



GRADE 10<sup>TH</sup> SCIENCE  
CHAPTER 10

# LIGHT-REFLECTION AND REFRACTION

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2

Read the following and answer any four questions from 2(i) to 2(v).

The spherical mirror forms different types of images when the object is placed at different locations.

When the image is formed on screen, the image is real and when the image does not form on screen, the image is virtual. When the two reflected rays meet actually, the image is real and when they appear to meet, the image is virtual.

A concave mirror always forms a real and inverted image for different positions of the object. But if the object is placed between the focus and pole, the image formed is virtual and erect.

A convex mirror always forms a virtual, erect and diminished image. A concave mirror is used as doctor's head mirror to focus light on body parts like eyes, ears, nose etc., to be examined because it can form erect and magnified image of the object. The convex mirror is used as a rear view mirrors in automobiles because it can form an small and erect image of an object.

- (i) When an object is placed at the centre of curvature of a concave mirror, the image formed is
- |                                     |                             |
|-------------------------------------|-----------------------------|
| (a) larger than the object          | (b) smaller than the object |
| (c) same size as that of the object | (d) highly enlarged.        |
- (ii) No matter how far you stand from a mirror, your image appears erect. The mirror is likely to be
- |            |                             |
|------------|-----------------------------|
| (a) plane  | (b) concave                 |
| (c) convex | (d) either plane or convex. |
- (iii) A child is standing in front of a magic mirror. She finds the image of her head bigger, the middle portion of her body of the same size and that of the legs smaller. The following is the order of combinations for the magic mirror from the top.
- |                               |                               |
|-------------------------------|-------------------------------|
| (a) Plane, convex and concave | (b) Convex, concave and plane |
| (c) Concave, plane and convex | (d) Convex, plane and concave |
- (iv) To get an image larger than the object, one can use
- |  |  |
|--|--|
| (a) convex mirror but not a concave mirror     | (b) a concave mirror but not a convex mirror |
| (c) either a convex mirror or a concave mirror | (d) a plane mirror.                          |
- (v) A convex mirror has wider field of view because
- |  |
|--|
| (a) the image formed is much smaller than the object and large number of images can be seen. |
| (b) the image formed is much closer to the mirror  |
| (c) both (a) and (b)   |
| (d) none of these.   |

3

Read the following and answer any four questions from 3(i) to 3(v).

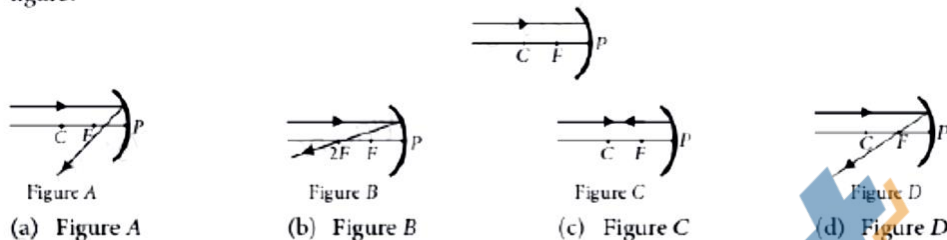
The relation between distance of an object from the mirror ( $u$ ), distance of image from the mirror ( $v$ ) and the focal length ( $F$ ) is called mirror formula. This formula is valid in all situations for all spherical mirrors for all positions of the object. The size of image formed by a spherical mirror depends on the position of the object from the mirror. The image formed by a spherical mirror can be bigger than the object, equal to the object or smaller than the object. The size of the image relative to the object is given by the linear magnification ( $m$ ). Thus, the magnification is given by the ratio of height of image to the height of object. If magnification is negative, image is real and if it is positive, image is virtual.



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- (i) What is the position of an image when an object is placed at a distance of 20 cm from a concave mirror of focal length 20 cm?  
 (a) 5 cm                      (b) 20 cm                      (c) 10 cm                      (d) infinity

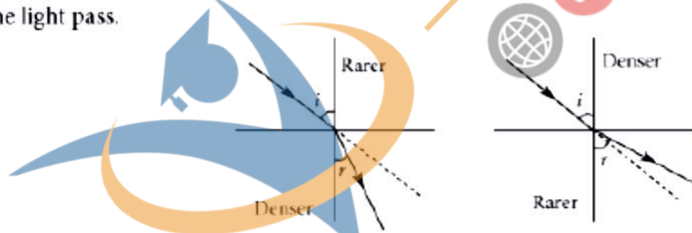
- (ii) Which of the following ray diagrams is correct for the ray of light incident on a concave mirror as shown in figure?



- (iii) If the magnification of an image is  $-2$ , the characteristic of image will be  
 (a) real and inverted                      (b) virtual and enlarged                      (c) virtual and inverted                      (d) real and small
- (iv) The mirror formula holds for  
 (a) concave mirror                      (b) convex mirror                      (c) plane mirror                      (d) all of these
- (v) A parallel beam of light is made to fall on a concave mirror. An image is formed at a distance of 7.5 from the mirror. The focal length of the mirror is  
 (a) 15 cm                      (b) 7.5 cm                      (c) 3.75 cm                      (d) 10 cm

**4**

Read the following and answer any four questions from 4(i) to 4(v).  
 When the rays of light travels from one transparent medium to another, the path of light is deviated. This phenomena is called refraction of light. The bending of light depends on the optical density of medium through which the light pass.



The speed of light varies from medium to medium. A medium in which the speed of light is more is optically rarer medium whereas in which the speed of light is less is optically denser medium. Whenever light goes from one medium to another, the frequency of light does not change however, speed and wavelength change. It concluded that change in speed of light is the basic cause of refraction.

