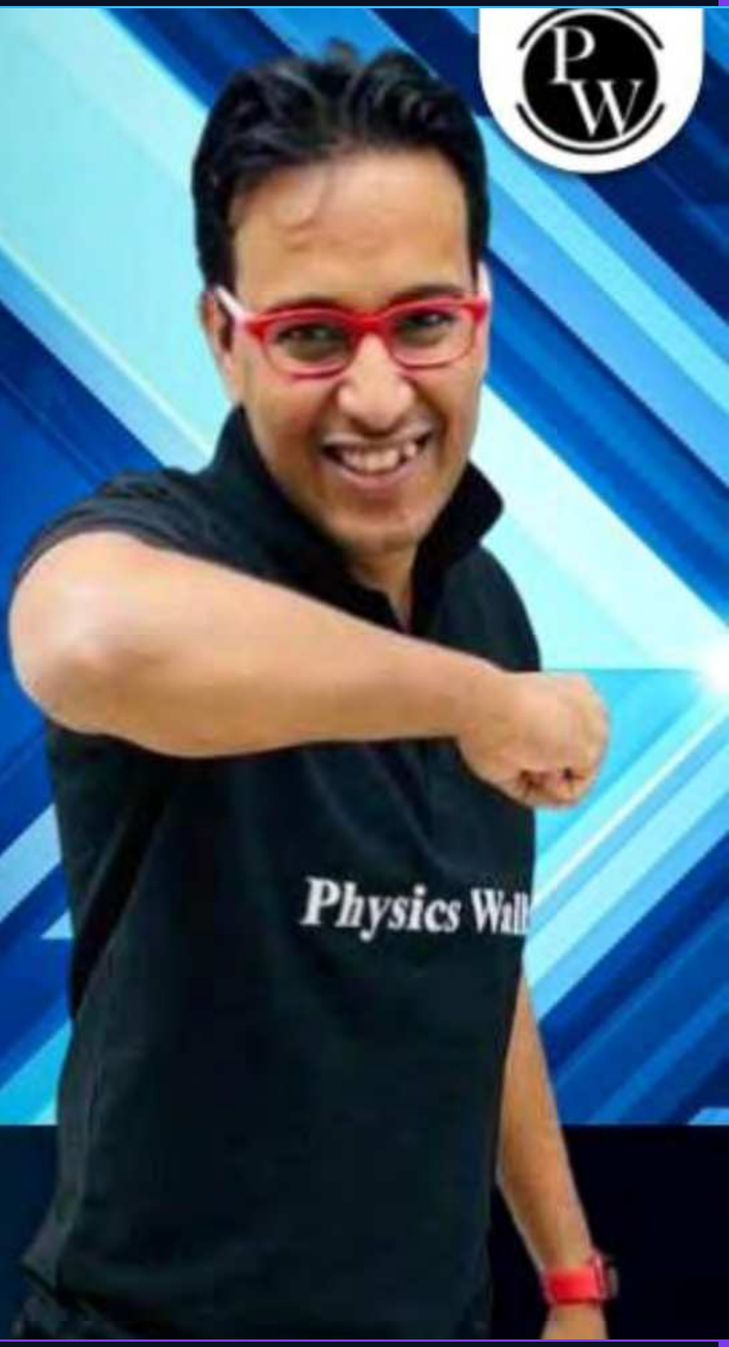
PRAYAS

JEE 2025

Lecture - 01

Physics

[redacted] Ray Optics



By- Saleem Ahmed Sir

Topics to be covered

1. Plane Mirror
2.
3.
4.

ATDB.uno

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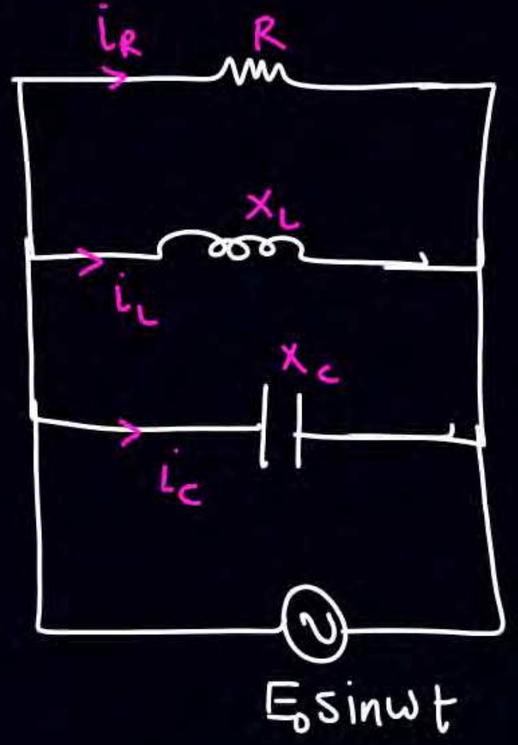


$$i_R = \frac{E_0}{R}\sin\omega t$$

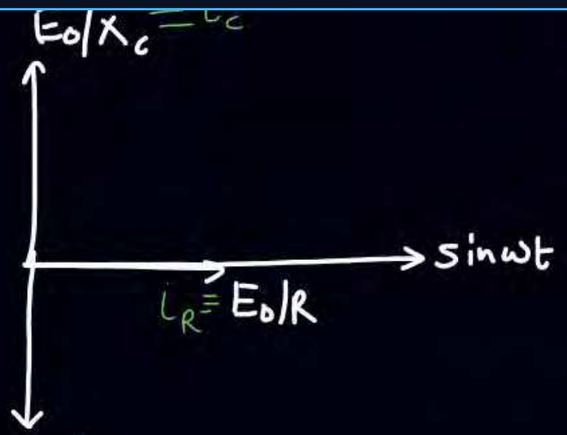
$$i_L = \frac{E_0}{X_L}\sin(\omega t - 90)$$

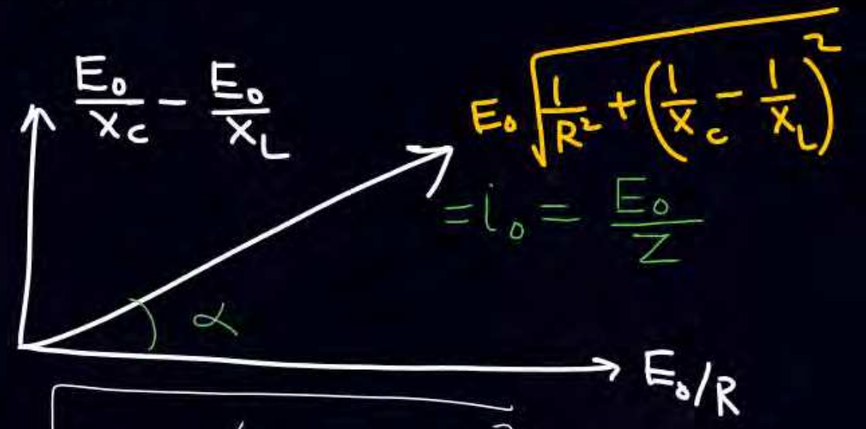
$$i_C = \frac{E_0}{X_C}\sin(\omega t + 90)$$

