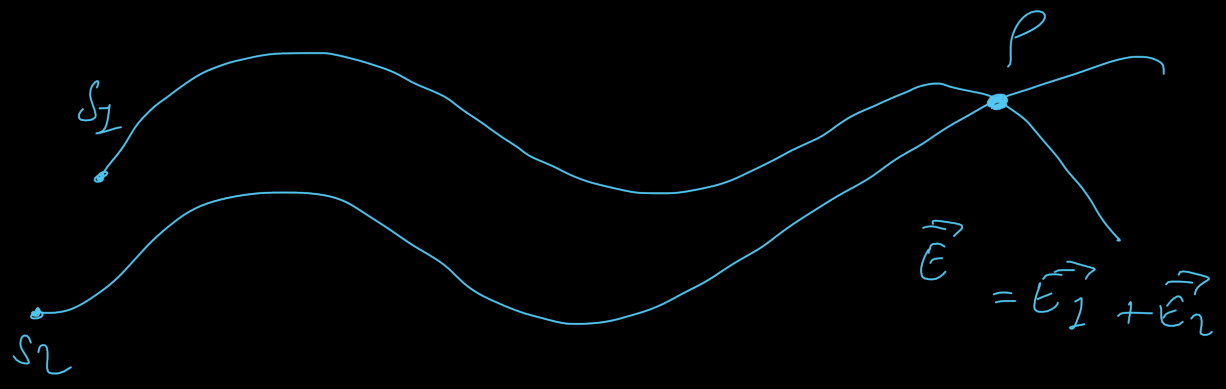
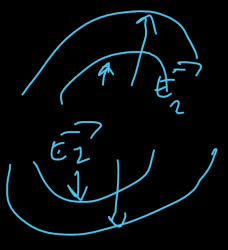
Interference :-



const./max. bright



> The phenomenon of modification in intensity of light due to mixing / super composing = of two or more light waves is called interference of light.

⇒ When the intensity of light increases it is called constructive interference or maxima or bright

⇒ When the intensity of resultant light decreases it is called destructive interference, minima or dark.

⊙ Relation b/w path & Phase difference

Phase difference $(\phi) = \frac{2\pi}{\lambda} \times$ path diff (x)

$$\boxed{\phi = \left(\frac{2\pi}{\lambda}\right) x}$$

for constructive interference :-

$$p.d = n\lambda \quad , n = 1, 2, 3, 4, \text{-----}$$

$$\boxed{\phi = (2\pi)n}$$

for dist. interference, $p.d = (2n \pm 1)\frac{\lambda}{2}$

for +ve, $n = 0, 1, 2, 3, \text{---}$

for -ve, $n = 1, 2, 3, \text{----}$

$$\boxed{\phi = (2n+1)\pi}$$

⊙ Condition for sustained interference :-

(1) The two sources must be coherent

(2) The sources must be monochromatic

(3) The interfering waves should have same amplitude or intensity.

(4) The distance b/w two sources should be small.

(5) The perpendicular distance of screen from two sources should be large.

(6) Sources must be narrow.

