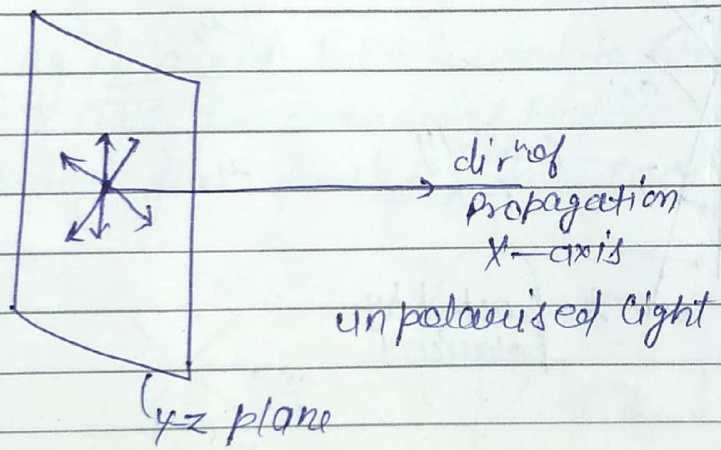
: Polarisation :

Acc. to EM theory of light, light wave consist of E.f and M.f vectors ⊥r to each other and also ⊥r to the dirn of wave E.f Vector also called Light vector

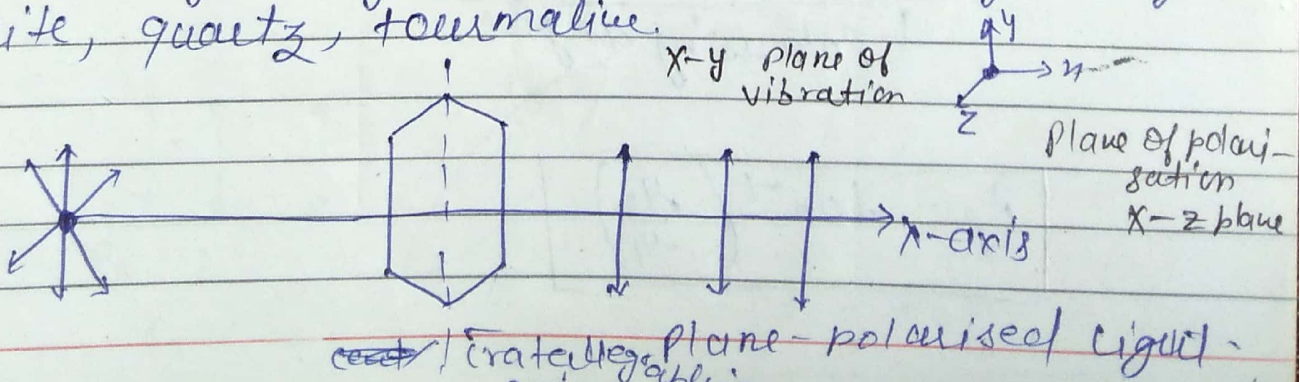
In ordinary light large no. of waves are emitted by atoms or molecules of light source. Each atom Produce Electric field acc. to its own orientation Hence Electric field have equal Probability to vibrate in each direction such a light is called unpolarised light.

$$E = E_0 \sin(kx - \omega t)$$



if vibration of E.f are confined in a fixed direction ⊥r to the direction of propagation of light then it is called plane Polarised light.

It is done by passing unpolarised light through a crystal. Calcite, quartz, tourmaline.

