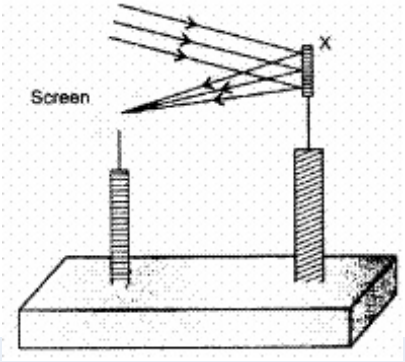
CBSE Test Paper-02

Chapter 10 Light Reflection and Refraction

1. A student determines the focal length of a device X, by focusing the image of a far off object on the screen positioned as shown in the figure below: **(1)**



The device X is a :

   a. Convex lens
   b. Concave mirror
   c. Concave lens
   d. Convex lens

2. Name the type of image that can be obtained on a screen. **(1)**

   a. Real
   b. Virtual
   c. Blur
   d. Undefined

3. If the angle of incidence is 90°, what is the angle of refraction? **(1)**

   a. r = $\frac{1}{}$
   b. r = 45°
   c. r = sin-1 $\left(\frac{1}{n}\right)$
   d. r = 90°

4. The extent to which a ray of light travelling in one medium and entering the second medium bends depends on**: (1)**

   a. The speed of light
   b. None of the above

c. The wavelength of light
d. The frequency of light

5. While doing experiment with candle to find focal length of a concave mirror, the candle is placed between: **(1)**
   a. pole and focus
   b. at focus
   c. focus and centre of curvature
   d. beyond focus
6. Is it possible that a convergent lens in one medium becomes divergent, when placed in another medium? **(1)**
7. What kind of image can be obtained on the screen? **(1)**
8. Out of convex mirror and a concave mirror, whose focus is situated behind the mirror? **(1)**
9. Name a point inside a lens such that a ray of light passing through it goes undeviated. **(1)**
10. An object 3 cm high is placed 20 cm from convex lens of focal length 12 cm. Find the nature, position and height of the image. **(3)**
11. An object is placed at a distance of 10 cm from a convex mirror of focal length 15 cm. Find the position and nature of the image. **(3)**
12. An object of size 7.0 cm is placed at 27 cm in front of a concave mirror of focal length 18 cm. At what distance from the mirror should a screen be placed, so that a sharp focused image can be obtained? Find the size and the nature of the image. **(3)**
13. Why do we prefer a convex mirror as a rear-view mirror in vehicles? (3)
14. Under what condition in an arrangement of two plane mirrors, incident ray and reflected ray will always be parallel to each other, whatever may be angle of incidence. Show the same with the help of diagram. **(5)**
15. How are the images formed in convex mirror when object is moved from infinity to the mirror? **(5)**

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Answers

1. b. Concave mirror

   Explanation: Because the screen is on the same side of the object which means it is never a lens becoz it happens behind the lenses in such case. Moreover Concave mirror forms real images i.e. image can be obtained on a screen.

2. a. Real

   Explanation: A real image is an image which is located in the plane of convergence for the light rays that originate from a given object. If a screen is placed in the plane of a real image the image will generally become visible on the screen. Examples of real images include the image seen on a cinema screen (the source being the projector), the image produced on a detector in the rear of a camera, and the image produced on an eyeball retina

3. c. (c) r = sin-1 $\left(\frac{1}{n}\right)$

   Explanation: According to Snell's law of refraction, the ratio of the sine of angle of incidence to the sine of angle of refraction is a constant for a given pair of media, and for the light of a given colour. If " i " is the angle of incidence and " r " is the angle of refraction, then**:**

   $\frac{sin\, i}{sin\, r} = n \implies$ r = sin-1 $\left(\frac{1}{n}\right)$

4. a. The speed of light

   Explanation: When a ray of light travels obliquely from one transparent medium to another transparent medium, there is always a change in its speed and direction. The extent to which a ray of light bends, depends on the speed of light in the two media. $n_{21} = \frac{speed\, of\, light\, in\, medium\, 1}{speed\, of\, light\, in\, medium\, 2}$

5. c. focus and centre of curvature

   Explanation: For objects between f and 2f or centre of curvature the image formed will be enlarged and beyond C.

6. Yes it's **possible that convergent lens in one medium acts divergent in another medium** . If a **lens** acts as **convergent** in a **medium** having refractive index less than that of **lens** material, then it will act as **divergent** in **medium** having greater refractive index and vice versa.
7. Real image.
8. Out of the two spherical mirrors convex and concave mirror, the convex mirror has the focus point situated behind the mirror as its centre of curvature lies behind the mirror due to which it forms virtual and erect image always
9. Optical centre.
10. Since lens is convex, therefore/is positive.

    Given: u = - 20 cm, f = + 12 cm, h = 3 cm, v= ?, h' = ?

