Class - X | 2023-24 | Board: CBSE

Light

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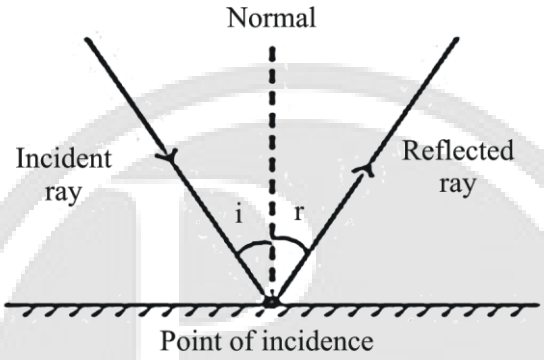
Reflection of Light: The phenomenon of bouncing back of light into the same medium by the smooth surface is called reflection.

Laws of reflection

- The law of reflection defines that upon reflection from a smooth surface, the angle of the reflected ray is equal to the angle of the incident ray, with respect to the normal to the surface that is to a line perpendicular to the surface at the point of contact.



- The reflected ray is always in the plane defined by the incident ray and the normal to the surface at the point of contact of the incident ray.

Spherical Mirror: If the reflecting surface is part of the hollow sphere then the mirror is a spherical mirror.

Convex mirror: In this mirror the reflecting surface is convex. It diverges the light so it is also called a diverging mirror.

Concave mirror: In this mirror the reflecting surface is concave. It converges the light so it is also called a converging mirror.

Parameters of Mirror:

- Center of Curvature: The centre of a hollow sphere of which the mirror is a part.
- The radius of curvature: The radius of the hollow sphere of which the mirror is a part.
- Pole: The centre of the mirror (middle point) is the pole.
- Principal axis: The line joining the pole and center of curvature is called principal axis.
- Aperture: Size of mirror is called the aperture of the mirror.
- Principal Focus: The point on the principal axis, where all the incident rays parallel to the principal axis converge or diverge after reflection through the mirror.
- Focal Length: The distance between pole and focus point is focal length.

Sign Conventions of Spherical Mirror:

- All the distances are measured from the pole of the mirror as the origin.
- Distances measured in the direction of incident rays are taken as positive.
- Distances measured opposite to the direction of incident rays are taken as negative.
- Distances measured upward and perpendicular to the principal axis are taken as positive.
- Distances measured downward and perpendicular to the principal axis are taken as negative.
- $1/f=1/v+1/u$ …where f, v and u are focal length, image distance, object distance
- Linear Magnification: This is the ratio of the height of the image to the height of the object.
- $m=h'/h =(-v/u)$…where m = magnification, h' = height of image, h = height of object

For mirrors, the following results hold :

- u is – ve, if the object is in front of the mirror.(Real object)
- u is + ve, if the object is behind the mirror.(Virtual object)
- v is – ve, if the image is in front of the mirror.(Real image)
- v is +ve, if the image is behind the mirror.(Virtual image)

Real image : When the rays of light, after reflection from a mirror, actually meet at a point, then the image formed by these rays is said to be real. Real images can be obtained on a screen.

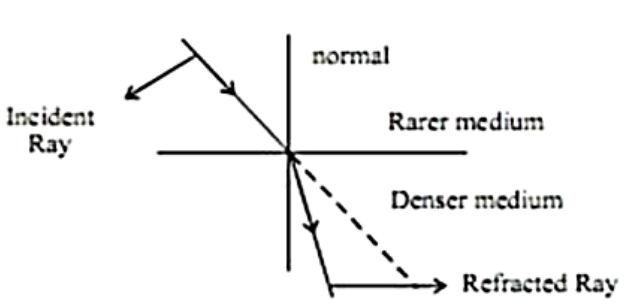
Virtual image: When the rays of light, after reflection from a mirror, appear to meet at a point, then the image formed by these rays is said to be virtual. Virtual images can't be obtained on a screen.

Refraction of Light: The bending of light at the interface of two different mediums is called Refraction of light.

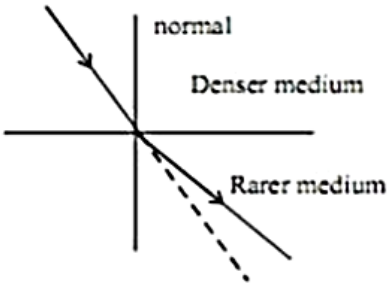
- If the velocity of light in medium is more, then medium is called optical rarer.

  Example, air or vacuum is more optically rarer.
- If the velocity of light in medium is less, then medium is called optical denser.

  Example, glass is denser than air.



When ray travel from Rarer to Denser it bends towards normal after refraction



When ray travel from denser to rarer medium it bends away from normal

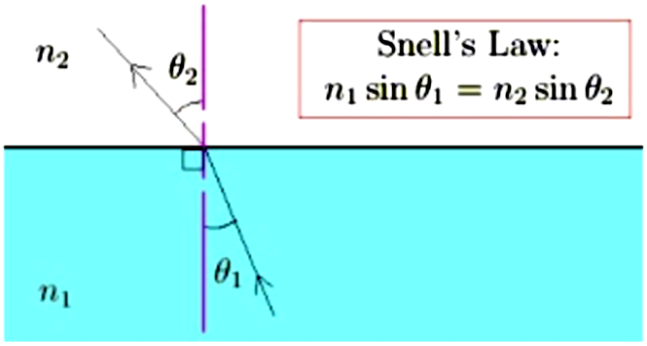
Refractive Index: It represents the amount or extent of bending of light when it passes from one medium to another.