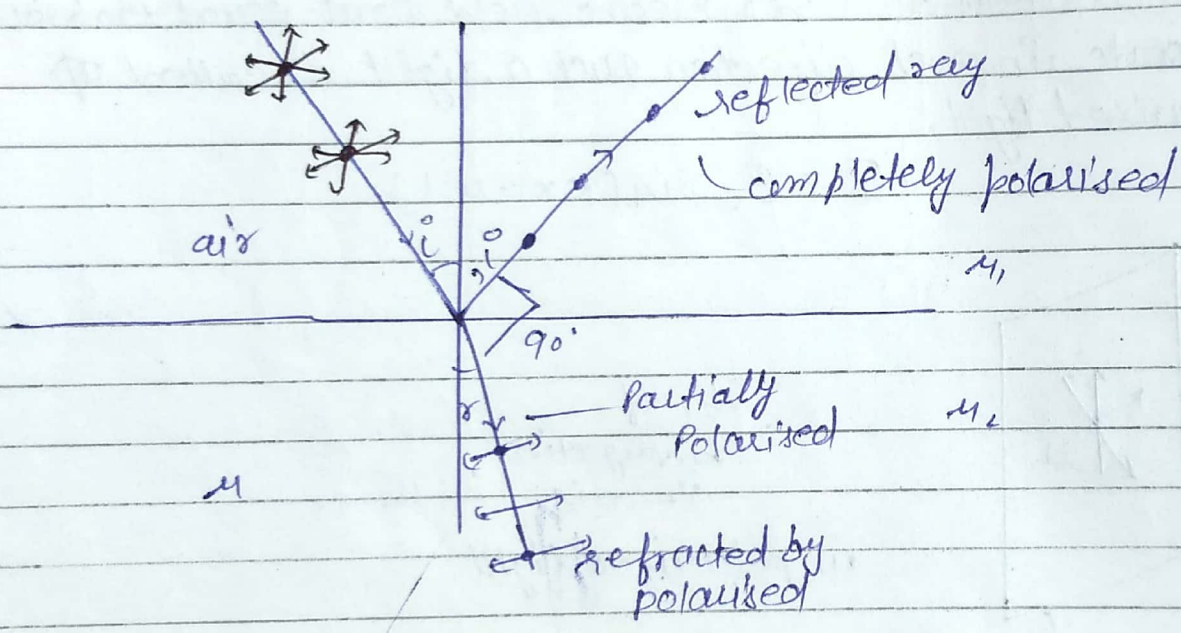


Plane Polarised light

x-z- plane of vibration
x-y- " " Polarisation

* Plane of Vibration:
It is a plane containing dirn of vibration and dirn of propogation of light

(ii) By Reflection:
(It is based upon Brewster's law)



Snell's law

$\mu \sin i^\circ = \mu \sin r$

$\sin i^\circ = \mu \sin(90 - i)$

$\sin i^\circ = \mu \cos i$

$\tan i = \mu$

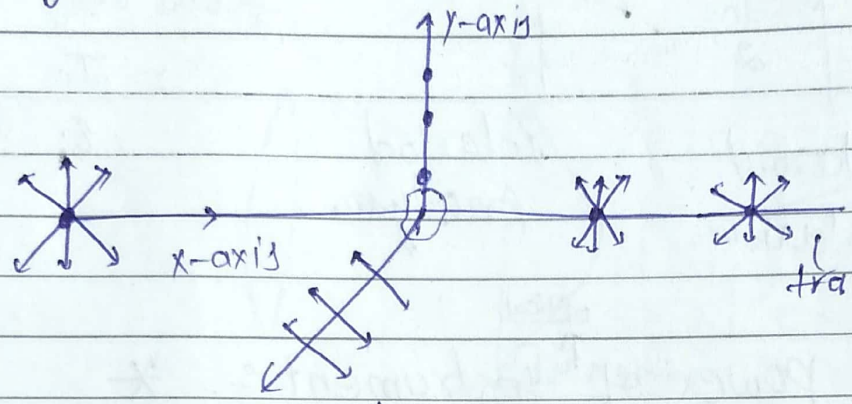
$$\boxed{i_p = i^\circ = \tan^{-1}(\mu)}$$

Polarising angle

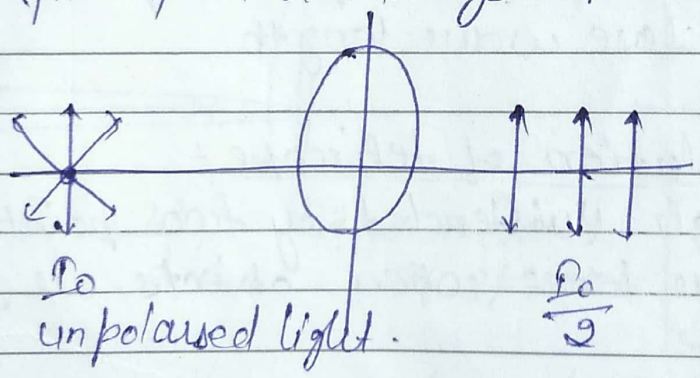
$$\boxed{i_p^\circ = \tan^{-1}\left(\frac{\mu_2}{\mu_1}\right)}$$

* By Scattering :- When light incident on atom or molecules e⁻ is absorve light and reradiate in all dir^n. it is called Scattering of light.