⇓ Add

$$i_{net} = E_0\sqrt{\frac{1}{R^2} + \left(\frac{1}{X_C} - \frac{1}{X_L}\right)^2}\sin(\omega t + \alpha)$$

$$i = \frac{E_0}{Z}\sin(\omega t + \alpha)$$

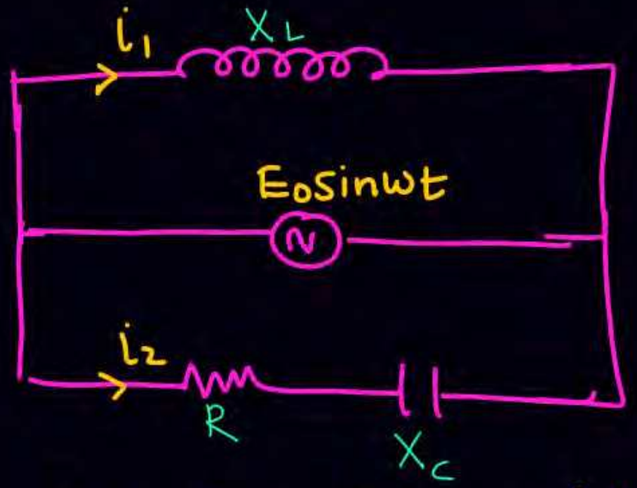


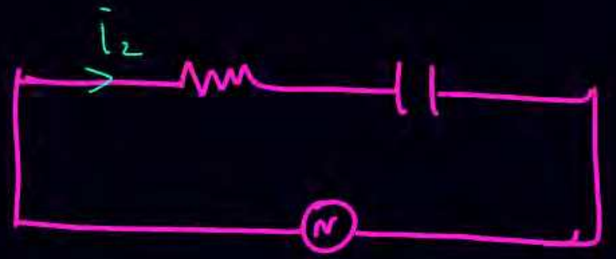


$$\frac{1}{Z} = \sqrt{\frac{1}{R^2} + \left(\frac{1}{X_C} - \frac{1}{X_L}\right)^2} = \frac{1}{Z} = \text{Admittance}$$

$$\tan\alpha = \frac{\frac{1}{X_C} - \frac{1}{X_L}}{1/R}$$

Q





Find phase difference b/w i_1 & i_2

Phase diff

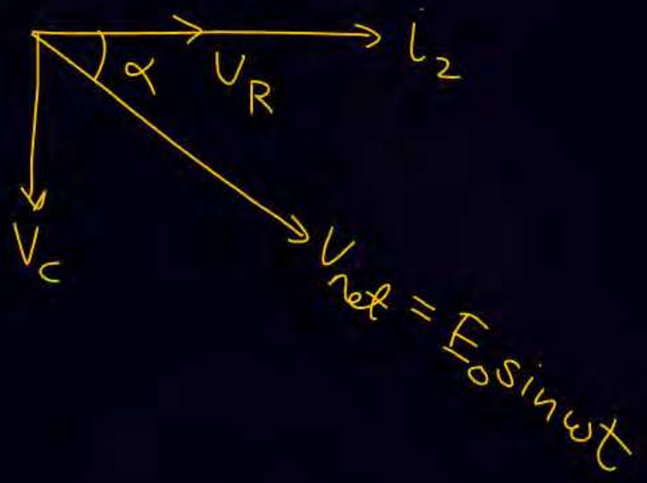
Ans $(\omega t + \alpha) - (\omega t - 90^\circ)$

$= \alpha + 90^\circ$

$$i_1 = \frac{E_0}{X_L} \sin(\omega t - 90^\circ)$$

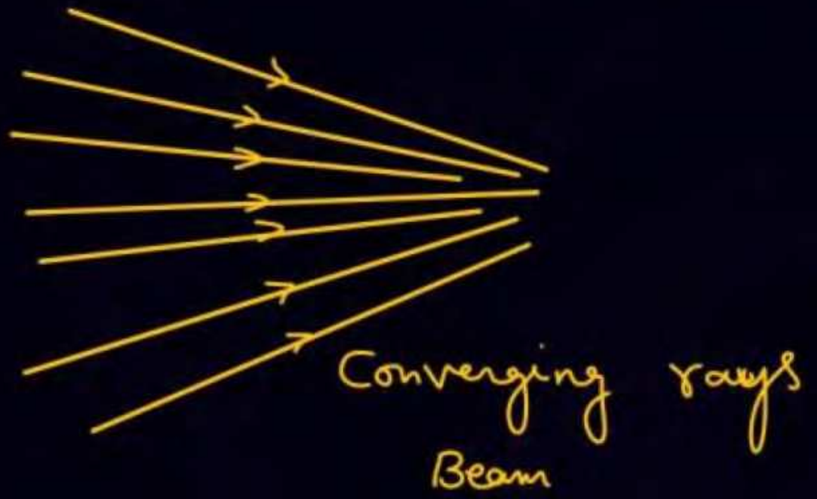
$$i_2 = \frac{E_0}{\sqrt{R^2 + X_C^2}} \sin(\omega t + \alpha)$$

