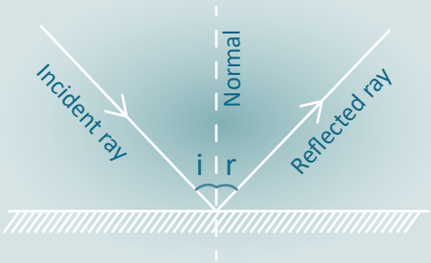
RAY OPTICS

PART-1

REFLECTION OF LIGHT

According to the laws of reflection,
$\angle i = \angle r$
If a plane mirror is rotated by an angle of θ, the reflected rays rotates by an angle 2θ.



TOTAL INTERNAL REFLECTION

TIR CONDITIONS

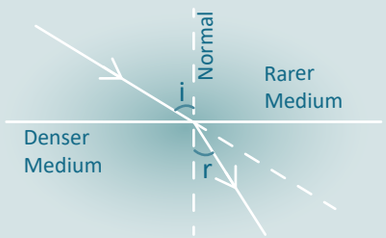
- Light must travel from denser to rarer,
- Incident angle i>critical angle ie

Relation between μ & ie : $\mu = \frac{1}{\sin ie}$

APPLICATION OF TIR

- Fiber optics Communication
- Medical endoscopy
- Periscope (using prism)
- Sparkling of diamond

REFRACTION OF LIGHT



SNELL'S LAW

When light travels from medium a to medium b,

$$\mu_{ab} = \frac{\mu_a}{\mu_b} = \frac{\sin i}{\sin r}$$

Refractive index,

$$\mu = \frac{c}{v}$$

Real & apparent depth

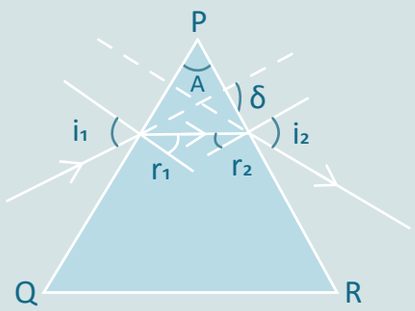
$$\mu = \frac{\text{real depth (x)}}{\text{Apparent depth (y)}}$$

REFLECTION BY SPHERICAL MIRROR

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

Magnification, $m = -\frac{v}{u} = \frac{h_i}{h_o}$

REFRACTION THROUGH PRISM



Relation between μ and δ_m

$$\mu = \frac{\sin [(A+\delta_m)/2]}{\sin (A/2)}$$

or, $\delta = (\mu-1)A$

Angular dispersion,

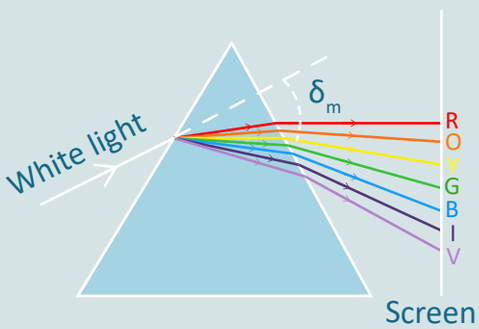
$$= \delta_v - \delta_R = (\mu_V - \mu_R)A$$

Dispersive power,

$$w = \frac{\delta_v - \delta_R}{\delta} = \frac{\mu_V - \mu_R}{\mu - 1}$$

Mean deviation,

$$\delta = \frac{\delta_v + \delta_R}{2}$$



REFRACTION BY SPHERICAL SURFACE

Relation between object distance (u), image distance (v) and refraction index (μ)

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

Lens maker's formula

$$\frac{1}{f} = (\mu-1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$$

THIN SPHERICAL LENS

Thin lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

Magnification,

$$m = \frac{v}{u} = \frac{h_i}{h_o}$$

POWER OF LENS

Power of lens, $P = \frac{1}{f\ (\text{in m})}$

Combination of lenses,

Power : $P = P_1 + P_2 - dP_1P_2$

(d=small separation between the lenses)

For d = 0 (lenses in contact)

Power : $P = P_1 + P_2 + P_3 + \ldots\ldots$

SCATTERING OF LIGHT

The process of re-emission of absorbed light in all directions with different intensities by atoms or molecules , is called scattering of light.

DAILY LIFE APPLICATIONS

- Blue colour of the sky.
- Reddening of the sun at sunrise and sunset.