Properties of light

The light has many properties for:

Reflection, refraction, dispersion and velocity of light are the important properties of light. We briefly discuss about them here.

1- Reflection of light

Reflection of light is the simple phenomenon of the light bouncing back after falling on an object. The most common example of this is not being able to see anything on entering a dark room but once you switch on the lights, everything will be visible.

Reflection of light from a smooth surface where the reflected rays are all parallel to each other is called **(regular or specular reflection).**

see fig. (4) a.

If the reflecting surface is rough, as shown in Fig. (4) b, Reflection from any rough surface, where the reflected rays travel in random directions is known as **(diffuse reflection).**

The difference between diffuse and specular reflection is **a matter of surface roughness.**

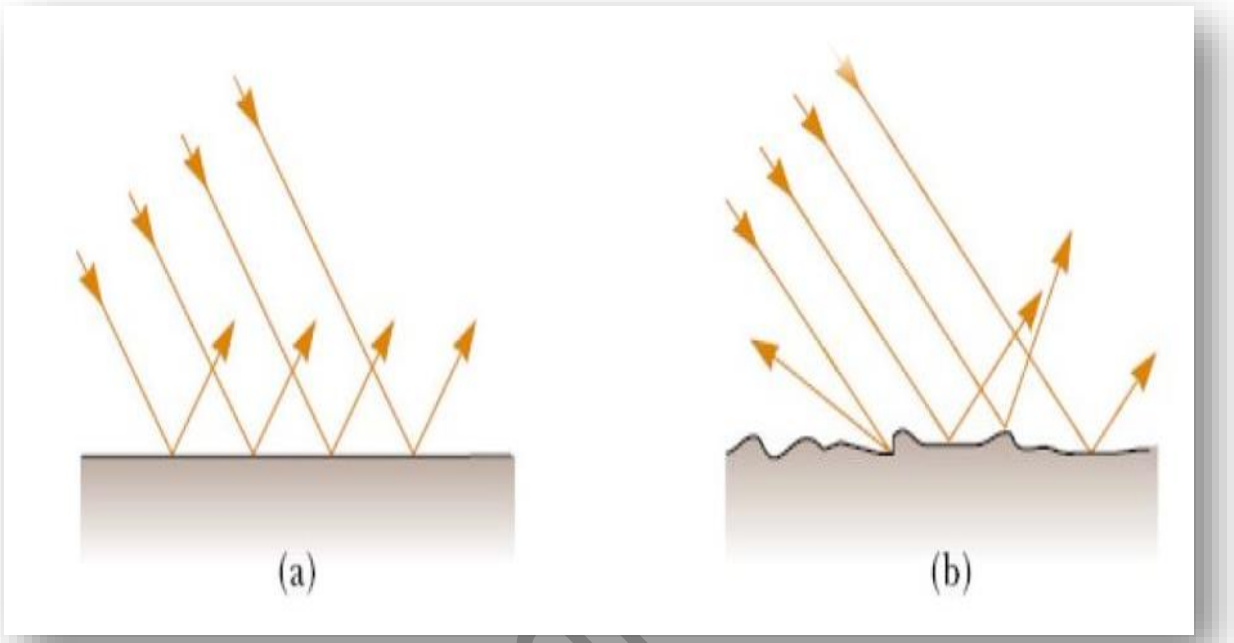

Fig (4): Schematic representation of

(a) specular reflection, (b) diffuse reflection

Laws of reflection

First law: The incident ray, the reflected ray and the normal at the of point incidence are in the same plane.

Second law: The angle of reflection equals the angle of incidence.

$\theta 1=\theta 1'$ ……………………………………………………………..(1)