$$\tan\alpha = \frac{V_C}{V_R} = \frac{X_C}{R}$$

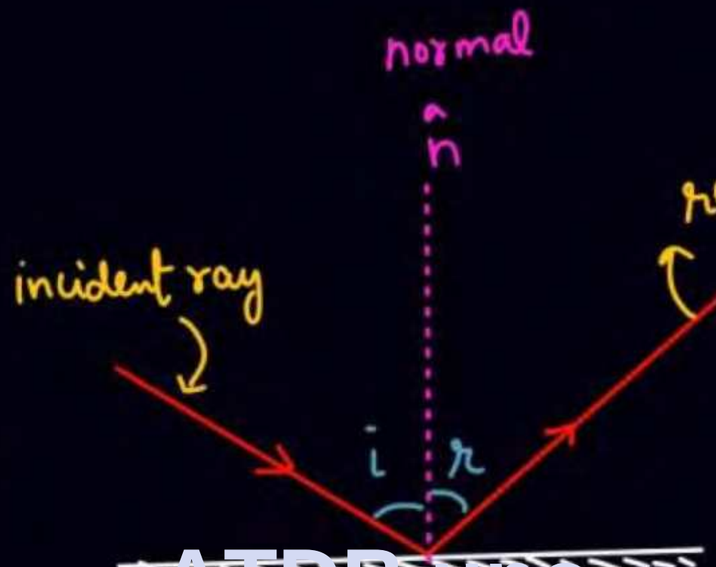


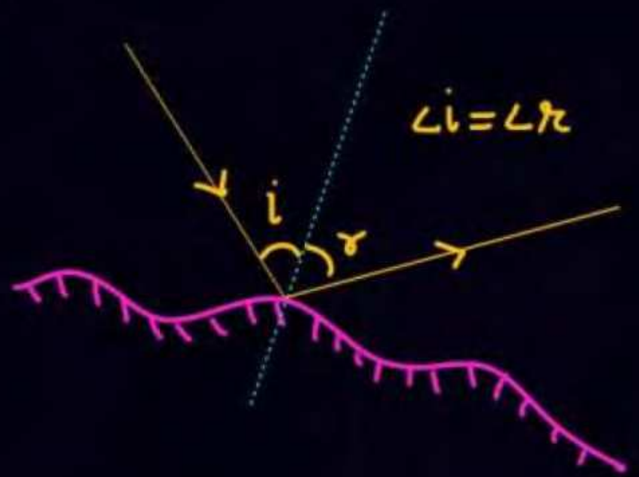
Ray optics

Geometrical optics



Law of Reflection





① incident ray, reflected ray, normal to the mirror

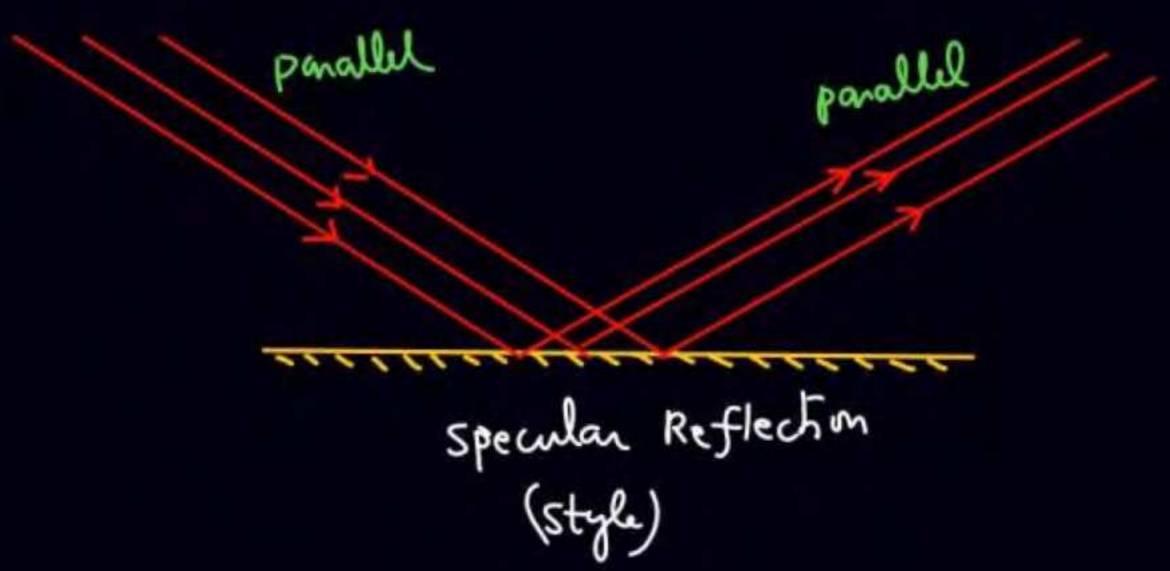
⇓

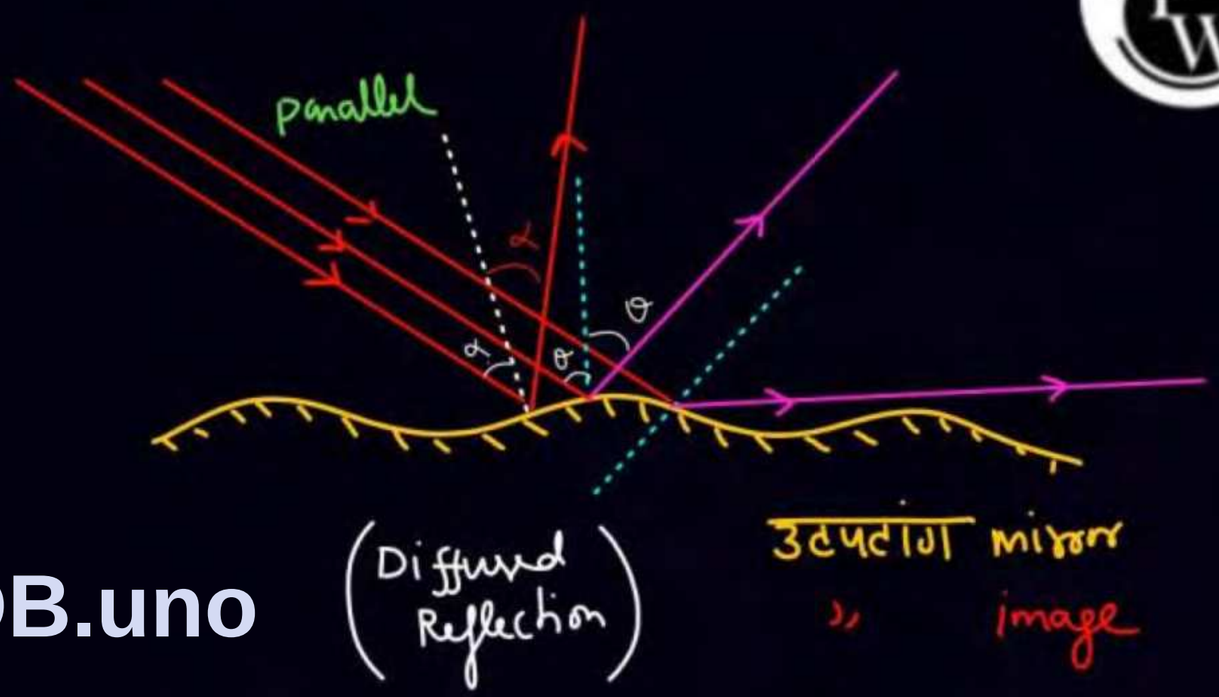
In same plane

② $\angle i = \angle r$

$\angle i \longrightarrow$ angle of incident

$\angle r \longrightarrow$ angle of reflection



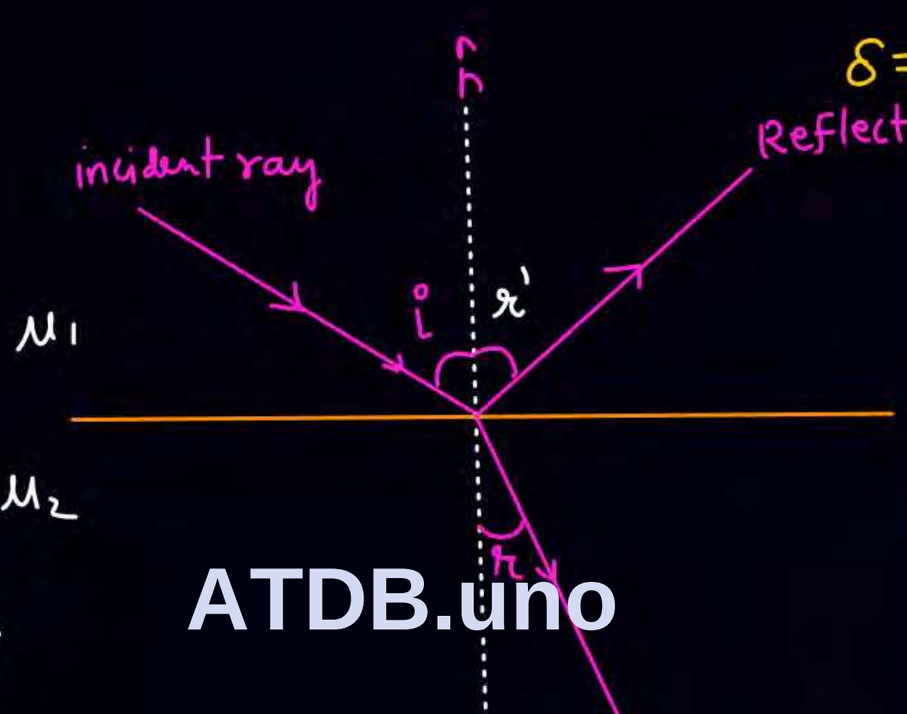


$i \rightarrow$ angle of incident

