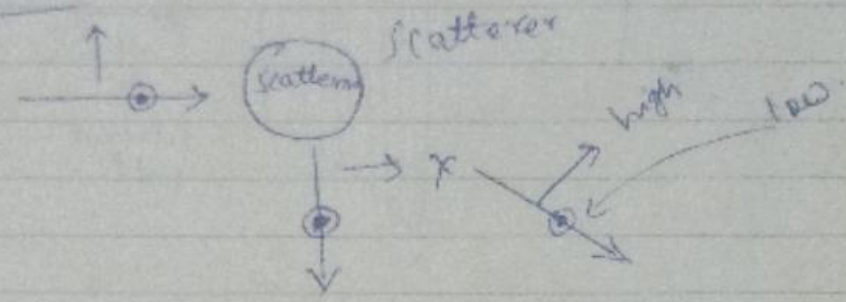
Polarization

By:

1. Scattering
2. Reflection
3. Birefringence
4. Absorption

1. Scattering:



~~So if unpolarized light incident ⊥r to the scattering~~

So, when the scattered light is ⊥r to the dir^n of incidence, then the component of polarization in the plane of scattering is going to be absent.

If the dir^n of scattered light is other than 90° the scattered light is partially polarized.

how

Dichroism: or absorption (wavelength dependent)

the absorption of light will be different for different polarization.

① **Wire mess**

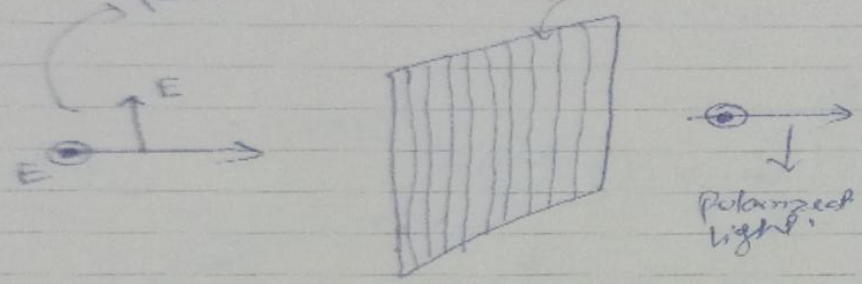
parallel to wire ⇒ oscillation of electrons ⇒ radiation in backward & forward dirn.

⇓

Cancellation of E field i.e ∥ to mess

⇓

only ⊥r to the ~~mess~~ wire will survive.

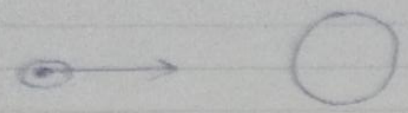


how selective absorption introduces polarization.

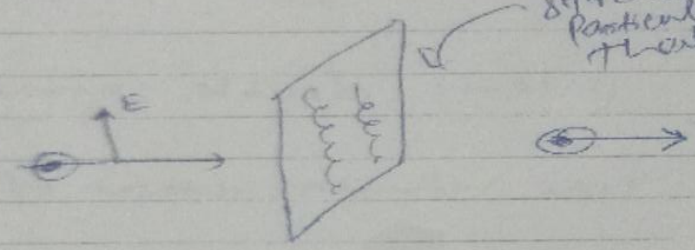
spacing ~~of the~~ between the wires should be smaller than the wavelength.

Polarization upto the infrared band is possible through this mess but for higher freq. band it is difficult.

(II) Dichroic Crystal (Ex:- Tourmaline crystal)

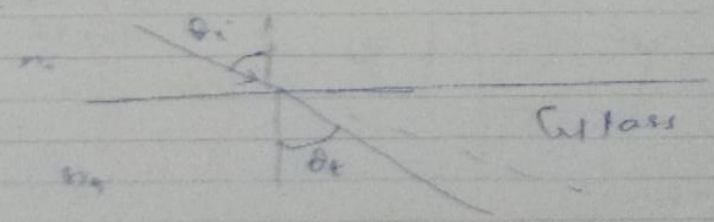


(III) Polaroid sheets:



stretchable along the particular dirn. ⇒ field of that dirn is vanished

Reflection



$\theta_i + \theta_r = 90^\circ$ condition for ⊙ polarization.

