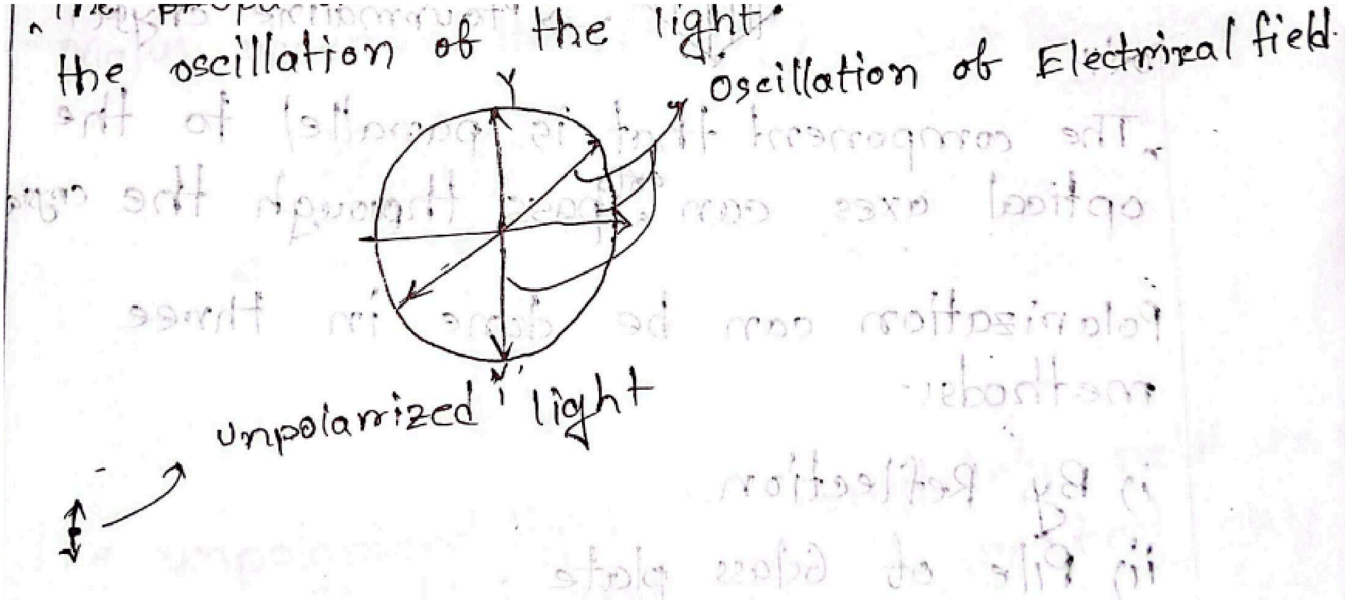
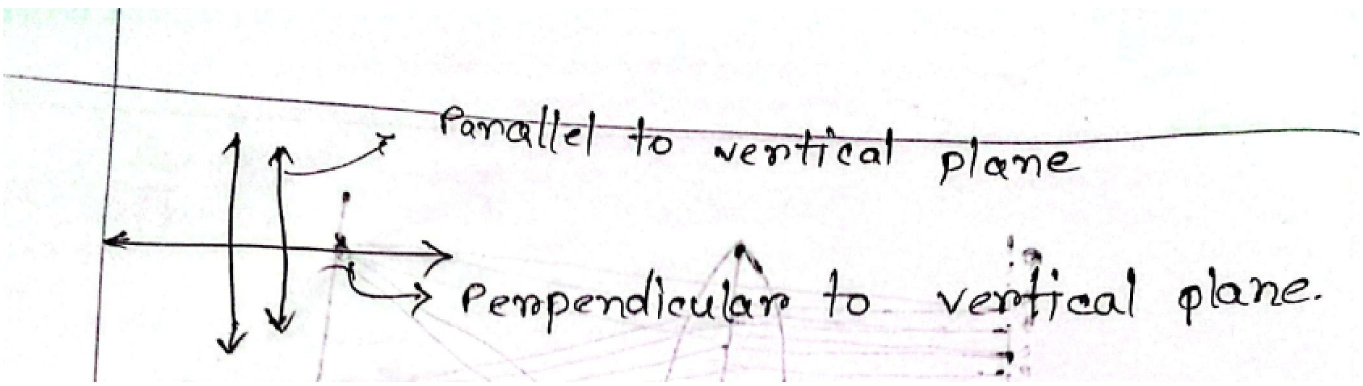
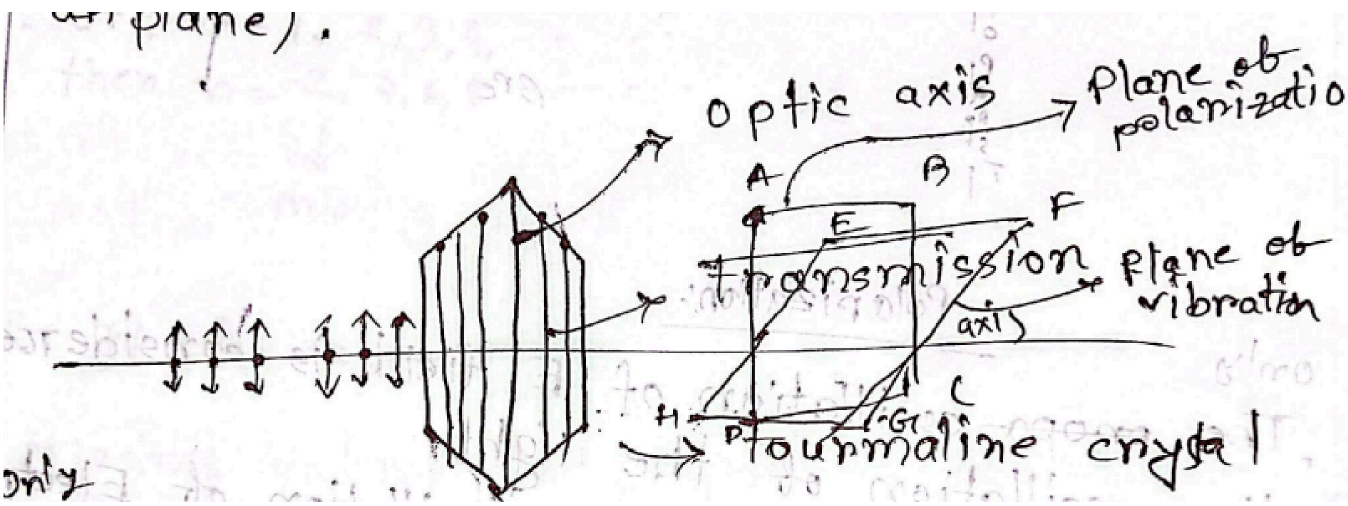
Only the oscillation of E field is considered as the oscillation of the light





