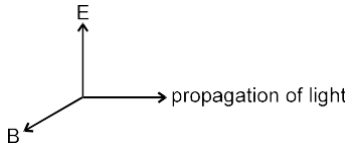
1. Properties of Light

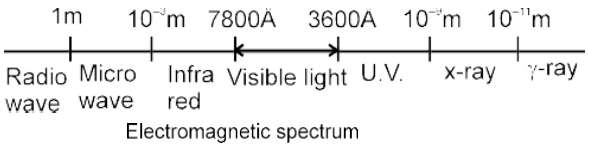
(i) Speed of light in vacuum, denoted by c, is equal to 3×10^8 m/s approximately.

(ii) Light is electromagnetic wave (proposed by Maxwell). It consists of varying electric field and magnetic field.



(iii) Light carries energy and momentum.

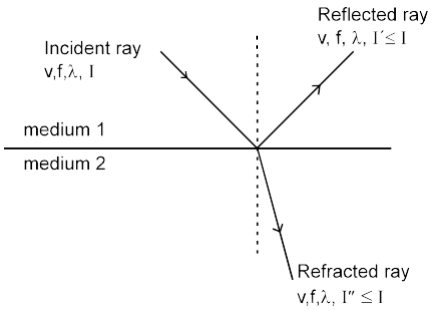
(iv) The formula $v = f\lambda$ is applicable to light.



Electromagnetic spectrum

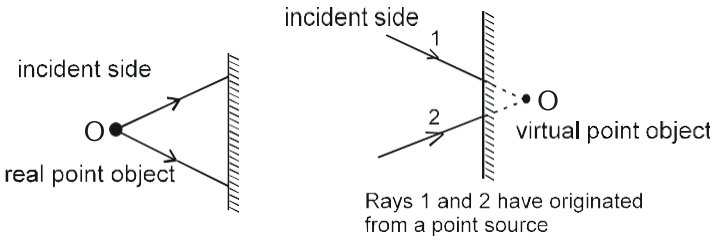
(v) When light gets reflected in same medium, it suffers no change in frequency, speed and wavelength.

(vi) Frequency of light remains unchanged when it gets reflected or refracted.



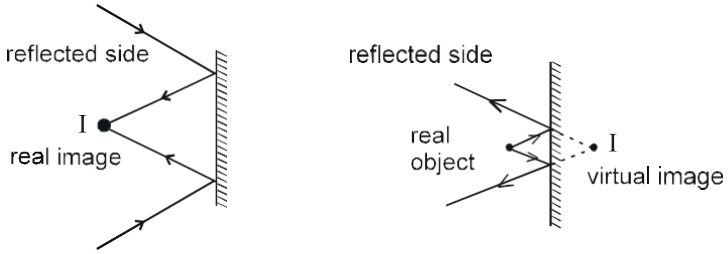
Object and Image

(a) Object (O) : Object is defined as point of intersection of **incident** rays.



Note : An object is called **real** if it lies on incident side otherwise it is called **virtual**.

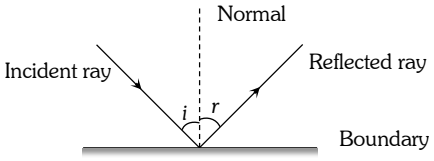
(b) Image (I) : Image is defined as point of intersection of **reflected** rays (in case of reflection) or **refracted** rays (in case of refraction).



Note : An image is called **real** if it lies on reflected or refracted side otherwise it is called **virtual.**

Reflection of Light

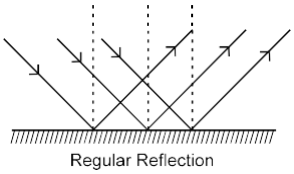
When a ray of light after incidenting on a boundary separating two media comes back into the same media, then this phenomenon, is called reflection of light.



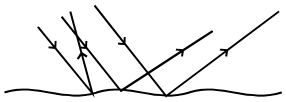
(1) $\angle i = \angle r$

(2) After reflection, velocity, wave length and frequency of light remains same but intensity decreases.

(a) Regular Reflection:

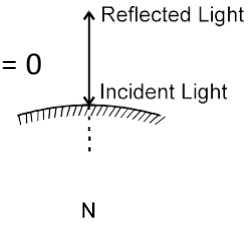


(b) Diffused Reflection



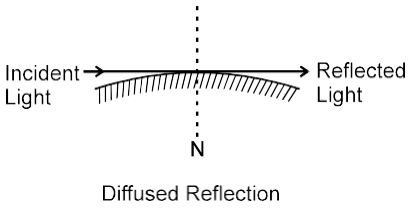
Special Cases :

Normal Incidence : In case light is incident normally, i = r = 0



Note : We say that the ray has retraced its path.

Grazing Incidence : In case light strikes the reflecting surface tangentially, i = r = 90

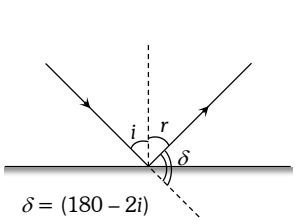


Diffused Reflection

Reflection From a Plane Surface (Plane Mirror)

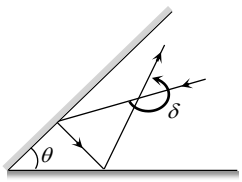
The image formed by a plane mirror is virtual, erect, laterally inverted, equal in size that of the object and at a distance equal to the distance of the object in front of the mirror.

(1) **Deviation (δ) :** Deviation produced by a plane mirror and by two inclined plane mirrors.



$\delta = (180 - 2i)$

(A) Single Reflection



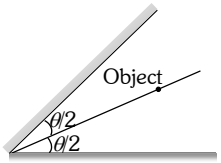
$\delta = (360 - 2\theta)$

(B) Double Reflection

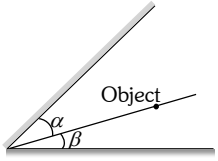
(2) **Images by two inclined plane mirrors :** When two plane mirrors are inclined to each other at an angle θ, then number of images (n) formed of an object which is kept between them.

(i) $n = \left(\frac{360^o}{\theta} - 1\right)$; If $\frac{360^o}{\theta}$ = even integer

(ii) If $\frac{360^o}{\theta}$ = odd integer then there are two possibilities



(A) Object is placed symmetrically



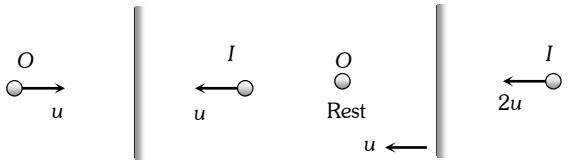
(B) Object is placed asymmetrically

$n = \left(\frac{360}{\theta} - 1\right)$ $\qquad$ $n = \frac{360}{\theta}$

(3) **Other important informations**

(i) When the object moves with speed u towards (or away) from the plane mirror then image also moves towards (or away) with speed u. But relative speed of image *w.r.t.* object is 2u.

(ii) When mirror moves towards the stationary object with speed u, the image will move with speed 2u in same direction as that of mirror.



(iii) A man of height h requires a mirror of length at least equal to $h/2$, to see his own complete image.

(iv) To see complete wall behind himself a person requires a plane mirror of at least one third the height of wall. It should be noted that person is standing in the middle of the room.