$\theta_p + \theta_t = 90^\circ$

$n_i \sin\theta_p = n_t \sin\theta_t$

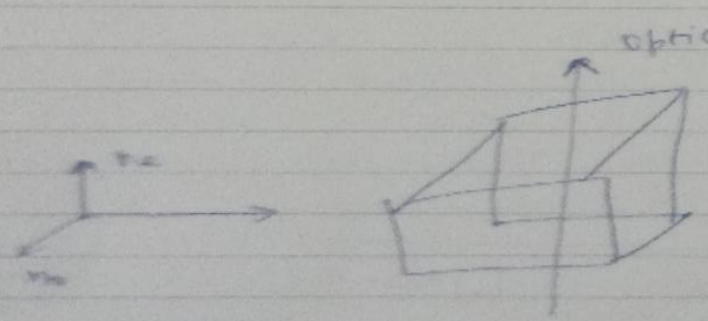
$= n_t \cos\theta_p$

$\tan\theta_p = \left(\frac{n_t}{n_i}\right)$

$\theta_p = \tan^{-1}\left(\frac{n_t}{n_i}\right)$ → Brewster's angle

Birefringence (means double refraction)

Two refractive images of a ~~single~~ some object.



Ref. index depends on the dirn. of electric field

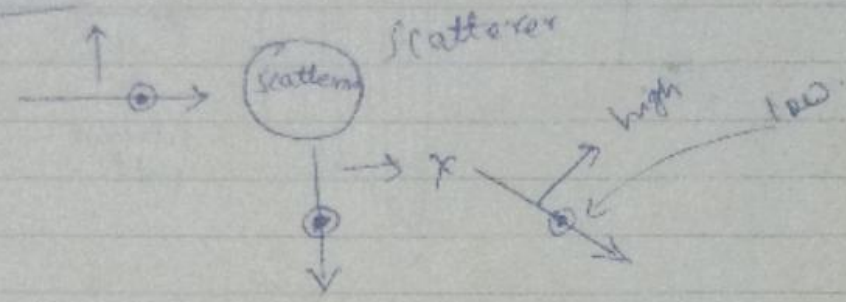
(Calcium carbonate)	no	ne
Calcite	1.6584	1.4864
& Quartz	1.5443	1.5334

Polarization

By:

1. Scattering
2. Reflection
3. Birefringence
4. Absorption

1. Scattering:



~~So if unpolarized light incident ⊥r to the scattering~~

So, when the scattered light is ⊥r to the dir^n of incidence, then the component of polarization in the plane of scattering is going to be absent.

If the dir^n of scattered light is other than 90° the scattered light is partially polarized.

how

Dichroism: or absorption (wavelength dependent)

the absorption of light will be different for different polarization.

① **Wire mess**

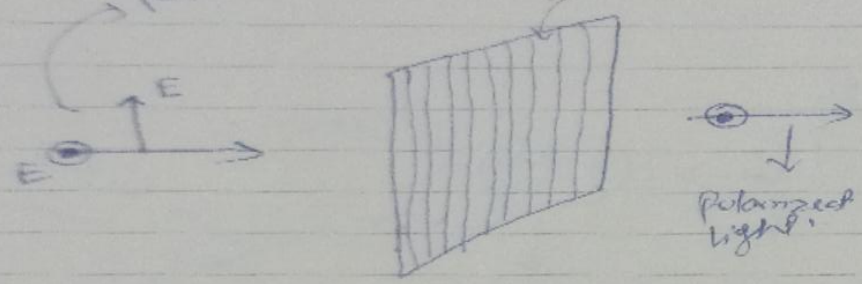
parallel to wire ⇒ oscillation of electrons ⇒ radiation in backward & forward dirn.

⇓

Cancellation of E field i.e ∥ to mess

⇓

only ⊥r to the ~~mess~~ wire will survive.

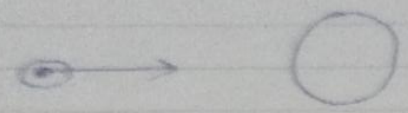


how selective absorption introduces polarization.