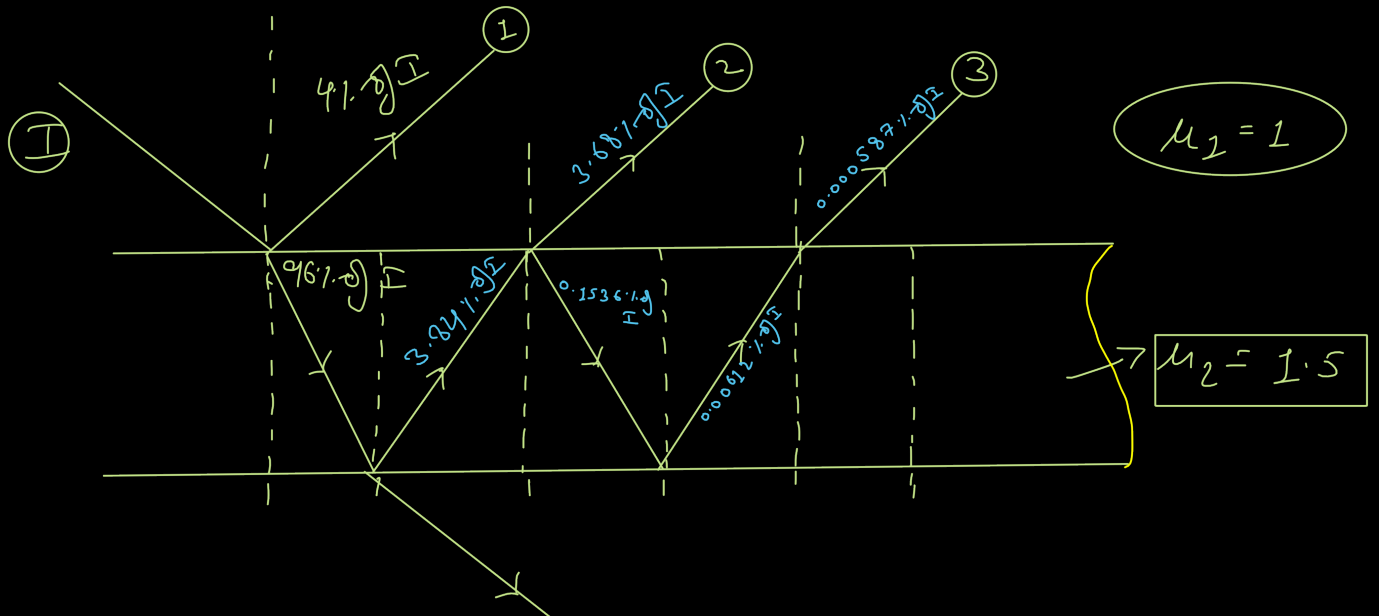
(7) The two interfering waves must have the same plane of polarization.

⊙ Interference due to Division of Amplitude:-

When a ray of monochromatic light is incident on a transparent medium bounded by two surfaces, multiple reflection and refraction takes place. The interference due to this is called interference due to Division of Amplitude or intensity.

The Transparent medium having thickness of (0.1 Å) to (10 Å) is called thin film in interference.

$$I \longrightarrow \mu_1 \longrightarrow \mu_2 \longrightarrow I_R = \left(\frac{\mu_2 - \mu_1}{\mu_2 + \mu_1}\right)^2 I$$



Therefore, we can say that only the first two rays will interfere with each other.

optical path and equivalent path travelled by light in air or vaccume is called optical path.