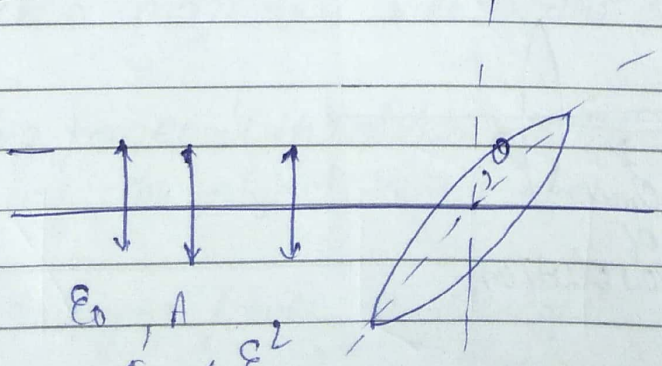
In Scattering scattered light ⊥^r to direction of Incident light is completely polarised



* Using Polaroid :- It is used to obtained plane polarised light for commercial purpose. It is a large size Polarising film fixed b/w two glass plates



* Malus law :-



$I \propto \varepsilon_0^2 \cos^2\theta$

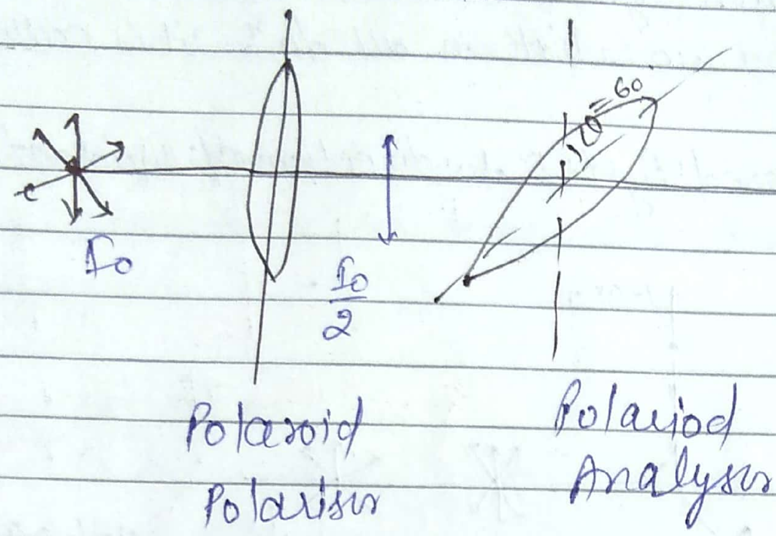
$\boxed{I = I_0 \cos^2\theta}$

Supplier for J-main

(4-0) J-A = 15th

$I = I_0 \cos^2\theta$.

Ex!



$\frac{I_0}{2}\cos^2 60$

$= \frac{I_0}{8}$;

* Resolving power of optical Instrument : *

It is the ability of an optical Instrument to produce seperate Image of two near by object

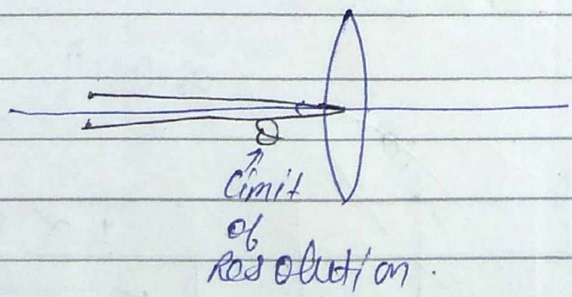
OR

It is the ability to produce seperate spectral lines having two or more close wave length

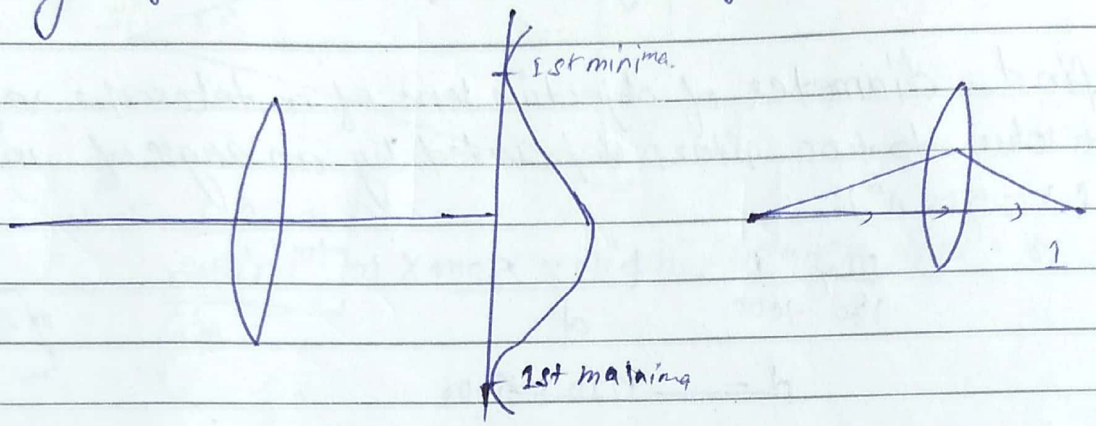
* Limit of resolution of teliscope :