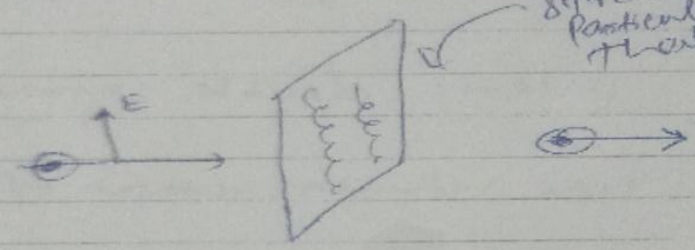
spacing ~~of the~~ between the wires should be smaller than the wavelength.

Polarization upto the infrared band is possible through this mess but for higher freq. band it is difficult.

(II) Dichroic Crystal (Ex:- Tourmaline crystal)

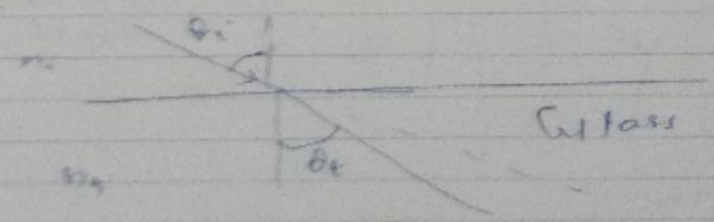


(III) Polaroid sheets:



stretchable along the particular dirn. ⇒ field of that dirn is vanished

Reflection

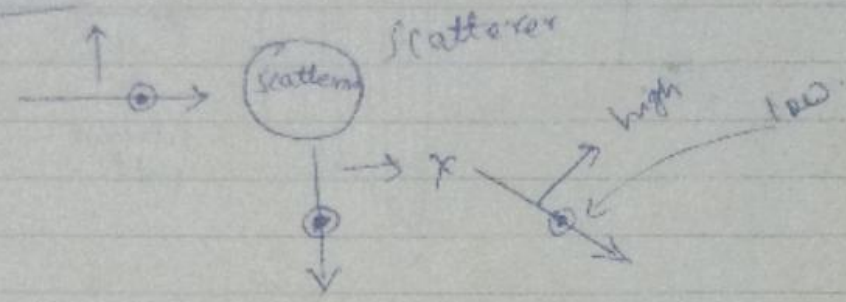


Polarization

By:

1. Scattering
2. Reflection
3. Birefringence
4. Absorption

1. Scattering:



~~So if unpolarized light incident ⊥r to the scattering~~

So, when the scattered light is ⊥r to the dir^n of incidence, then the component of polarization in the plane of scattering is going to be absent.

If the dir^n of scattered light is other than 90° the scattered light is partially polarized.

how

Dichroism: or absorption (wavelength dependent)

the absorption of light will be different for different polarization.

① **Wire mess**

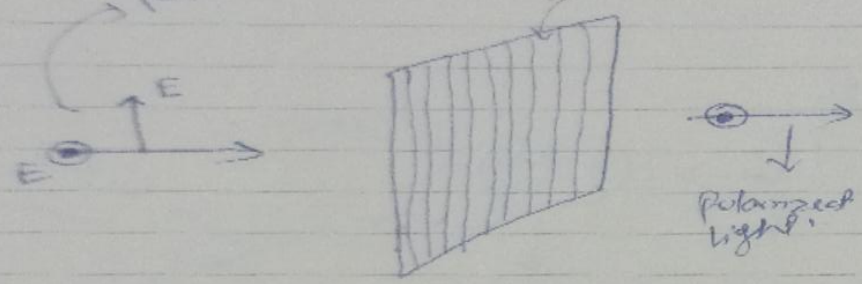
parallel to wire ⇒ oscillation of electrons ⇒ radiation in backward & forward dirn.

⇓

Cancellation of E field i.e ∥ to mess

⇓

only ⊥r to the ~~mess~~ wire will survive.

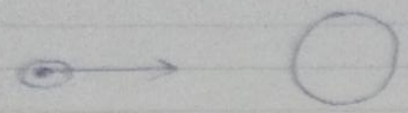


how selective absorption introduces polarization.

