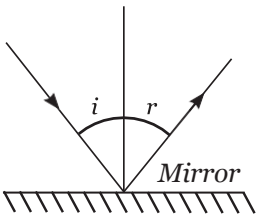

Fig. 10.21

Ans: (ii) 50°

Angle of incidence (i) = 40°

According to the law of reflection,

Angle of reflection (r) = Angle of incidence (i) = 40°

Angle between reflected ray and mirror = 90° – angle of reflection

= 90° – 40°

= 50°

2. Fig. 10.22 shows three different situations where a light ray falls on a mirror:

(i) **The light ray falls along the normal.**

(ii) **The mirror is tilted, but the light ray still falls along the normal to the tilted surface.**

(iii) **The mirror is tilted, and the light ray falls at an angle of 20° from the normal.**

Draw the reflected ray in each case (Use a ruler and protractor for accurate drawing). What is the angle of reflection in each case?

Ans:

(i) Ray retraces its path (r = 0°). It reflects back along the same line.

(ii) Ray retraces its path (r = 0°). It reflects back along the same line.

(iii)

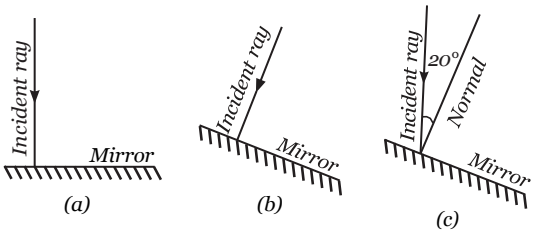

Fig. 10.22

By the law of reflection:

Angle of reflection = 20°

The reflected ray will make a 20° angle with the normal, on the opposite side.

3. In Fig. 10.23, the cap of a sketch pen is placed in front of three types of mirrors.

Match each image with the correct mirror.

(i) Plane mirror

(ii) Convex mirror

(iii) Concave mirror


(i) (ii) (iii)

Fig. 10.23

Ans:

(i) Plane mirror → (iii) erect, same size.

(ii) Convex mirror → (i) erect, smaller.

(iii) Concave mirror → (ii) inverted, enlarged or same size.

4. In Fig. 10.24 the cap of a sketch pen is placed behind a convex lens, a concave lens, and a flat transparent glass piece — all at the same distance.

Match each image with the correct type of lens or glass.

(i) *(ii)* *(iii)*

Fig. 10.24

Ans:

(i) Flat glass → (ii) same size.

(ii) Convex lens → (i) enlarged.

(iii) Concave lens → (ii) diminished.

5. When the light is incident along the normal on the mirror, which of the following statements is true:

(i) **Angle of incidence is 90°**

(ii) **Angle of incidence is 0°**

(iii) **Angle of reflection is 90°**

(iv) **No reflection of light takes place in this case**

Ans: (ii) Angle of incidence is 0°.

When a ray of light falls along the normal to a mirror, it means the light ray strikes the mirror perpendicularly.

The normal is an imaginary line drawn at 90° to the surface of the mirror at the point of incidence.

Here, since the incident ray and the normal coincide, the angle between them is 0°.

According to the laws of reflection,

Angle of incidence (i) = Angle of reflection (r). So, when i = 0°, then r = 0°.

The ray of light retraces its path — it is reflected back along the same line.

6. Three mirrors—plane, concave and convex are placed in Fig. 10.25. On the basis of the images of the graph sheet formed in the mirrors, identify the mirrors and write their names above the mirrors.

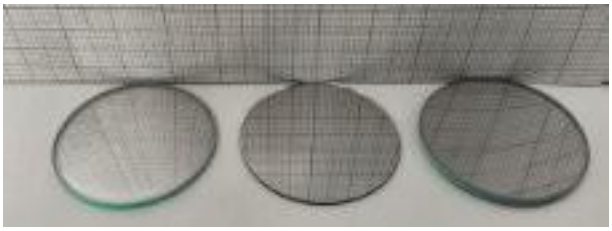

Fig. 10.25

Ans: Convex: smaller.

Plane: same size image.

Concave: enlarged.

7. In a museum, a woman walks towards a large convex mirror (Fig. 10.26). She will see that:

(i) **her erect image keeps decreasing in size.**

(ii) **her inverted image keeps decreasing in size.**

(iii) **her inverted image keeps increasing in size and eventually it becomes erect and magnified.**

(iv) **her erect image keeps increasing in size.**

Fig. 10.26

Ans:

(i) Her erect image keeps decreasing in size. Because a convex mirror always forms a virtual, erect, and diminished image.

8. Hold a magnifying glass over text and identify the distance where you can see the text bigger than they are written. Now move it away from the text. What do you notice? Which type of lens is a magnifying glass?

Ans:

When you hold a magnifying glass over a text and slowly adjust its distance from the page:

At a certain distance, you can see the letters appear larger and clearer — the text looks magnified.

When you move the magnifying glass farther away from the text, the letters appear blurred or inverted, and you can no longer see them clearly.

This happens because the lens forms different types of images depending on the distance between the lens and the object.

Magnifying glass is a convex lens.

9. Match the entries in Column I with those in Column II.

Column I	Column II
(i) Concavemirror	(a) Spherical mirror with a reflecting surface that curves inwards.
(ii) Convex mirror	(b) It forms an image which is always erect and diminished in size.
(iii) Convex lens	(c) Object placed behind it may appear inverted at some distance.
(iv) Concave lens	(d) Object placed behind it always appears diminished in size.

10. The following question is based on Assertion/Reason.

Assertion: Convex mirrors are preferred for observing the traffic behind us.

Reason: Convex mirrors provide a significantly larger view area than plane mirrors.

Choose the correct option:

(i) Both Assertion and Reason are correct and Reason is the correct explanation for Assertion.

(ii) Both Assertion and Reason are correct but Reason is not the correct explanation for Assertion.

(iii) Assertion is correct but Reason is incorrect.

(iv) Both Assertion and Reason are incorrect.

Ans: (i) Both Assertion and Reason are correct and Reason explains Assertion.

11. In Fig. 10.27, note that O stands for object, M for mirror, and I for image. Which of the following statements is true?

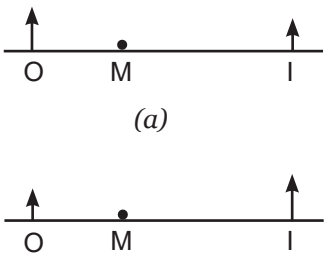

Fig. 10.27

(i) Figure (a) indicates a plane mirror and Figure (b) indicates a concave mirror.

(ii) Figure (a) indicates a convex mirror and Figure (b) indicates a concave mirror.

(iii) Figure (a) indicates a concave mirror and Figure (b) indicates a convex mirror.

(iv) Figure (a) indicates a plane mirror and Figure (b) indicates a convex mirror.

Ans: (ii) Figure (a) → Convex mirror, (b) → Concave mirror

12. Place a pencil behind a transparent glass tumbler (Fig. 10.28a). Now fill the tumbler halfway with water (Fig. 10.28b). How does the pencil appear when viewed through the water? Explain why its shape appears changed.

(a) *(b)*

Fig. 10.28

Ans: The pencil appears bent or displaced at the water surface because of refraction of light — light bends when it passes from air to water.

- Refraction is the bending of light when it passes from one medium to another — for example, from air to water.
- When light travels from air (a rarer medium) into water (a denser medium), it slows down and bends towards the normal.
- The part of the pencil inside water appears to be at a different position because the light rays coming from that part are bent before they reach our eyes.

As a result, our brain assumes the light rays are coming in a straight line, making the submerged part of the pencil appear raised and bent.