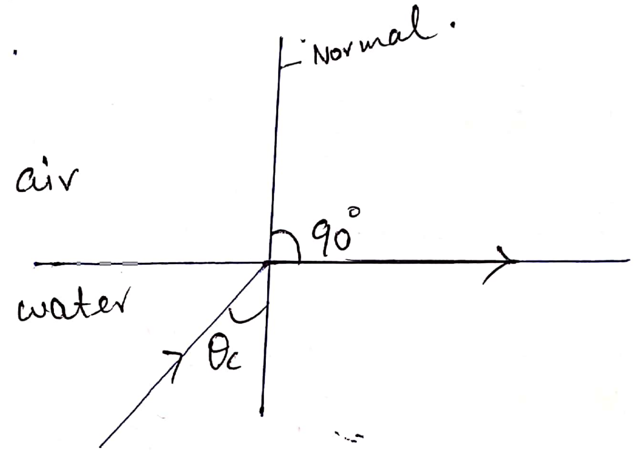
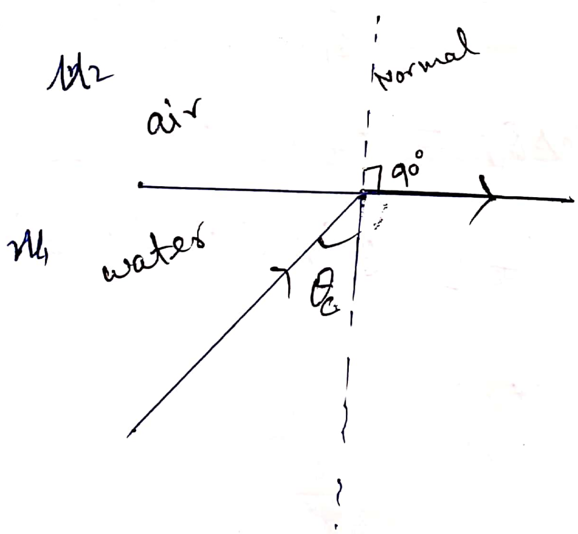
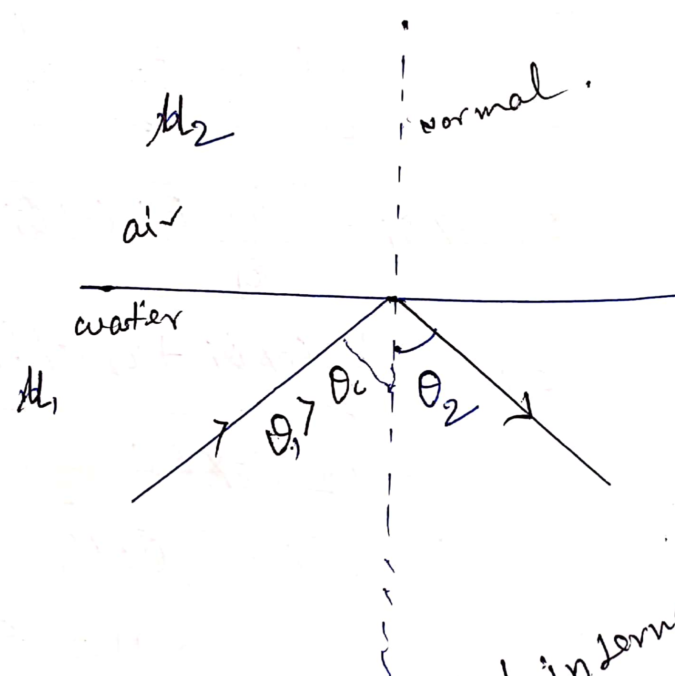
Total internal reflection :-

critical angle: The angle of incidence for which the angle of refraction is 90° is called critical angle.



Total internal reflection occurs when ~~when~~ angle of incidence is greater than the critical angle i.e the ray is totally reflected back into the same medium.





total internal reflection.

according to the snell's law

$$\mu_1 \sin\theta_1 = \mu_2 \sin\theta_2$$

if $\theta_1 = \theta_c$ then $\theta_2 = 90^\circ$

$$\mu_1 \sin\theta_c = \mu_2 \sin 90^\circ$$

$$\mu_1 \sin\theta_c = \mu_2$$

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

$$\boxed{\theta_c = \sin^{-1}\left(\frac{\mu_2}{\mu_1}\right)} \Rightarrow \theta_c = \sin^{-1}\left(\frac{\mu_2}{\mu_1}\right)$$

$\mu_1 > \mu_2$

Total internal reflection occurs for any incidence angle greater than the critical angle θ_c. and it can only occur when the Second medium has refractive index less than the first medium.

~~Skind~~ Skin depth or Skin effect :-

It is the phenomina in which the oscillating the e.m wave and it's associatted current are confined in a small region of the medium this phenomina is called skin effect.

$$\vec{E} = \vec{E_0}\, e^{-\beta r}\, e^{i(\alpha r - \omega t)}$$

if $r = \delta = \frac{1}{\beta}$ penetration depth.

Then $$\vec{E} = \frac{\vec{E_0}}{e}\, e^{i(\alpha r - \omega t)}$$

$$\vec{E} = \frac{1}{e}\,\vec{E_0}\, e^{i(\alpha r - \omega t)}$$

Teacher's Signature ________

The amplitude of the wave becomes $\frac{1}{e}$ times to the original amplitude then it define skin depth.

Skin depth $\delta = \frac{1}{\beta} = \sqrt{\frac{2}{\mu\sigma\omega}}$

$$\boxed{\delta = \sqrt{\frac{2}{\mu\sigma\omega}}}$$ for good conductor.

when $\sigma \to \infty$

Then $\delta = 0$

The penetration depth decreases with increase the frequency.

for poo conductor

$$\beta = \frac{\sigma}{2}\sqrt{\frac{\mu}{\epsilon}}$$

$$\delta = \frac{1}{\beta} = \frac{2}{\sigma}\sqrt{\frac{\epsilon}{\mu}}$$

$$\boxed{\delta = \frac{2}{\sigma}\sqrt{\frac{\epsilon}{\mu}}}$$ poor conductor.