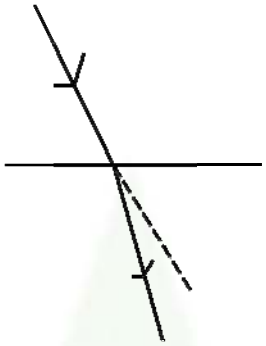
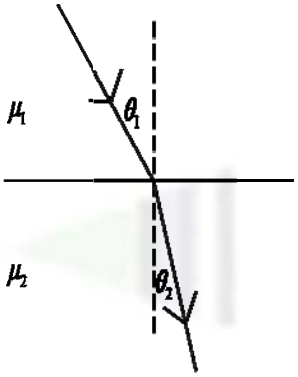
Refraction

Refraction: When light passes from one medium to other medium it deviates from its path this phenomenon is known as refraction.



Refraction at plane surface:



Refractive Index: It is defined as the ratio of velocity of light in vacuum to the velocity of light in the medium.

$$\mu = \frac{\text{velocity of light in vacuum}}{\text{velocity of light in the medium}} = \frac{c}{v}$$

$$c = 3 \times 10^8 \, m/s$$

$$v = \eta\lambda$$

We know that when light goes from one medium to other medium the frequency of light does not change i.e. η is constant.

$$\mu \propto \frac{1}{\lambda}$$

The exact relation between refractive index and wave length is given by Cauchy's relation.

$$\mu = A + \frac{B}{\lambda^2}$$

Light is an electromagnetic wave. All electromagnetic wave travel with a speed in vacuum.

Electromagnetic Spectrum:

$$\gamma \text{ ray} \,|\, \text{x ray} \,|\, visible \,|\, Infra\ red\ ray \,|\, micro \text{ waves} \,|\, \text{radio waves}$$

This grouping is based on range of wave length or frequency, from left to right λ increases i.e. η decreases.

The wave length range for visible light 3500 ^{0}A to 7500 ^{0}A

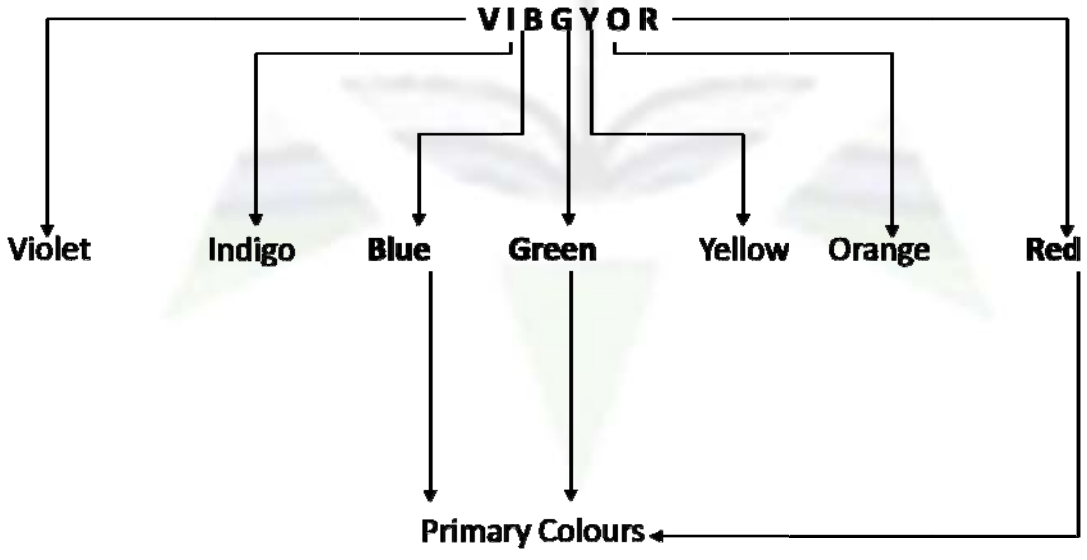
In visible range we have different colours starting with violet and ending with red, from violet to red wave length increases.

Since refractive index depends of λ , and λ is different of different colours hence refractive index of a medium depends on colour of light.

$$\mu \propto \frac{1}{\lambda} \quad \text{Since } \lambda_v < \lambda_r \therefore \mu_v > \mu_r$$

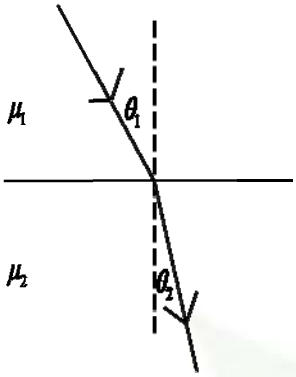
When we don't mention any colour it indicates that refractive index for mean ray is given.

$$\mu = \frac{\mu_v + \mu_r}{2} \text{ where } \mu = \text{refractive index for mean ray.}$$



Snell's Law: μsinΘ = constant

$$\mu_1 \sin\theta_1 = \mu_2 \sin\theta_2 = \mu_3 \sin\theta_3$$



Product of refractive index and sine of the angle of a medium is constant.

Special Case: Refractive index of air =1 then

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

$$1.\sin i = \mu \sin r$$

$$\frac{\sin i}{\sin r} = \mu$$