- (i) When light travels from air to glass, the ray of light bends  
 (a) towards the normal                      (b) away from normal                      (c) anywhere                      (d) none of these
- (ii) A ray of light passes from a medium A to another medium B. No bending of light occurs if the ray of light hits the boundary of medium B at an angle of  
 (a)  $0^\circ$                       (b)  $45^\circ$                       (c)  $90^\circ$                       (d)  $120^\circ$
- (iii) When light passes from one medium to another, the frequency of light  
 (a) increases                      (b) decreases                      (c) remains same                      (d) none of these

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- (iv) When light passes from glass to water, the speed of light  
 (a) increases (b) decreases  
 (c) remains same (d) first increases then decrease
- (v) The bottom of pool filled with water appears to be \_\_\_\_\_ due to refraction of light.  
 (a) shallower (b) deeper (c) at same depth (d) empty

5

Read the following and answer any four questions from 5(i) to 5(v).

The refraction of light on going from one medium to another takes place according to two laws which are known as the laws of refraction of light. These laws are

1. The ratio of sine of angle of incidence to the sine of angle of refraction is always constant for the pair of media in contact.

$$\frac{\sin i}{\sin r} = \mu = \text{constant}$$

This constant is called refractive index of the second medium with respect to the first medium.

Refractive index is also defined as the ratio of speed of light in vacuum to the speed of light in medium.

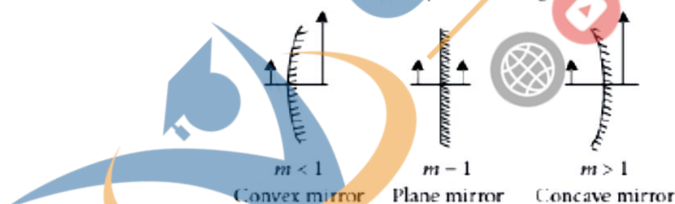
2. The incident ray, refracted ray and normal all lie in the same plane.  
 This law is called Snell's law of refraction.
- (i) When light travels from air to glass,  
 (a) angle of incidence > angle of refraction (b) angle of incidence < angle of refraction  
 (c) angle of incidence = angle of refraction (d) can't say
- (ii) When light travels from air to medium, the angle of incidence is  $45^\circ$  and angle of refraction is  $30^\circ$ . The refractive index of second medium with respect to the first medium is  
 (a) 1.41 (b) 1.50 (c) 1.23 (d) 1
- (iii) In which medium, the speed of light is minimum?  
 (a) Air (b) Glass (c) Water (d) Diamond
- (iv) If the refractive index of glass is 1.5 and speed of light in air is  $3 \times 10^8$  m/s. The speed of light in glass is  
 (a)  $2 \times 10^8$  m/s (b)  $2.9 \times 10^8$  m/s (c)  $4.5 \times 10^8$  m/s (d)  $3 \times 10^8$  m/s
- (v) Refractive index of  $a$  with respect to  $b$  is 2. Find the refractive index of  $b$  with respect to  $a$ .  
 (a) 0.4 (b) 0.5 (c) 0.25 (d) 2.

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### ASSERTION & REASON

For question numbers 9-20, two statements are given—one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below :

- (a) Both A and R are true, and R is correct explanation of the assertion.  
 (b) Both A and R are true, but R is not the correct explanation of the assertion.  
 (c) A is true, but R is false.  
 (d) A is false, but R is true.
9. **Assertion :** If a ray of light is incident on a convex mirror along its principal axis, then the angle of incidence as well as the angle of reflection for a ray of light will be zero.  
**Reason :** A ray of light going towards the centre of curvature of a convex mirror is reflected back along the same path.
10. **Assertion :** Linear magnification of a mirror has no unit.  
**Reason :** The ratio of height of the image to the height of the object is the linear magnification produced by mirror.
11. **Assertion :** Light is able to reach earth from the sun.  
**Reason :** Light rays can travel in vacuum.
12. **Assertion :** Property of converging of a convergent lens does not remain same in all media.  
**Reason :** Property of lens whether the ray is diverging or converging is independent of the surrounding medium.
13. **Assertion :** We can decide the nature of a mirror by observing the size of erect image in the mirror.



**Reason :** The minimum distance between a real object and its real image in a concave mirror is non zero.

14. **Assertion :** A convex lens is made of two different materials. A point object is placed on the principal axis. The number of images formed by the lens will be two.  
**Reason :** The image formed by convex lens is always virtual.
15. **Assertion :** In diffused reflection, a parallel beam of incident light is reflected in different direction.  
**Reason :** The diffused reflection of light is due to the failure of the laws of reflection.
16. **Assertion :** The image of a virtual object formed by a thin converging lens is always real.  
**Reason :** In the case of a thin lens,  $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ .

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17. **Assertion :** In the case of concave mirror, the minimum distance between real object and its real image is zero.  
**Reason :** If concave mirror forms virtual image of real object, the image is magnified.
18. **Assertion :** The size of the mirror affect the nature of the image.  
**Reason :** Small mirrors always form virtual images.
19. **Assertion :** Keeping a point object fixed, if a plane mirror is moved, the image will also move.  
**Reason :** In case of a plane mirror, distance of object and its image is equal from any point on the mirror.
20. **Assertion :** A plane mirror neither converges parallel rays of light nor diverges them.  
**Reason :** The focal length of a plane mirror can be considered to be infinite.

