~~along which the molecules tend to orient is called the director.~~

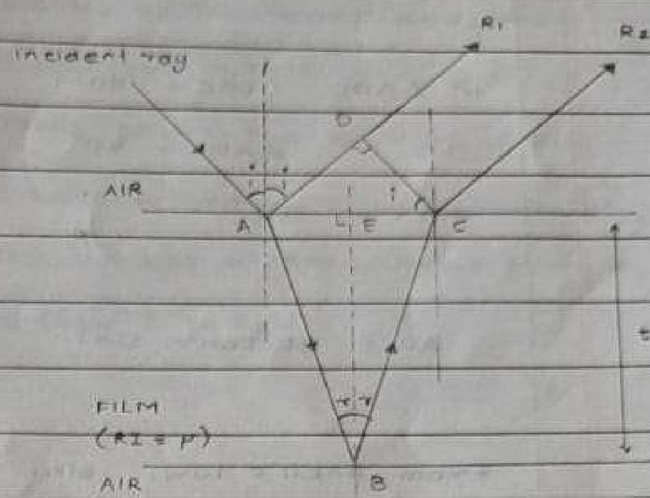
~~liquid crystals have..~~

thin film interference

3. Derivation for maximum and minimum condition: (thin film interference)

→ from figure,

DIAGRAM



CD is normal to AD.

the ray AD travels in air while the ray AC travels in the film of refractive index μ along the path AB and BC.

∴ The geometric path difference between the two rays is:

AB + BC - AD

∴ optical path difference = ~~μt~~ $\mu(AB + BC)$

now, when a ray is reflected at the boundary of a rarer to denser medium, a path change of $\lambda/2$ occurs for ray AD

∴ Additional phase difference = $\pm\lambda/2$

∴ Effective path difference = $\mu(AB + BC) - AD \pm \lambda/2$ — (i)

In ΔABC, $\angle ABE = \angle CBE = \angle r$

also, AB = BC

now, $\cos r = BE/AB$

$$\therefore \frac{BE}{\cos r} = AB = \frac{t}{\cos r}$$

$$\therefore AB + BC = \frac{2t}{\cos r} \quad \text{— (ii)}$$

polarization

also, $AE = EC$

$\therefore AC = 2AE$

now, $\tan r = \frac{AE}{BE}$

$\therefore AE = t \cdot \tan r$

$\therefore AC = 2t \cdot \tan r$

for a fixed t and μ, color of a thin film depends on its inclination angle (i). (esp. white light)

in ΔADC, $\angle DAC = 90 - i$

$\angle ADC = 90°$, $\angle ACD = i$

$\sin i = \frac{AD}{AC}$

$\therefore AD = 2t \cdot \tan r \cdot \sin i$

from Snell's law, $\frac{\sin i}{\sin r} = \mu$

$\Rightarrow \sin i = \mu \sin r$

$\therefore AD = 2t \cdot \tan r \, (\mu \sin r) = \frac{2\mu t \sin^2 r}{\cos r}$ —— (iii)

now, from (i), (ii), (iii),

effective path difference

$= \frac{\mu(2t)}{\cos r} - \frac{(2\mu t \sin^2 r)}{\cos r} \pm \lambda/2$

$= \frac{2\mu t}{\cos r}(1 - \sin^2 r) \pm \lambda/2$

$= \frac{2\mu t \cos^2 r}{\cos r} \pm \lambda/2$

$= 2\mu t \cos r \pm \lambda/2$

condition for maxima:

~~epd/b~~ (brightness)

$2\mu t \cos r = (2n-1)\lambda/2$

condition for minima:

(darkness)

$2\mu t \cos r = n\lambda$