    Using lens formula

    $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

    We have, $\frac{1}{v} - \frac{1}{-2012} = \frac{1}{12}$

    $\frac{1}{v} + \frac{1}{20} = \frac{1}{12}$

    $\frac{1}{v} = \frac{1}{12} - \frac{1}{20}$

    $\frac{1}{v} = \frac{5-3}{60} = \frac{1}{30}$

    v = 30 cm

    Since 'V' is positive, the image is located on the other side of the lens.

    m = $\frac{v}{u} = \frac{+30}{-20}$

    = -1.5

    Since m is negative and greater than 1, the image is real, inverted and larger than the object.

    m = $\frac{h'}{h} = -1.5 = \frac{h'}{3}$

    or h' = -4.5 cm

    Thus the image is 30 cm from the convex lens, located on the other side of the lens. It is real, inverted and 4.5 cm high.
11. u = –10 cm [u is always negative]; f = 15 cm [convex mirror] v = ?

    Using $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$, we have

    $\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{15} - \frac{1}{-10} = \frac{1}{15} + \frac{1}{10} = \frac{2+3}{30} = \frac{5}{30} = \frac{1}{6}$

    So v = 6 cm behind the mirror or towards left of the mirror. Image is virtual and erect.
12. u = - 27 cm, f = - 18 cm. h_o = 7.0 cm

1/v = 1/f - 1/u

1/v = -1/18 + 1/27 = -1/54

v = - 54 cm

Screen must be placed at a distance of 54 cm from the mirror in front of it.

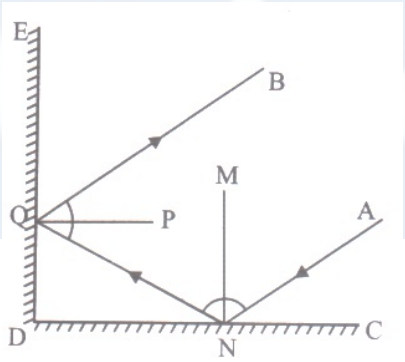
$h_i/h_o = v/u$

$h_i/7 = +54/-27$

$h_i = -2 \times 7 = -14$ cm.

Thus, the image is of 14 cm length and is inverted image.

13. Convex mirrors are used as rear-view mirrors in vehicles to see the traffic at the rear side. Convex mirrors are preferred because
    a. they always give an erect, though diminished image.
    b. they have a wider field of view as they are curved outwards.
    c. Thus, convex mirrors enables the driver to view much larger area than a plane mirror.
14. When two plane mirrors are at 90^0 then incident ray and reflected ray will always be parallel as explained below:



ED and DC are two plane mirrors placed at 90^0:

$\angle ANM = \angle MNQ$ (angle i=angle r)

$\angle NQP = \angle PQB$ (same as above)

$\angle MNQ + \angle QND = 90^\circ$ (MN is normal on CD) ...(1)

$\angle QDN = 90^\circ$ (mirrors are at right angle)

Hence, in ΔQDN;

$\angle QND + \angle NQD = 90^\circ$

(acute angles of a right triangle are complementary) ...(2)

From equations (1) and (2);

$\angle MNQ = \angle NQD$

Hence, $\angle QND = \angle NQP$

(because $\angle NQP$ and $\angle NQD$ are complementary)

Now, $\angle PQB$ and $\angle PQD$ are supplementary (PQ is normal on DE)

So, $\angle BQE = NQD = \angle MNQ = \angle ANM$

Or, $\angle BQE = \angle ANM$

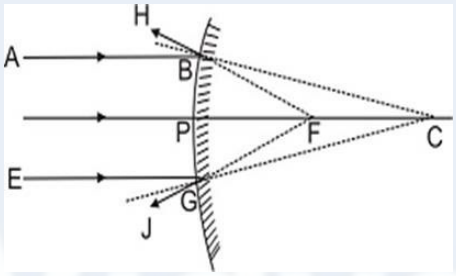
Since corresponding angles are equal

Hence, $BQ||AN$ proved

This means that incident ray and reflected ray will always be parallel; irrespective of value of angle of incidence.

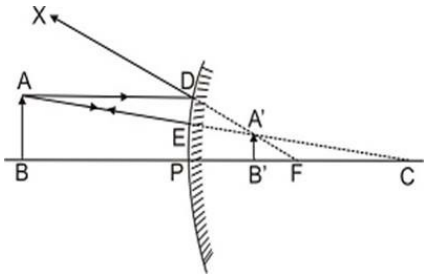
15. Object at Infinity: Rays from infinity come parallel to principal axis. Ray AB is reflected towards BH and ray EG is reflected towards GJ. When produced back they meet at F, the principal focus (Rule 1).

    An extremely small, erect, virtual image is formed at F.



    Object at infinity: A virtual, erect, extremely diminished image is formed at F.

    Object placed anywhere except infinity. A ray AD parallel to principal axis after reflection appears to pass through F. Another ray AE normal to mirror and appearing to pass through C is reflected back along the same path. They appear to meet at A' forming image of A and A'. Similarly, image of B is formed at B'. This virtual, erect image of AB is formed at A'B' between P and F behind the mirror. Image is erect and diminished in size.



    Object any where, A virtual, erect, diminished image is formed behind the mirror between F and P