$r' \rightarrow$ " reflection

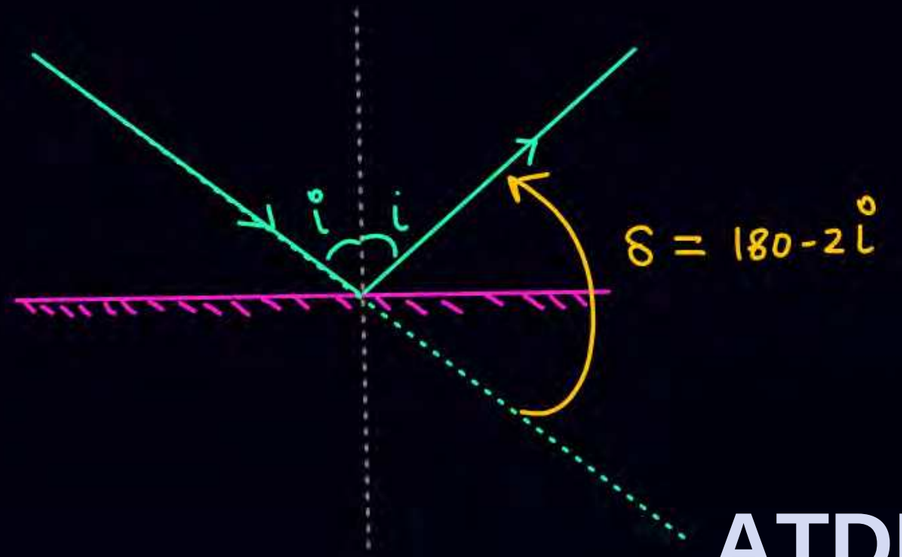
$\angle i = \angle r'$

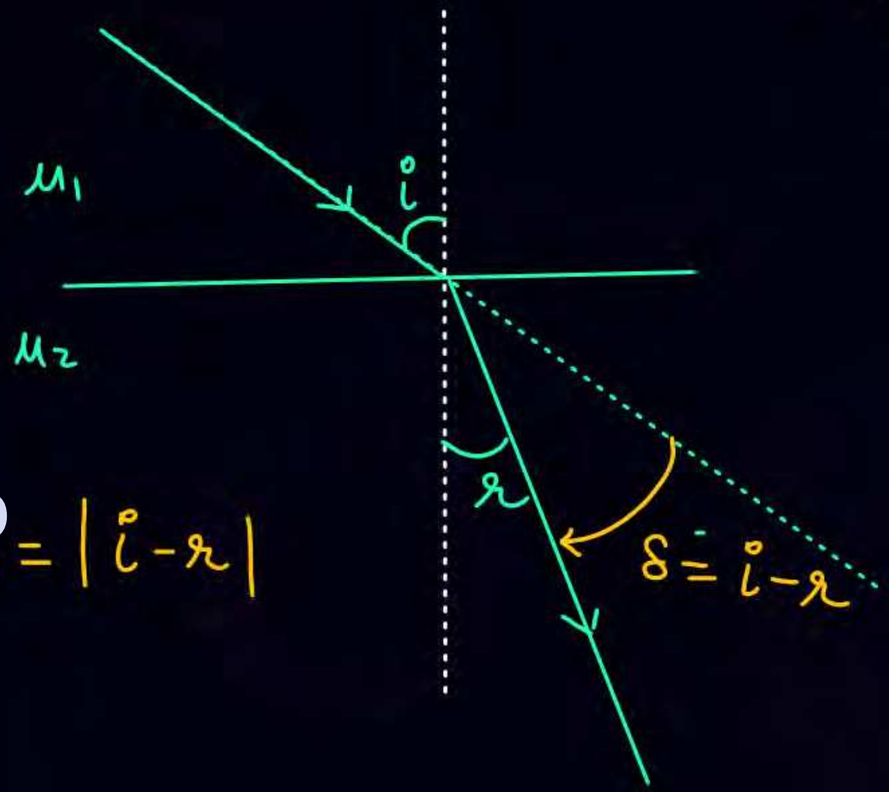
$r \longrightarrow$ Angle of refraction



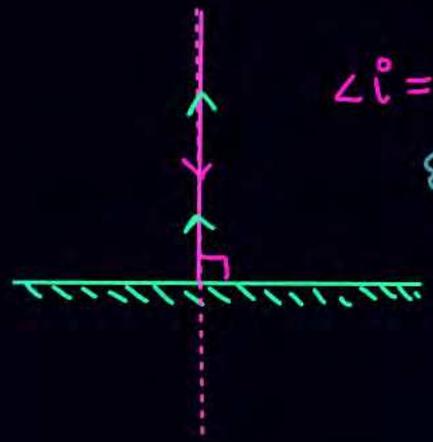
Snell's Law (Refraction)

$\mu_1 \sin i = \mu_2 \sin r$





$\delta = 180 - 2i^\circ$ (single reflection)



$\angle i^\circ = 0 = \angle r$

$\delta = 180 - 2i^\circ$, (put $i=0$)

$\delta = 180^\circ$

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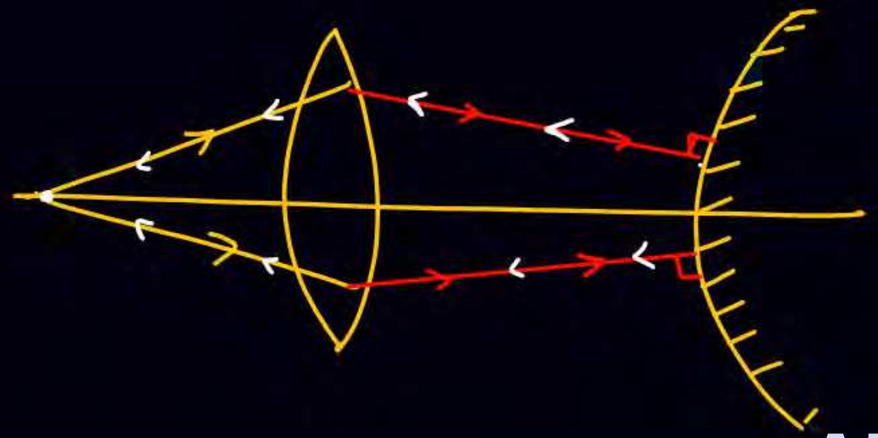