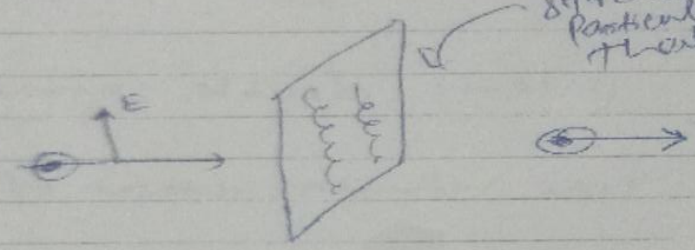
spacing ~~of the~~ between the wires should be smaller than the wavelength.

Polarization upto the infrared band is possible through this mess but for higher freq. band it is difficult.

(II) Dichroic Crystal (Ex:- Tourmaline crystal)

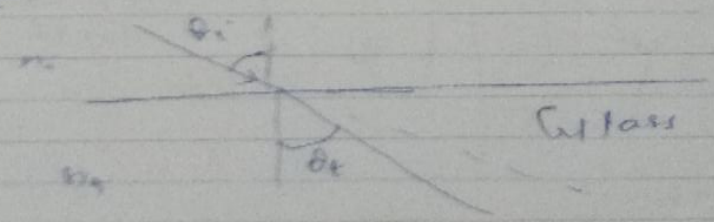


(III) Polaroid sheets:



stretchable along the particular dirn. ⇒ field of that dirn is vanished

Reflection



$\theta_i + \theta_r = 90^\circ$ condition for ⊙ polarization.

$\theta_p + \theta_t = 90^\circ$

$n_i \sin\theta_p = n_t \sin\theta_t$

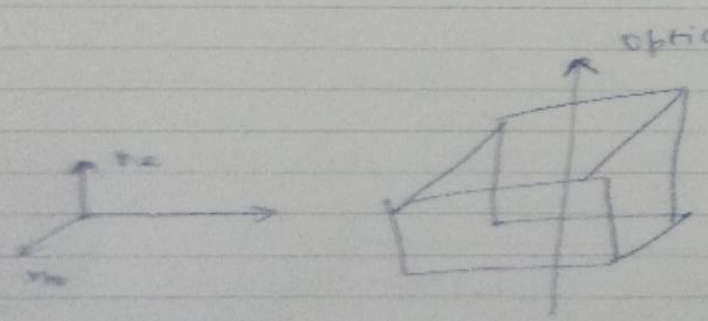
$= n_t \cos\theta_p$

$\tan\theta_p = \left(\frac{n_t}{n_i}\right)$

$\theta_p = \tan^{-1}\left(\frac{n_t}{n_i}\right)$ → Brewster's angle

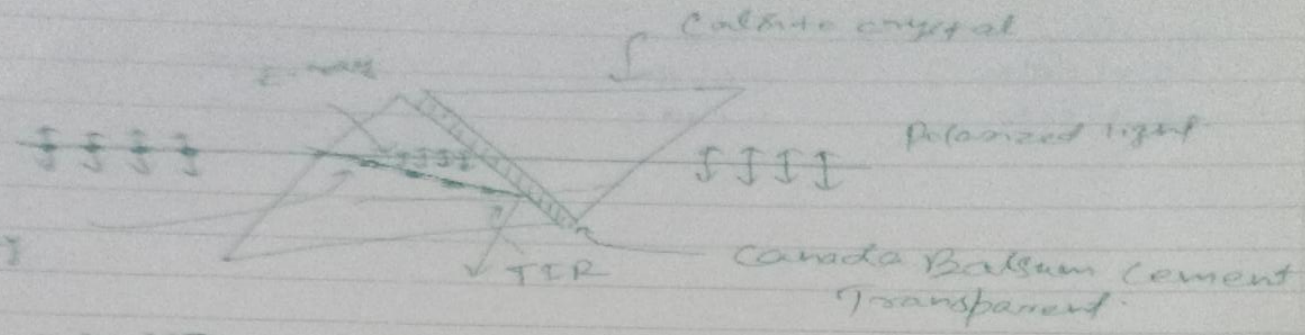
Birefringence (means double refraction)

Two refractive images of a ~~single~~ some object.



