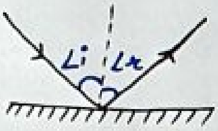
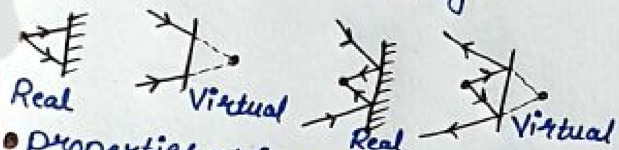
Ray Optics Mindmap

Mirror

Reflection



- $\angle i = \angle r$
- incident ray, reflected ray and normal lie in same plane.
- Object
- Image

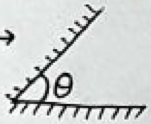


- properties of image by a plane mirror →
  1. Real image of virtual object.
  2. Virtual image of real object.
  3. Dist. of image = Dist. of object.
  4. Size of image = Size of object.
  5. Laterally inverted.

→ Velocity of image in a plane mirror →

$\boxed{(\vec{V}_{Im})_\perp = (\vec{V}_{om})_\perp}$ and $\boxed{(\vec{V}_I)_{\parallel} = -(\vec{V}_o)_{\parallel}}$

$\boxed{\omega_{Im} = 2\omega_{om}}$

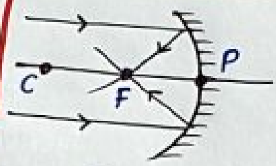
→ 

$\boxed{N = \frac{360}{\theta}}$

- If N = even → no. of images = N − 1
- If N = odd → no. of images = N − 1 (object is on angle bisector)
- If N = odd → no. of images = N (object is not on angle bisector)
- If N ≠ integer → count manually

Spherical Mirrors →

Concave Mirrors



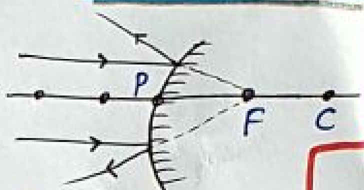
$R = -ve$, $f = -ve$

→ Mirror formula

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

- $|m| > 1$ → Enlarged
- $|m| < 1$ → Diminished
- $m < 0$ → Inverted
- $m > 0$ → Erect

Convex Mirrors

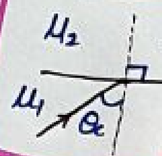


$R = +ve$, $f = +ve$

→ magnification

$\boxed{m = \frac{-v}{u}}$

Total Internal Reflection



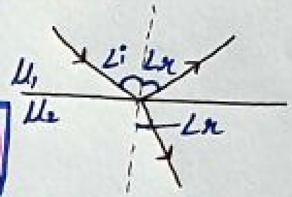
$\mu_1 > \mu_2$

For $i > \theta_c$

No refraction

$\boxed{\sin\theta_c = \frac{\mu_2}{\mu_1}}$

Refraction: →



$\boxed{\mu_{21} = \frac{v_1}{v_2}}$, $\boxed{\mu_{ma} = \frac{c}{v}}$

$\boxed{\frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2} = \frac{\mu_2}{\mu_1}}$

→ Snell's Law − $\boxed{\mu_1 \sin i = \mu_2 \sin r}$

- Apparent depth $\boxed{h_1 = \frac{h_0}{\mu}}$, $\boxed{\text{Shift} = h_0\left[1 - \frac{1}{\mu}\right]}$
- Lens Maker formula − $\boxed{\frac{1}{f} = (\mu_{21} - 1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]}$
- For Curved Surface $\boxed{\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}}$
- Lens formula − $\boxed{\frac{1}{f} = \frac{1}{v} - \frac{1}{u}}$
- Magnification $\boxed{m = \frac{h_i}{h_o} = \frac{v}{u}}$
- Velocity of image − $\boxed{\vec{V}_{Im} = \vec{V}_{om} \times m^2}$

$\boxed{\text{Power} = \frac{1}{f}}$

- Lens kept close to each other −

$\boxed{\frac{1}{f_{eq}} = \frac{1}{f_1} + \frac{1}{f_2} + \dots}$ $\boxed{P_n = P_1 + P_2 + \dots}$

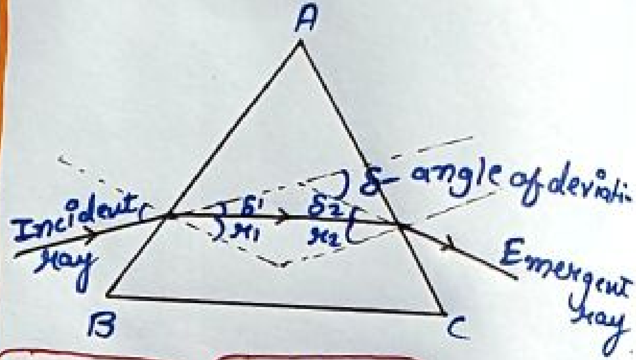
Concave Mirror

Object	Image: Position	Image: Size	Image: Nature	Image: Orientation
at ∞	at F	point	Real	Inverted
b/w ∞ and C	b/w C and F	diminish	Real	Inverted
at C	at C	same	Real	Inverted
b/w C and F	b/w C and ∞	magnified	Real	Inverted
at F	at ∞	Highly magnified	Real	Inverted
b/w F and P	other side	Large	Virtual	Erect

Convex Mirror

Object	Image: Position	Image: Size	Image: Nature	Image: Orientation
at ∞	at F	point	Virtual	Erect
b/w ∞ and P	b/w P and F	diminish	Virtual	Erect

Prism: →



$A = r_1 + r_2$

$\delta = i + e - A$

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

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

Instrument	Image at ∞ (Normal Adjustment)	Image at least Distance (LDDV)
Simple microscope	Magnification $= \frac{D}{f}$	Magnification $= \frac{D}{F} + 1$
Compound microscope	Total magnification $= \frac{-L}{f_o} \frac{D}{f_e}$	Magnification $= \frac{-L}{f_o}\left[1 + \frac{D}{f_e}\right]$
Astronomical Microscope	Magnification $= \frac{-f_o}{f_e}$	Magnification $= \frac{-f_o}{f_e}\left[1 + \frac{f_e}{D}\right]$