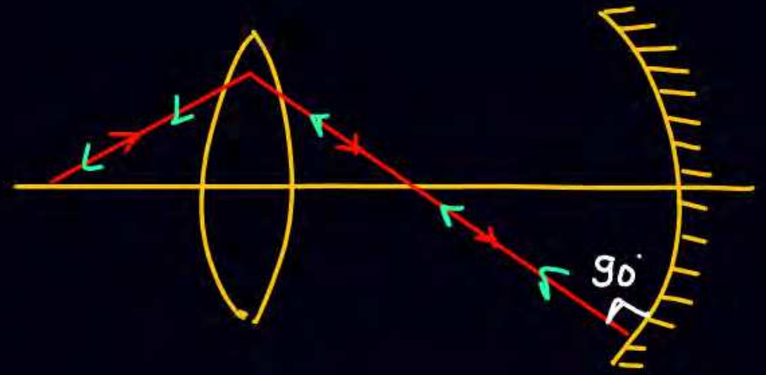

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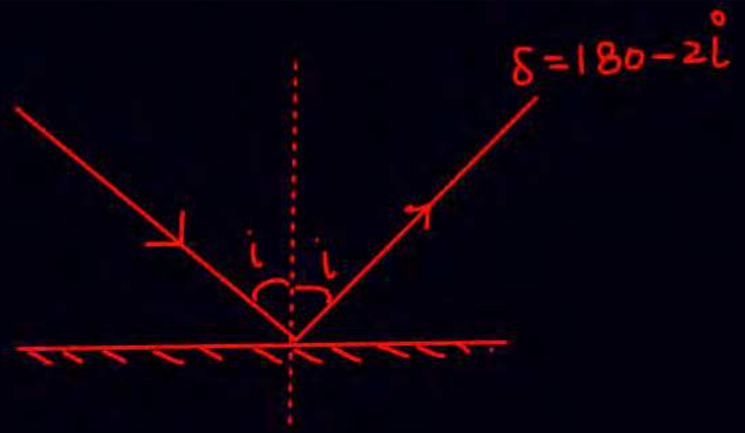
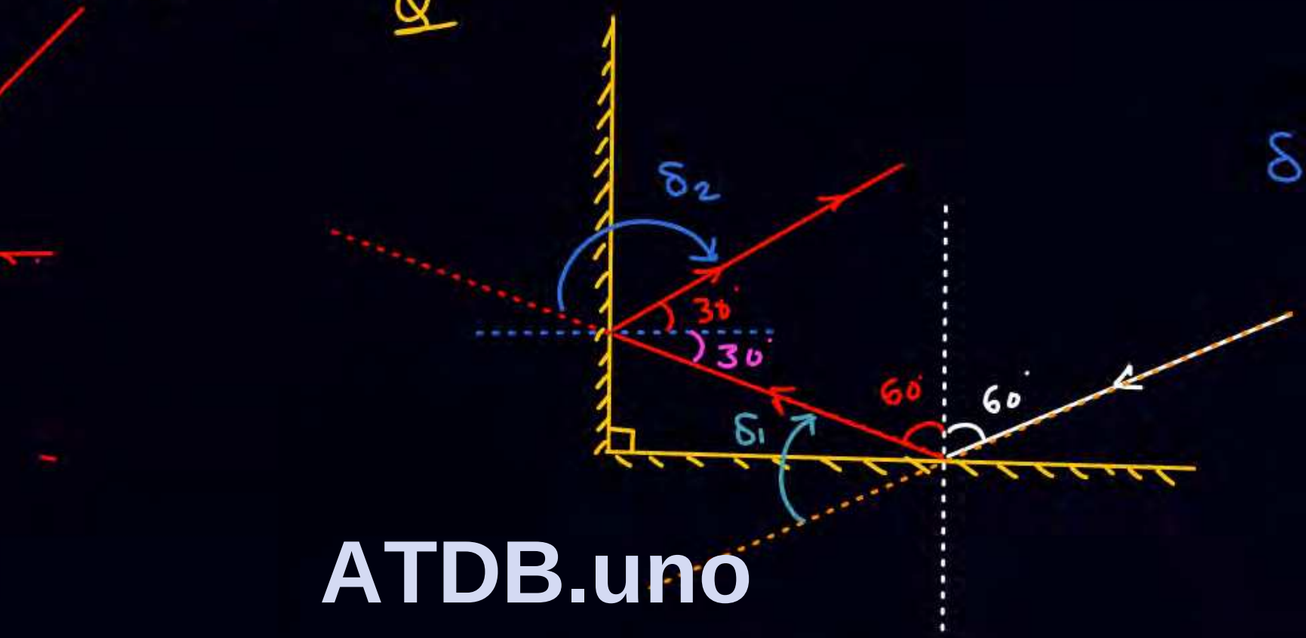


Q

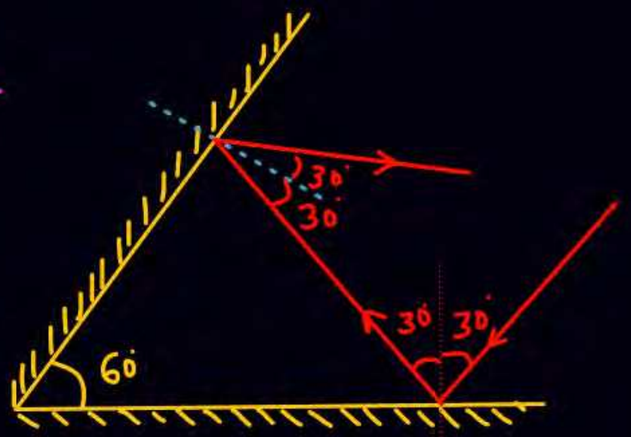


$\delta = 360 - 2\times 90$

$\delta = \underset{(cw)}{\delta_1} + \underset{(cw)}{\delta_2} = (180 - 2\times 60) + (180 - 2\times 30)$

$= 180°$

Q



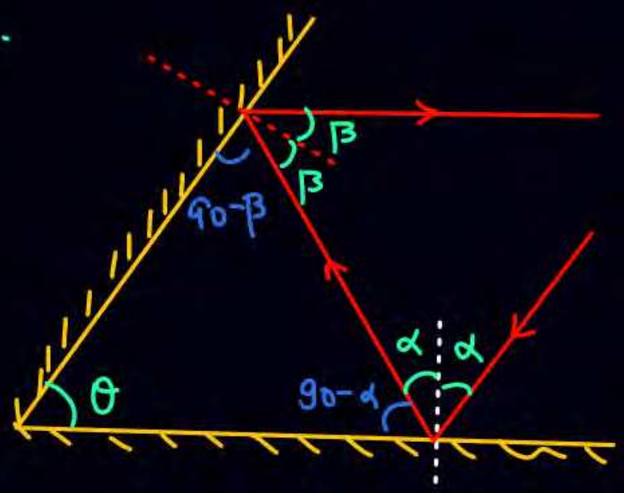
$\delta = (180 - 2\times30) + (180 - 2\times30)$

$= 240^\circ$ (CW)

$= 120$ ACW.