Polarized light oscillates in a single plane but unpolarized light oscillates in two planes (both parallel and perpendicular to vertical plane)

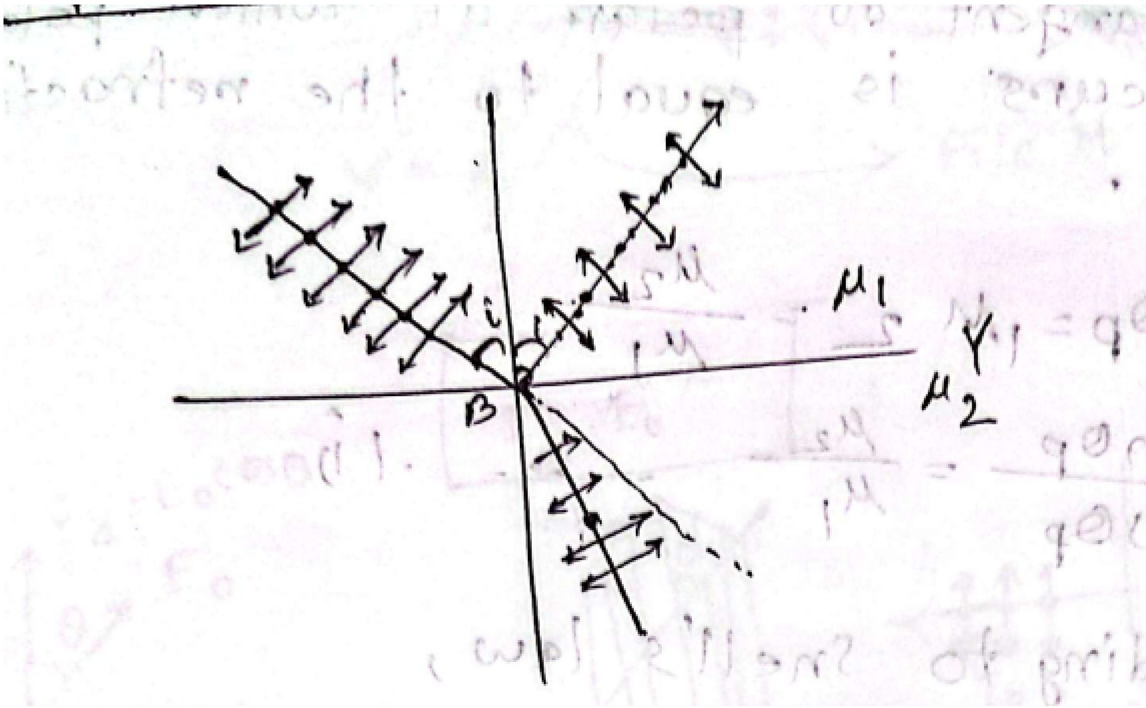


Only the components that is parallel to the optical axes can pass through the crystal.

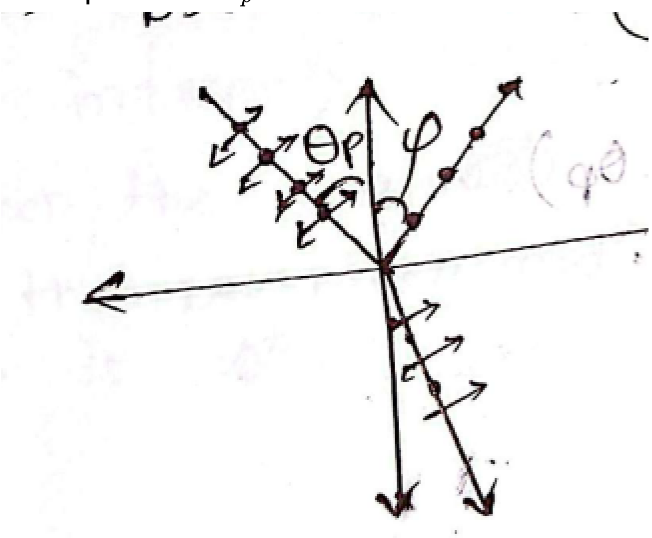
Polarization can be done in three methods

- By Reflection
- Pile of Glass Plate
- Double-Refraction

By-Reflection



For a particular θ_p of the incident Malus observed that, which is also called the polarizing angle



The unpolarized light is completely polarized after reflection and the refracted ray is partially polarized.

