RAY OPTICS

for small angle $\sin\theta \approx \theta$
" " " $\tan\theta \approx \theta$
" " " $\cos\theta \approx 1$

Mirror :-

Sign convention;

* P, Focus, convex, $f = +ve$

* F, pole, concave, $f = -ve$

* (-) ← → (+)

mirror formula :

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

$$R = 2f$$

→ μ → independent

magnification :

$$m = \frac{hi}{ho} = \frac{-v}{u}$$

m(-ve) ⇓ inverted

* virtual object

mirror → P V
(+) ↓ (virtual) Object

*** Image formation →**

convex → all m → +ve
small size and virtual

*** Velocity of spherical :-**

$$V_{IM} = -\frac{v^2}{u^2} V_{OM}$$

→ object with respect to mirror

Lens :-

Sign convention;

focus, convex, $f = +ve$

F, concave, $f = -ve$

Lens formula :-

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

$$\frac{1}{f} = \left(\frac{\mu_{lens}}{\mu_{surr}} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

→ μ → dependent.

magnification ;

$$m = \frac{hi}{ho} = \frac{v}{u}$$

*** Image formation**

$\mu_L > \mu_S$

1 2 1, +ve

$\mu_L < \mu_S$

No conversion on this side

Lens → P R
(+ve) Real image
(-ve) virtual

*** Parts of lens :-**

R, μ, R → low intensity

high intensity of image

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

P = same

R, μ, R

$$f_1 = \frac{R}{2(\mu - 1)}$$

$$\frac{1}{f_2} = (\mu - 1)\left(\frac{1}{R} - \frac{1}{\infty}\right)$$

$$f_2 = \frac{R}{(\mu - 1)}$$

$$f_2 = 2f_1$$

*** Silvering :-**

$f_m = \infty$, μ, R_0, O

$$\frac{1}{f_{eq}} = \frac{1}{f_{mir}} - \frac{2}{f_{lens}}$$

R, μ, ∞

$$f = \frac{R}{(\mu - 1)}$$

*** Prism :-** ③

$A = r_1 + r_2$

i, A, δ, e, 1, r_1, r_2, 1, μ

$\delta = i + e - A$ or $i + e - A$

$1 \sin i = \mu \sin r_1$

$\mu \sin r_2 = 1 \sin e$

δ, δ_1, δ_{min}, i, e, i

i = e (δ_{min} Case)

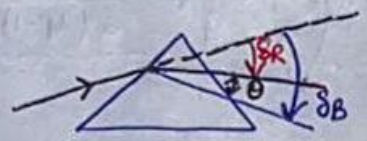
$$\mu = \frac{\sin\frac{\delta_{min} + A}{2}}{\sin\left[\frac{A}{2}\right]}$$

*** Thin Prism :-**

$A < 15°$ and i = small
r = small

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

* Dispersion of Prism :-



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

$\lambda_{max} \rightarrow$ Red, $\mu_{min} \rightarrow \delta_{min}$

$\lambda_{min} \rightarrow$ Blue $\rightarrow \mu_{max}$ ↓ δ_{max}

$$\theta = \delta_V - \delta_R$$

$$\theta = A(\mu_V - 1) - [A(\mu_R - 1)]$$

Deviation without the dispersion...

$\theta = \delta_V - \delta_R = 0$

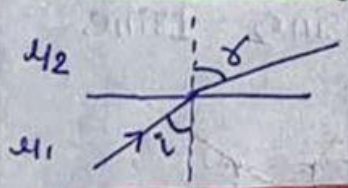
* DISPERSIVE POWER :-

$$\omega = \frac{\theta}{\delta_y} = \frac{\text{Angular disp}}{\text{mean deviati}}$$

$$\omega = \frac{\delta_V - \delta_R}{\delta_y}$$

$$\delta_y = A(\mu_y - 1)$$

* Refraction of light :-



$$\mu_2 \sin i = \mu_2 \sin \gamma$$

* Total internal Reflection :-

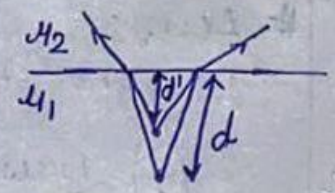
Critical angle, the value where $\{L\gamma = 90°\}$

$$\sin C = \frac{\mu_\gamma}{\mu_d}$$

$i > C \rightarrow$ for TIR

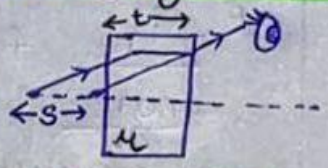
~~light from~~ ~~denser~~ → Rare

* Apparent depth :-



$$\frac{d'}{d} = \frac{\mu_2}{\mu_1}$$ originate of Rays

* Shift from Slab :-



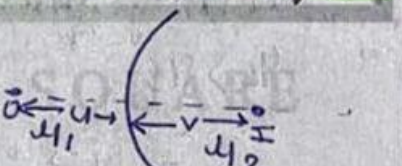
$$S = t\left(1 - \frac{1}{\mu}\right)$$

* Lateral shift :-



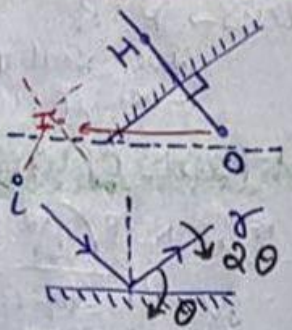
$$x = t \sec\gamma \cdot \sin(i - \gamma)$$

* Refraction from spherical surface :-



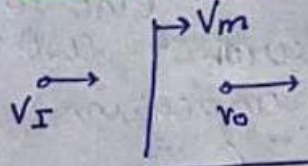
$$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$$

* Plane mirror :-



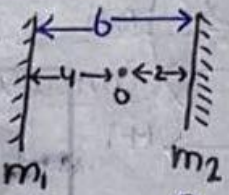
Height of mirror $= \frac{H}{2}$

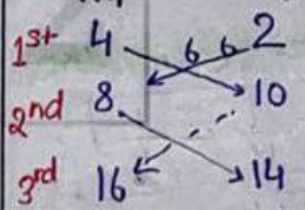
* Velocity in Plane :-

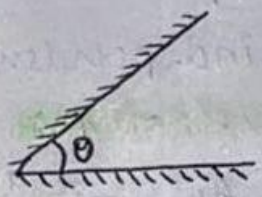


$$V_I = 2V_m - V_o$$

* No° of images :-







$\frac{360}{\theta}$

even → No° of images $\left(\frac{360}{\theta} - 1\right)$

odd → At bisector $\left(\frac{360}{\theta} - 1\right)$

Not at bisect $\frac{360}{\theta}$