$\delta = 360 - 2\times60 = 240$

formula



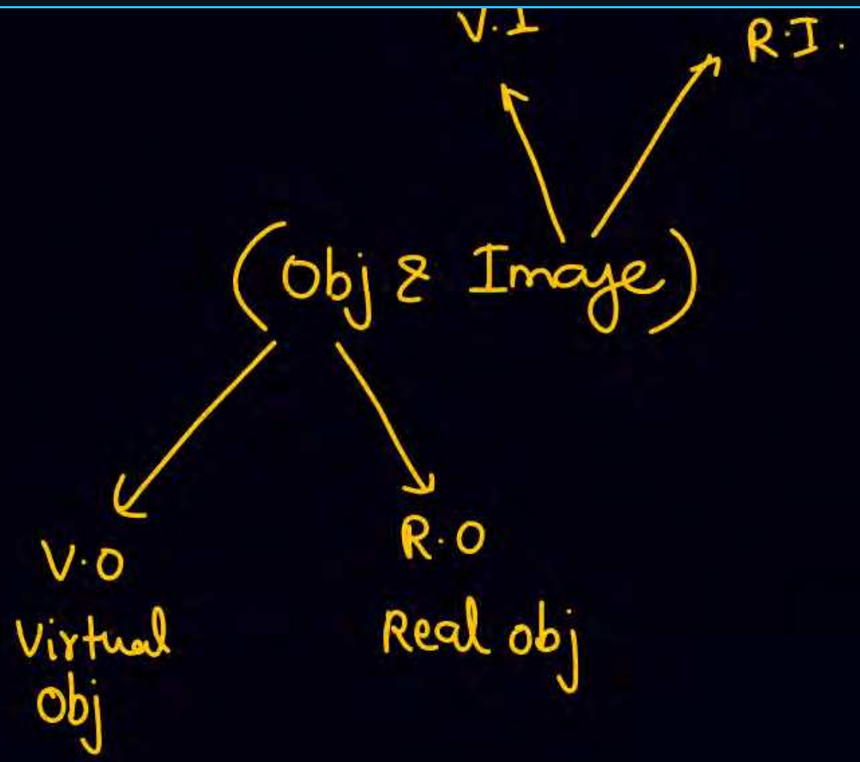
$\theta + 90 - \alpha + 90 - \beta = 180$

$\alpha + \beta = \theta$

$\delta = (180 - 2\alpha) + (180 - 2\beta)$

$= 360 - 2(\alpha + \beta)$

$\boxed{\delta = 360 - 2\theta}$



{ Obj ⟶ point of intersection of incident ray
Image ⟶ " " " reflected ray
or
" " " refracted ray.

