Class : 12th Physics
Chapter- 9 : Ray Optics and Optical Instruments

Ray Optics and Optical Instruments

- Refraction of light
- Spherical Mirror
- Reflection of light
- Sign Conversion
- Prism
- Total Internal Refection
- Lens Maker's Formula
- Optical Instruments
- Critical Angel
- Power of a lens
- Refraction on spherical surface
- Scattering of light
- Optical Instruments
- Optical Instruments
- Optical Instruments

$$\frac{\sin i}{\sin r} = \frac{v_1}{v_2} = \frac{\mu_2}{\mu_1}$$

$$\mu = \frac{\text{real depth}}{\text{apparent depth}}$$

$$\Delta t = \left(1 - \frac{1}{\mu}\right) t = \text{image shift}$$

- Pole is taken as origin
- Principle axis as the X-axis
- All distance measured from origin (or pole).
- All distance measured in the direction of incident ray is taken + ve.
- All distance measured in the direction opposite to the incident ray is taken - ve.

Angle of deviation $\delta = i - i' - A$

$\delta_{minimum} = 2i - A \left[i = i'\right] \rightarrow$

$\delta_{minimum} = (\mu - 1)A$, if A is small

When ray passes from optically denser to rarer medium.
If incident angle (i) further increased than (θ)$_c$ critical angle entire light is then reflected back to the denser medium again is called T.I.R. It is used in optical fibre.

$$\frac{1}{u} + \frac{1}{v} = \frac{2}{R} = \frac{1}{f}$$

Lateral Magnification $= \frac{h_2}{h_1} = -\frac{v}{u}$

- $\angle i = \angle r$
- Incident ray reflected ray and normal to the reflecting surface are coplanar

$$\frac{1}{v} - \frac{1}{u} = \frac{\mu_2 - \mu_1}{\mu_1}\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$\frac{1}{f} = \left(\frac{\mu_2}{\mu_1} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad \left[If\ \mu_2 = \mu, \mu_1 = 1\ (air)\right]$$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \quad \text{(lens formula)}$$

Lateral Magnification $= \frac{h_2}{h_1} = \frac{v}{u}$

- Incident angle (θ_c) for which angle of refraction is 90°

i.e. $\sin\theta_c = 1/\mu$

$\theta_c = \sin^{-1}\left(\frac{1}{\mu}\right)$

When ray passes from optically denser to rarer medium.

$$\frac{\mu_1}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$$

Lateral Magnification

$$m = \frac{h_2}{h_1} = \frac{\mu_1 v}{\mu_2 u} = \frac{R - v}{R - u}$$

Light scattered i.e. redirected in different paths when interacts with particle matters e.g. sunset, sunrise, colours, blue colour of sky

$$P = \frac{1}{f}$$

[For combination of lens]

$$P = \frac{1}{f_1} + \frac{1}{f_2}$$

$M = 1 + \frac{D}{f}$ [image at near point]

$M = D/f$ [image at infinite]

$M = \frac{v}{u}\left|\frac{D}{f_e}\right|$ [normal adjustment]

$M = \frac{v}{u}\left(1 + \frac{D}{f_e}\right) = -\frac{1}{f_e}\left(1 + \frac{D}{f_e}\right)$

For final image at least distance

$M = \frac{f_o}{f_e}\left(1 + \frac{f_e}{D}\right)$ [image at near point]

$M = -\frac{f_o}{f_e}$ [image at infinite]