

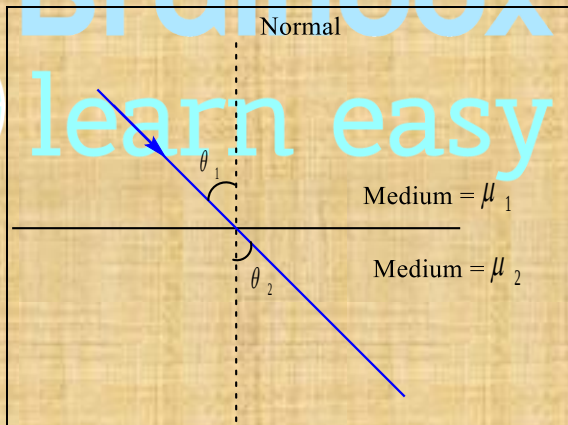
Chapter 10

REFLECTION AND REFRACTION

SNELL'S LAW:

1. When a ray of light travels from one medium to another medium, then the product of refractive index (μ) of a medium and the sine of angle (θ) between normal and the ray in that medium is constant. i.e., $[\mu \sin \theta = \text{constant}]$
2. If θ_1 and θ_2 are the angles made by a ray of light with the normal in the two media of refractive indices μ_1 and μ_2 respectively.

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



3. Snell's law in vector form

$\mu_1 [\hat{i} \times n] = \mu_2 [\hat{r} \times n]$ where $\hat{i}, \hat{r}, n$ are the refracted ray and the normal into the incident medium respectively.

4. If a ray of light passes from vacuum to a medium of refractive index μ , then $\mu = \frac{\sin i}{\sin r}$.

ABSOLUTE REFRACTIVE INDEX OF A MEDIUM:

1. According to Newton, the absolute refractive index of medium is the ratio of speed of light in vacuum to that in medium.

$$\mu = \frac{\text{Speed of light in vacuum}(c)}{\text{Speed of light in medium}(v)}$$

$$\therefore \text{Vacuum } \mu_{\text{medium}} = \frac{c}{v} = \frac{\lambda_{\text{vacuum}}}{\lambda_{\text{medium}}}$$

2. Absolute refractive index of medium varies with

a) Wavelength of light or colour of light

$$(\mu_{\text{violet}} > \mu_{\text{red}} \text{ as } \lambda_{\text{violet}} < \lambda_{\text{red}})$$

b) Temperature of medium. In general, with increase of temperature, refractive index of the medium decreases.

c) A medium in which the speed of light is more is known as optically denser medium.

d) When a ray of light travels from medium(1) to medium (2), then the refractive index of medium(2)

$$\text{with respect to medium(1) is i.e., } \mu_2 = \frac{\mu_2}{\mu_1} = \frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2}$$

Where v_1 and v_2 are the speeds of lights in medium(1) and medium (2) respectively.

3. According to this principle if a light ray is reversed, it always refracts its path. i.e., the refractive index of the second medium with respect to the first medium is equal to reciprocal of the refractive index of first

medium with respect to second medium. $\therefore$

$$\mu_2 = \frac{1}{2\mu_1} = \frac{\mu_2}{\mu_1}.$$

4. If a ray of light travels a distance 'X' in time 't' in medium of refractive index μ , then $\mu = \frac{Ct}{X}$.
5. If x_1 and x_2 are the distances traveled by light in two media of absolute refractive indices μ_1 and μ_2 respectively in a given time, then $\mu_1 x_1 = \mu_2 x_2$.
6. If a ray of light takes t_1 and t_2 times in two media of absolute refractive indices μ_1 and μ_2 respectively to travel the same distance, then $\mu_1 t_2 = \mu_2 t_1$.