Real obj

Start

R.O

Real obj

incident ray

ATDB.uno

R.O

Q2

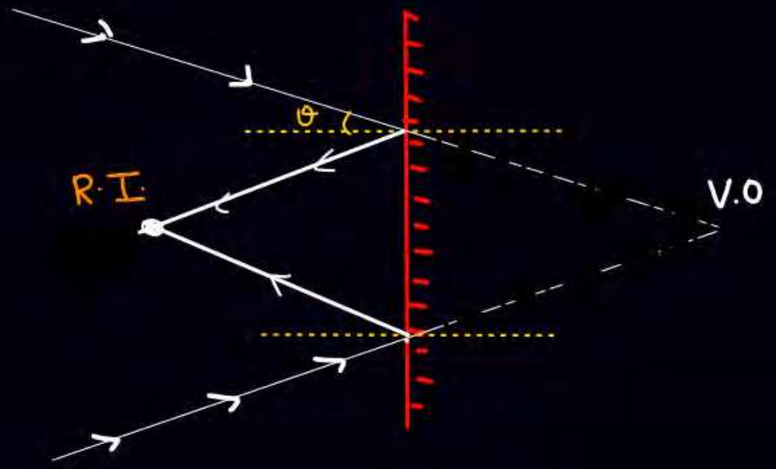
incident ray

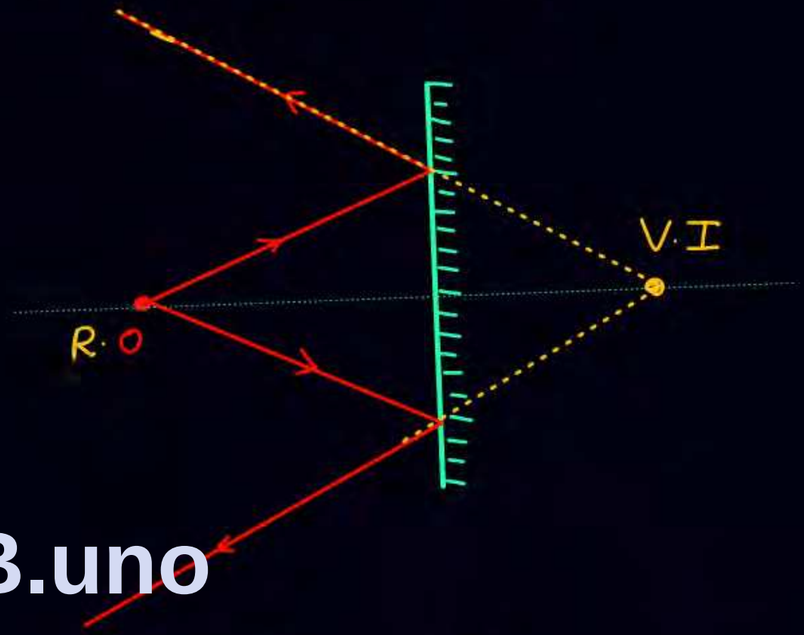
Virtual obj

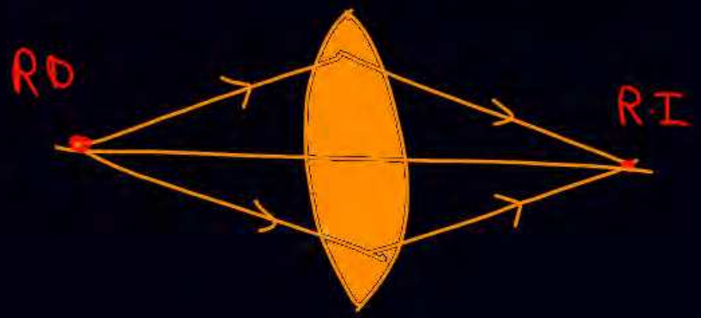
incident ray

Vo

Image ⟶ point of intersection of reflected/refracted ray





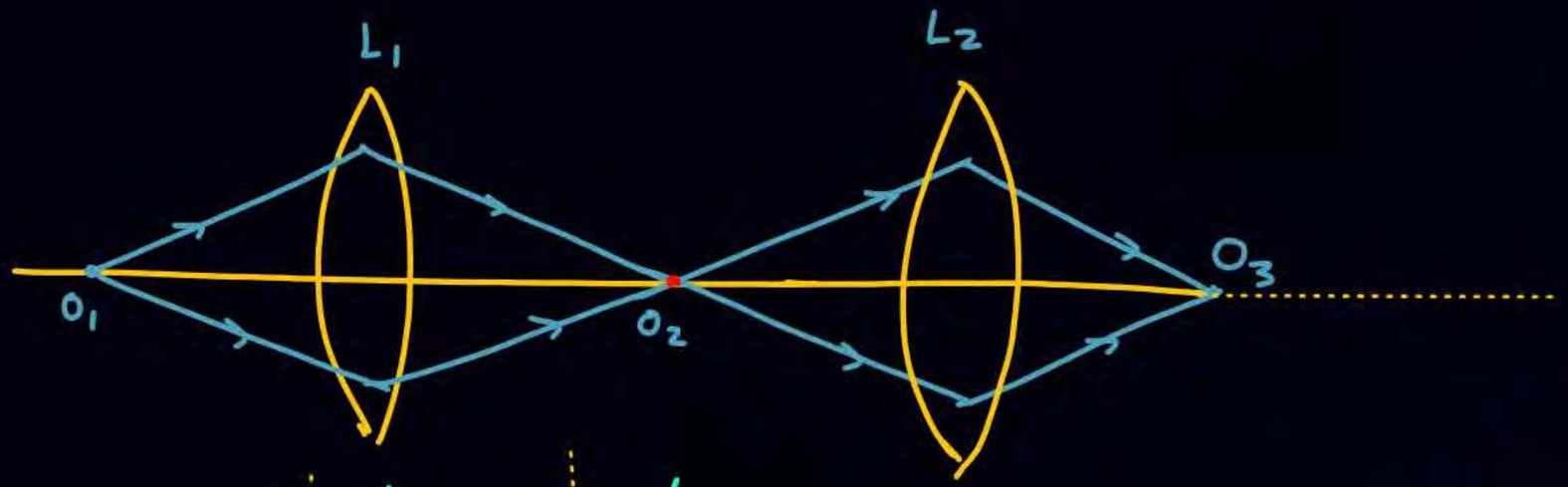


Plane Mirror

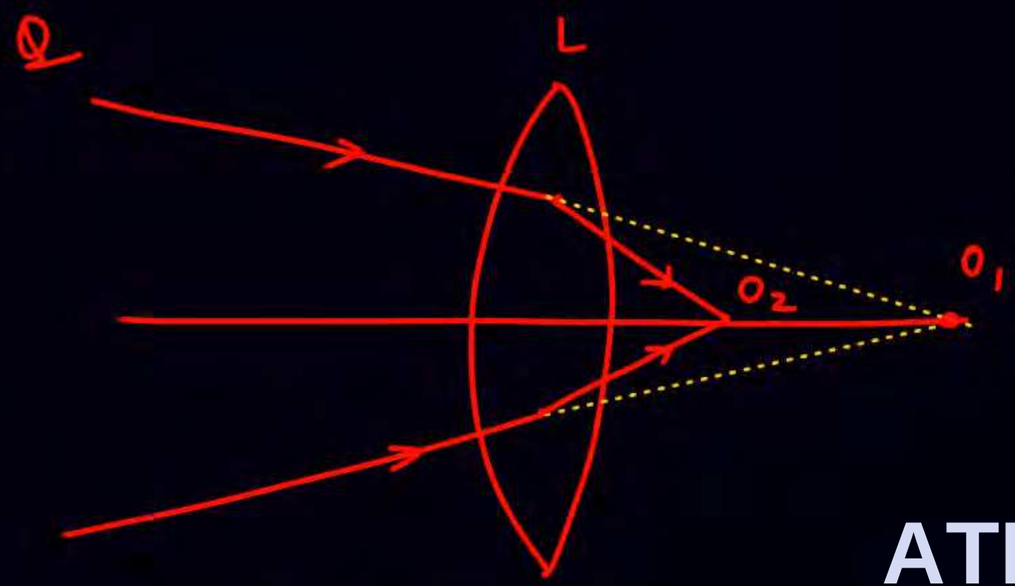
V·O ⟶ RI

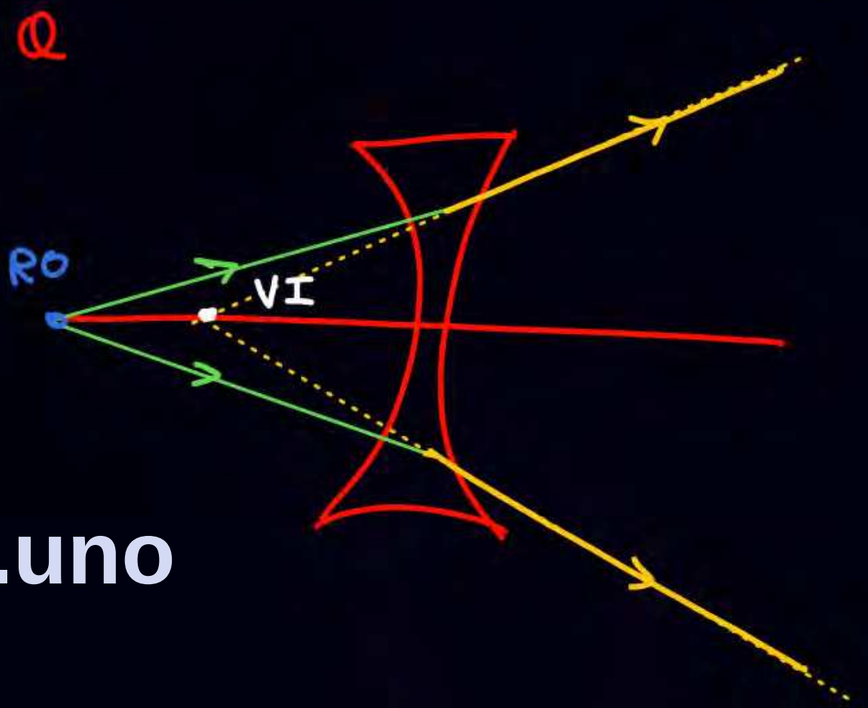
RO ⟶ VI

(1)