- Relative refractive index:Refractive index of medium with respect to other medium is called Relative Refractive Index.
- Absolute refractive index:Refractive index of medium with respect to air or vacuum is called Absolute Refractive Index.

Laws of Refraction: According to this law

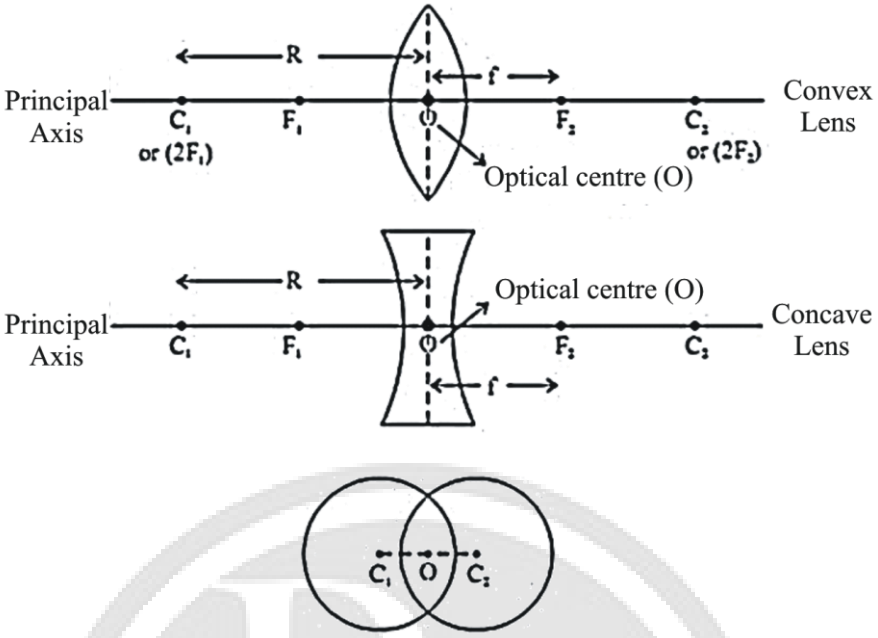
- "The incident ray, refracted ray and normal at the point of incidence all lie in the same plane."
- "The ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant." sini/sinr = constant (μ)

$\frac{Sini}{Sinr} = \frac{n_2}{n_1} = n_{21}$ Where 2 is for second medium and 1 is for first medium



Lens: The transparent refracting medium bounded by two surfaces in which at least one surface is curved is called a lens.

- Convex lens
- Concave lens



- If ${}_wn_g$ is the refractive index of glass w.r.t. water, ${}_an_g$ be the refractive index of glass w.r.t. air and ${}_an_w$ be the refractive index of water w.r.t. air, then ${}_wn_g = \frac{{}_an_g}{{}_an_w}$

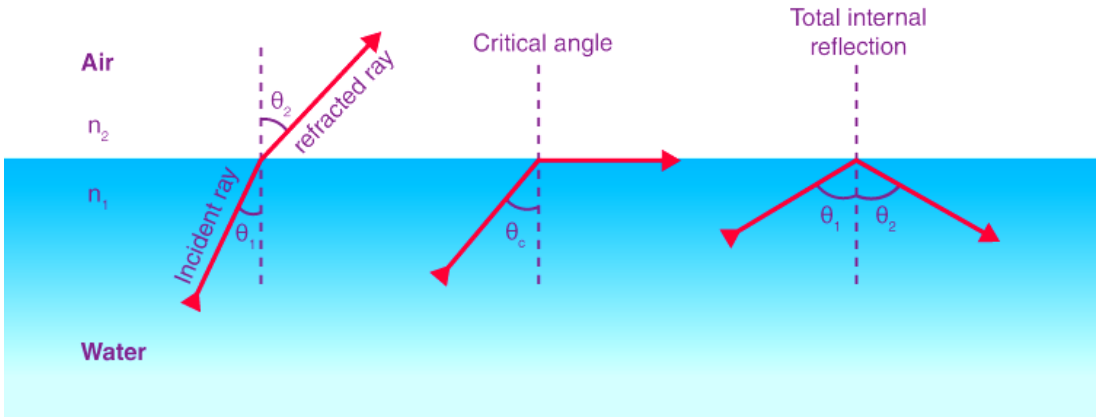
For the two lenses, the sign conventions take the form

- u is- ve, if the object is in front of the lens. (Real object)
- u is +ve, if the object is virtual.
- v is – ve, if the image is on the same side as that of the object. (Virtual image)
- v is +ve, if the image is real.
- Focal length of a concave lens is taken as – ve.
- Focal length of a convex lens is taken as +ve.
- Lens formula

  1/v-1/u = 1/f
- m=h'/h=v/u

Total Internal Reflection:

When light passes from a denser medium to a lighter medium at an angle more than the critical angle required for refraction, then the light is reflected back into the denser medium. This is a phenomenon called Total Internal Reflection.



PW Web/App - https://smart.link/7wwosivoicgd4

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