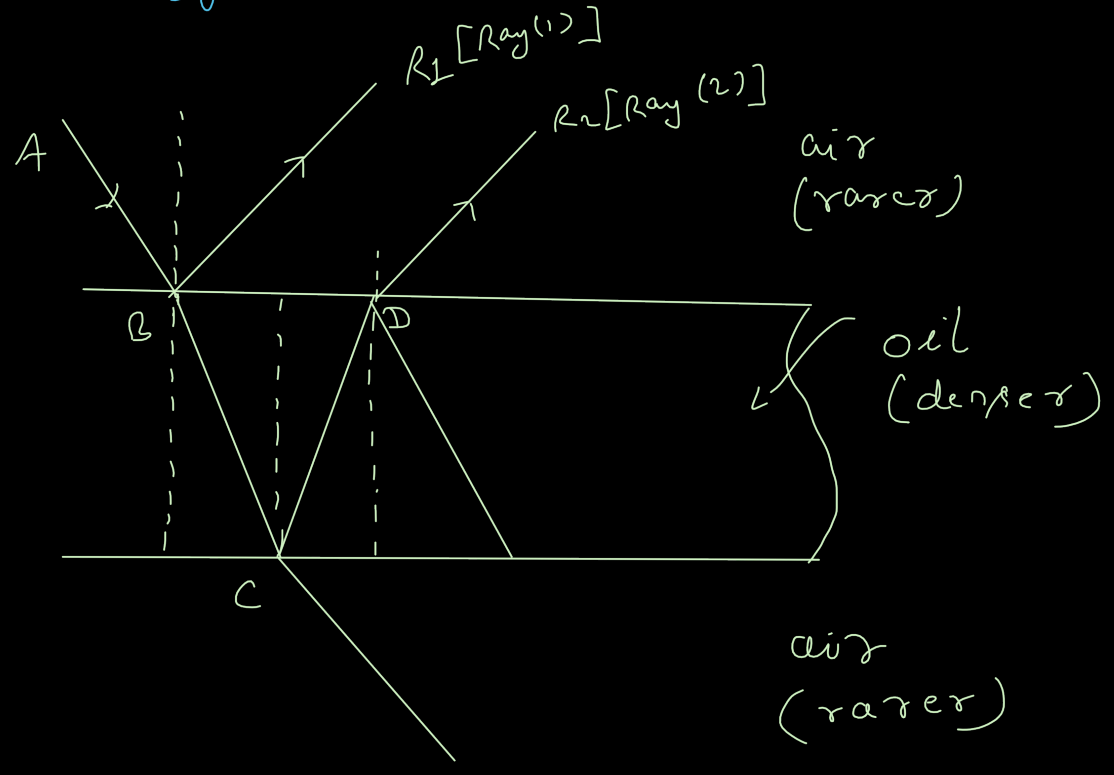
if the ray of light is travelling a dist. d in a medium of refractive index μ. then its optical path will be $\mu \cdot d$.

Reflection of a transverse wave

(1) When a ray of light travells in a rarer medium and reflect at a surface of a denser medium then and additional path difference of $\frac{\lambda}{2}$ is created. (in addition to geometrical path difference).

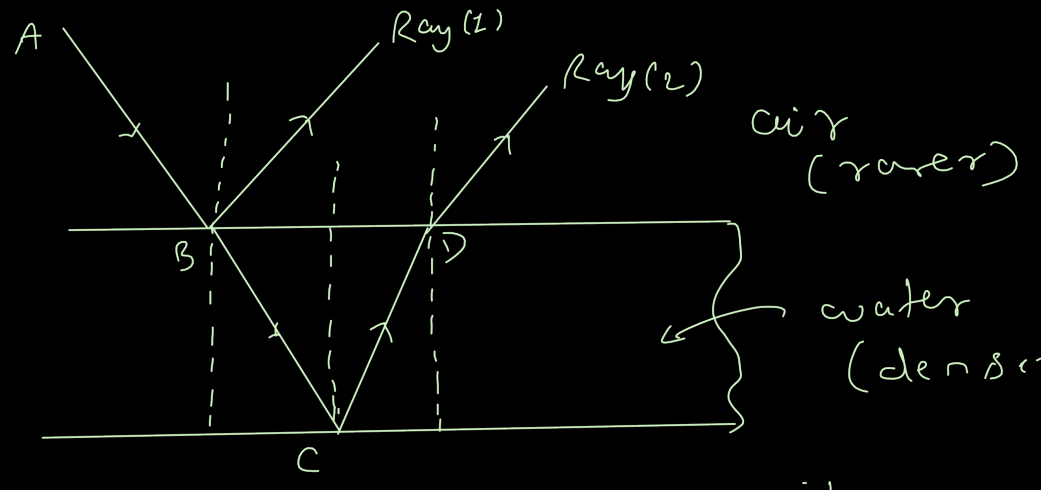
(2) When a ray of light travells in a denser medium and reflect at a surface

of a rarer medium then no additional path difference is created.



for rarer – denser – rarer

effective difference = (geometrical optical path difference) $\neq \frac{\lambda}{2}$