	L_1	L_2
O_1	R_O	—
O_2	R_I	R_O
O_3	—	R_I

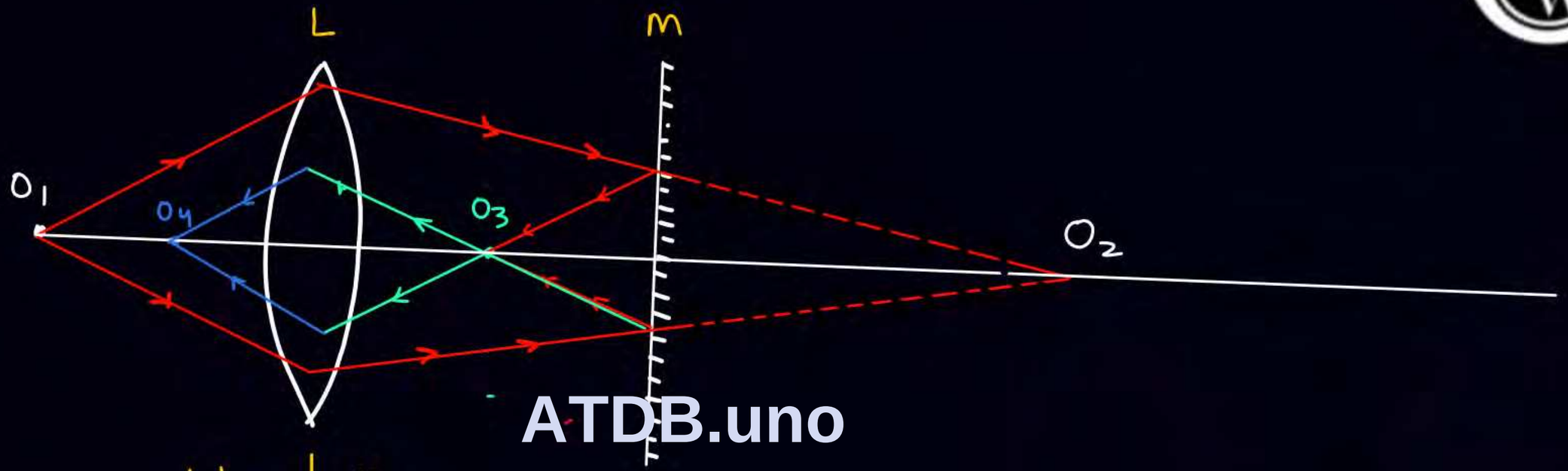




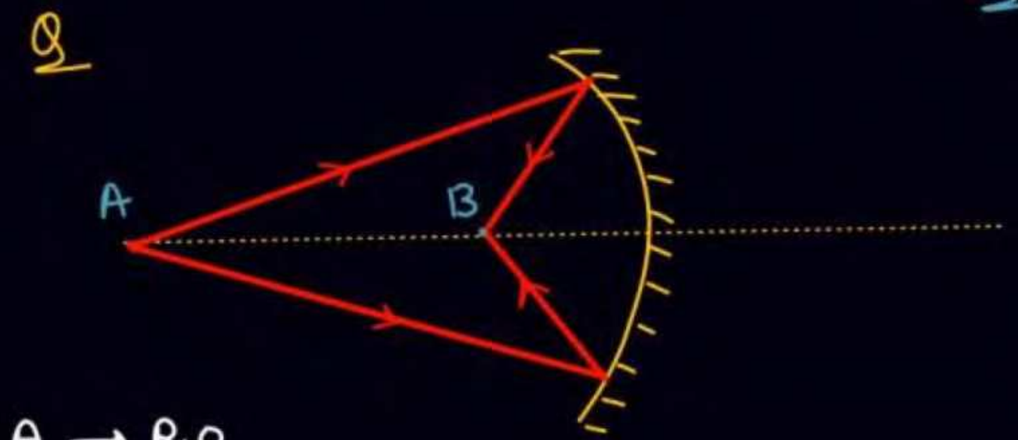
$O_1 \longrightarrow$ V.O.

$O_2 \longrightarrow$ RI

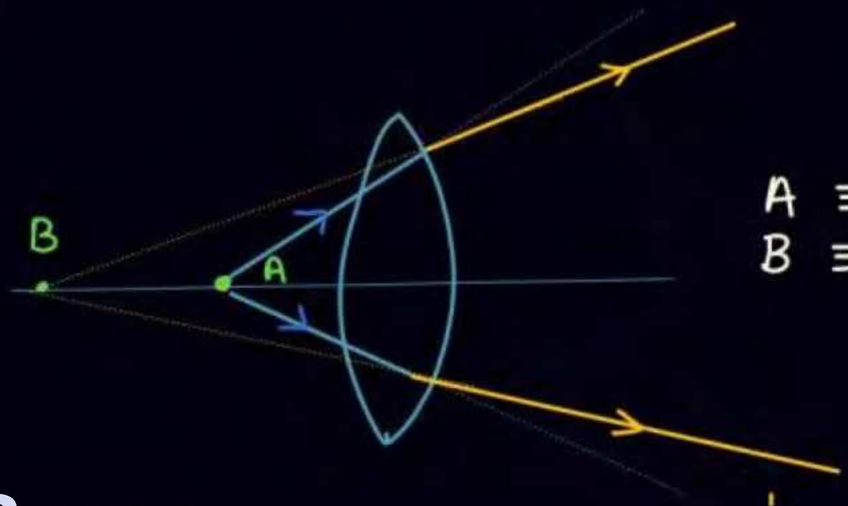
Q



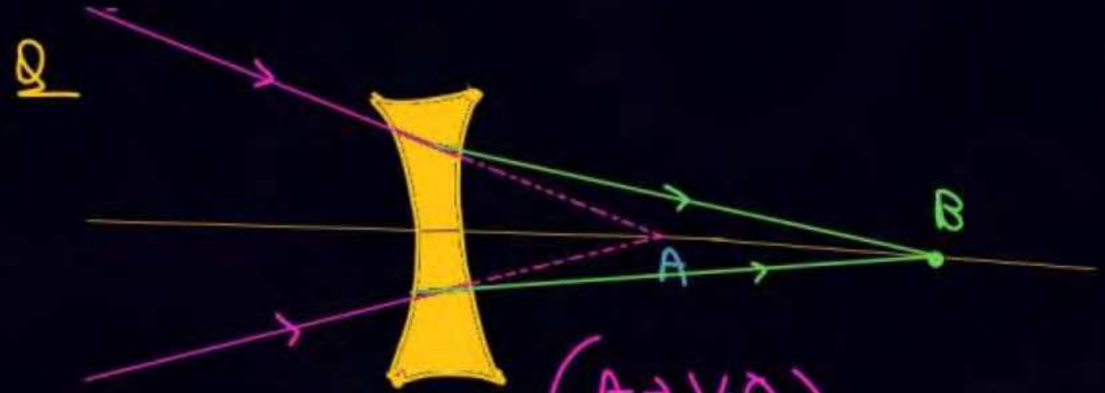
	L	M
O_1	RO	—
O_2	RI	VO
O_3	RO	RI
O_4	RI	—



A → R·O
B → R·I



A ≡ R·O
B ≡ V·I·



(A ⇒ V·O
B ≡ R·I)

Home work

- P40 A.C.