LIGHT

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.
- Incident ray, reflected ray and normal at a point of incidence ,all lie on the same plane..

Parameters of Mirror

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

Total Internal Reflection

When light passes from a denser medium to a rarer 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.**

Spherical Mirror

If the reflecting surface is part of the hollow sphere then the mirror is a **spherical mirror.**

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.

Mirror formula

$1/f=1/v+1/u$ ...where f, v and u are focal length, image distance, object distance.

Linear magnification

- **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

Concave Mirror

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

Convex Mirror

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

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.

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.

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)

Lens

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

- Convex lens
- Concave lens

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.
Eg. Air or vacuum is more optical rarer.
If the velocity of light in medium is less, then medium is called optical denser.
Eg. Glass is more denser than air.

Convex Lens

A convex lens is a type of optical lens that is thicker in the center than at the edges and can converge light rays to a focal point. Convex lenses are also known as converging lenses, because they focus parallel rays of light to a single point.

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.
  $\sin i/\sin r$ = constant (μ)

Concave Lens

A concave lens is a lens that diverges a straight light beam from the source to a diminished, upright, virtual image. It can form both real and virtual images. Concave lenses have at least one surface curved inside.

Lens formula

- Lens formula
  $1/v-1/u = 1/f$

Linear magnification

- **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 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.

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.