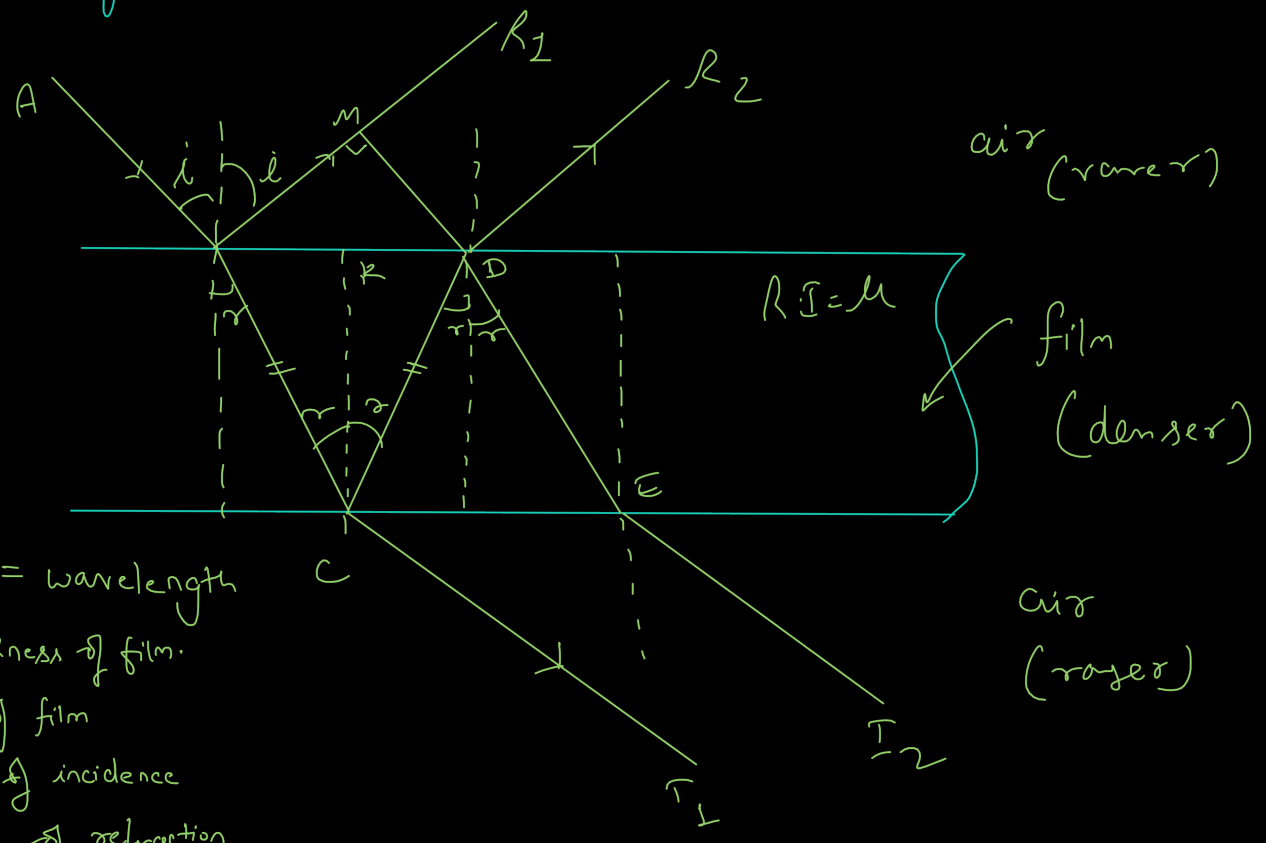


for rarer – denser – more denser

effective optical path difference = geometrical optical path difference.

Interference in thin film ..

(A) Reflected system.



Let λ = wavelength
t = thickness of film.
μ = R.I of film
i = angle of incidence
r = angle of refraction

The first ray travells an additional dist. of B.M in air where as in second ray travells from B to C in a film of refractive index μ

optical path difference (opd) = (path BCD in film of R.I μ) − (path BM in air)

$$opd = \mu (BC + CD) - BM \quad \text{——} (1)$$

from fig $BC = CD$

$$opd = \mu (2BC) - BM$$

$$opd = 2\mu (BC) - BM \quad \text{——} (2)$$