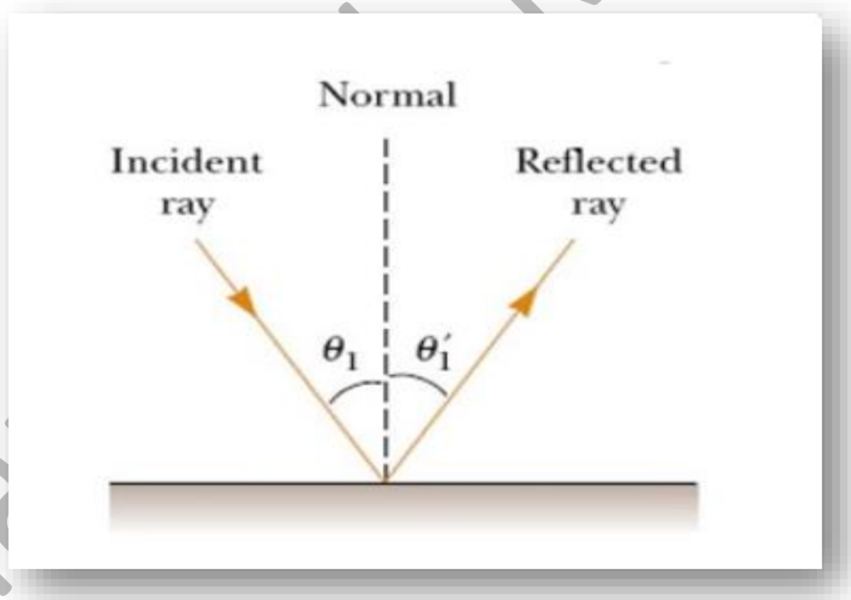

Fig (5): Illustration of law of reflection

2- Refraction of light

Refraction is a physical phenomenon known as the deviation of a ray of light from its path due to a change in its speed. This occurs when a ray of light moves from one medium to another with a different density, as is the case when a ray of light moves from air to water or glass, see Figure (6).

Laws of Refraction

First law: The incident ray, the refracted ray and the normal at the of point incidence lie in the same plane.

Second law: The ratio of the sine of the angle of incidence to the sine of the angle of refraction for any two given media is constant.

Sinθ1/sinθ2= v1 /v2 = constant …….... (1)

Where v1 is the speed of light in the first medium and v2 is the speed of light in the second medium.

The **angle of refraction** in **Figure 6**, depends on (**the properties of the two media and on the angle of incidence).**

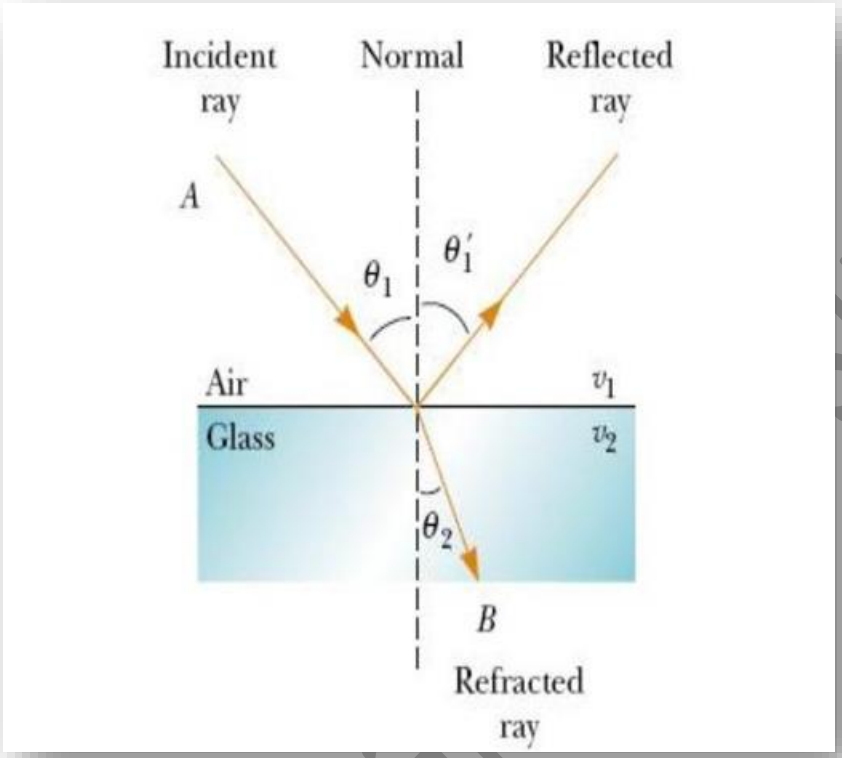

Fig (6): Illustration of the Refracted ray

Refractive Index

The refraction index of a medium is **defined** as:

the ratio of velocity of light in a vacuum to the velocity of light in the medium.

Thus,

μ=c/v ..... (2)

As light travels from one medium to another, its frequency does not change but its wavelength does.

Snell's law of refraction :

μ1 sinθ1=μ2 sinθ2 **..... (3)**

whereas:

μ = index of refraction

θ1 =angle of incidence

θ2= angle of refraction

The experimental discovery of this relationship is usually credited to scientist Snell (1591–1627) and is therefore known as **Snell's law of refraction**.

Example:

A beam of light of wavelength (550 nm) traveling in air is incident on a slab of transparent material. The incident beam makes an angle of (40.0°) with the normal, and the refracted beam makes an angle of (26.0°)with the normal. Find the index of refraction of the material.

Solution:

$\mu_1 \sin\theta_1 = \mu_2 \sin\theta_2$

$\mu_2 = \mu_1 \sin\theta_1 / \sin\theta_2$

$= (1.00) \sin 40.0° / \sin 26.0°$

$= 0.643 / 0.438$

$= 1.47$