It is the angle substended by two point object on the objective lense when objects are just resolved by the teliscope

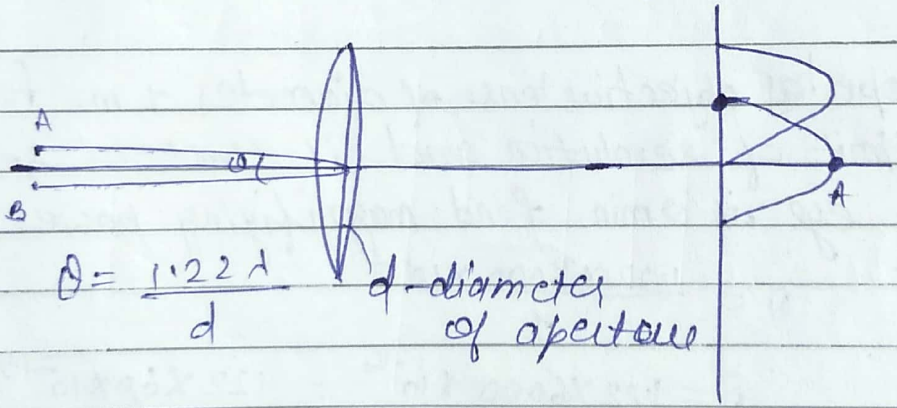
Limit of Resolution inversly propotion to resolving power



when a distant object seen through telescope the boundry of objective lens act like a circular aperture. Hence the image of star formed by the objective lense is actually a pattern of diffraction pattern. which consist of central bright fringe surrounding by alternate dark and bright fringes



* Rayleigh Criteria of Resolution :- Two objects are just resolve by an optical instrument when central maxima due to one object lies on the 1st minima of another object



$\theta = \frac{1.22\lambda}{d}$ d - diameter of aperture

* Diff. b/w magnifying power and Resolving power :-
Magnifying power is the ability of an instrument to produce a magnified view of the object to the eyes

Resolving power is the ability of instrument to show the find detail of the object to the eyes.

Magnifying power of telescope $m = \frac{\text{Angle subtended by final image}}{\text{Angle subtended by object at unaided eye.}}$

$\boxed{m = \frac{\beta}{\alpha}}$

4 when objects are just Resolve then angle β becomes resolving power of Eye if object are just resolved

$$m = \frac{\text{Resolving Power of eye}}{\text{Resolving Power of telescope}} = \frac{\text{Limit of Resolution of telescope}}{\text{Limit of Resolution of eye}}$$

5. find diameter of objective lens of a telescope required to resolve ~~to~~ 100 stars seperated by an angle of 10^{-3} degree ($\lambda = 5500 A^\circ$)

$$\frac{\pi}{180} \times \frac{1}{1000} = \frac{1.22 \times 5000 \times 10^{-10}}{d}$$

$$d = \frac{1220 \times 5500}{}$$

$$\frac{\pi}{180} \times \frac{1}{1000} = \frac{1.22 \times 500 \times 10^{-10}}{d}$$

$d =$

Que: A telescope has objective lense of diameter 1 m. for $\lambda = 6000 A^\circ$ find limit of resolution and if limit of resolution of human eye is 2 min find magnifiying power of telescope.

$$\theta = \frac{1.22 \times 6000 \times 10^{-10}}{1}$$

$$\theta = 1.22 \times 6000 \times 10^{-10} = 122 \times 60 \times 10^{-10} = 122 \times 6 \times 10^{-9}$$

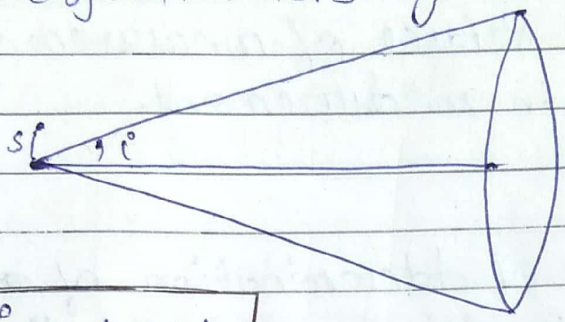
$$= 732 \times 10^{-9}$$

human eye $\theta' = 2$

$$m = \frac{2/60 \times \frac{\pi}{180}}{732 \times 10^{-9}} \qquad \theta' = \frac{2}{60} \times \frac{\pi}{180}$$

* Resolving power of microscope:

It is the smallest dist. b/w two object which are just resolved by objective lens of microscope



$$\theta = \frac{1.22\lambda}{2\mu \sin i}$$

i = semi-vertex angle of cone.