Ref. index depends on the dirn. of electric field

(Calcium carbonate)	no	ne
Calcite	1.6584	1.4864
& Quartz	1.5443	1.5334



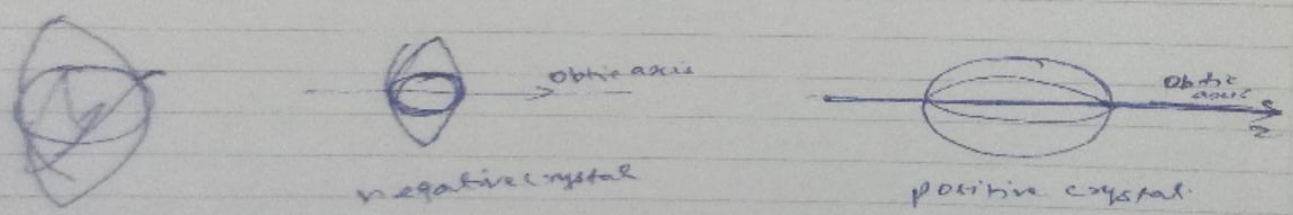
$n_o = 1.658$
$n_{CB} = 1.55$
$n_e = 1.486$

Ref index of canada balsam is higher than calcite i.e

$$\boxed{n_{ce} > n_{calcite}}$$

→ Nicol prism was used to plane polarise the light 1st time.

Nicol prism was invented 1st time in 1828.



$\frac{\pi}{2} + \frac{\pi}{4} = \frac{3\pi}{4}$

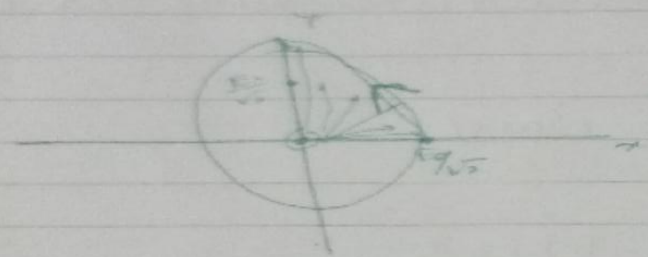
$\cos(\frac{\pi}{2} + \pi/4)$ $\quad \frac{1}{\sqrt{2}}$

$\sin\frac{\pi}{4} = \frac{1}{\sqrt{2}}$ $\quad -\frac{\pi}{2} + \frac{\pi}{4} = -\frac{\pi}{4}$

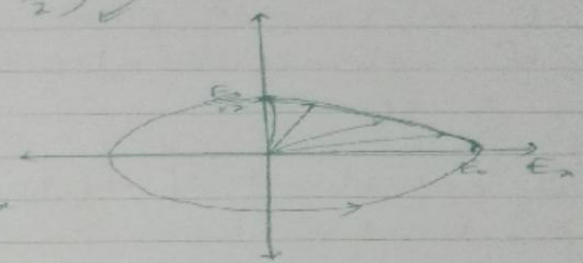
$$E_x = E_0 \cos\left(kz - \omega t + \frac{\pi}{4}\right)$$

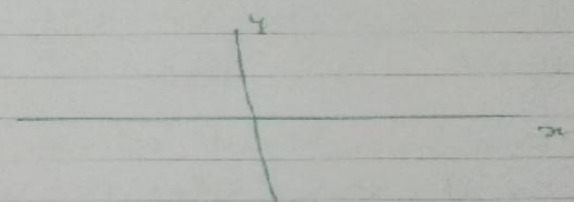
$$E_y = \frac{1}{\sqrt{2}} E_0 \sin(kz - \omega t)$$

$$E_y = \frac{1}{\sqrt{2}} E_0 \cos\left(kz - \omega t - \frac{\pi}{2}\right)$$

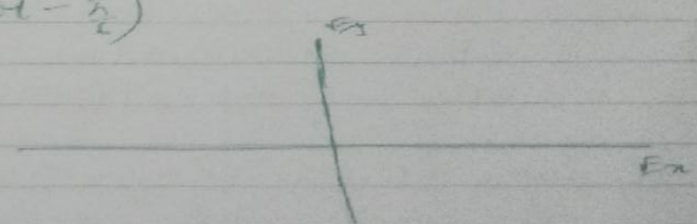


L.C.P





Ex:

$$E_x = E_0 \sin(kz - \omega t + \pi/3)$$

$$E_y = E_0 \sin\left(kz - \omega t - \frac{\pi}{2}\right)$$