Brewster Law:
The tangent of the angle at which polarization occurs is equal to the refractive index

$$\tan\theta_p = \frac{\mu_2}{\mu_1} \dots (i)$$

According to Snell's Law,

$$\frac{\sin\theta_p}{\sin r} = \frac{\mu_2}{\mu_1} \ldots (ii)$$

From (i) and (ii),

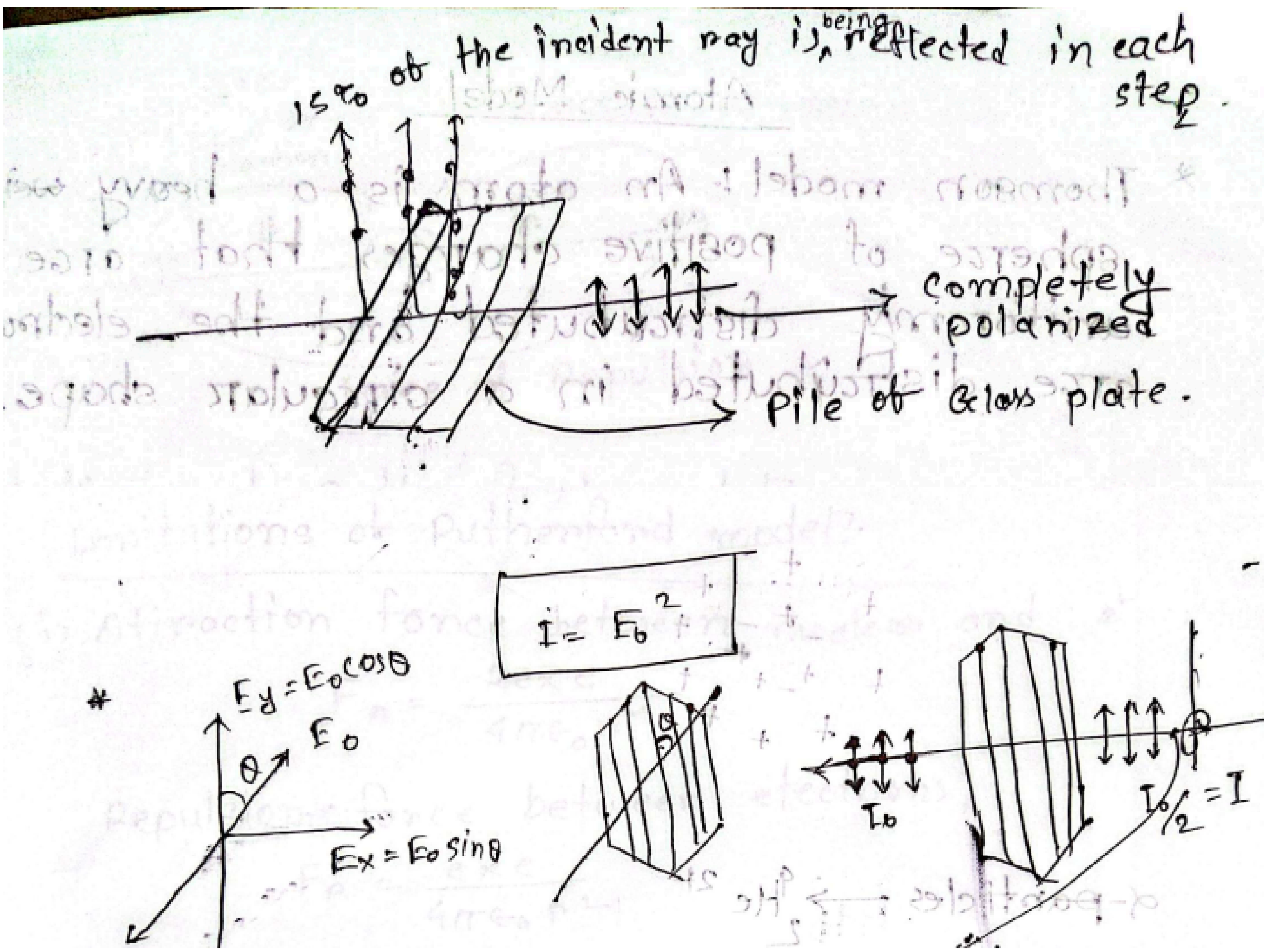
$$\frac{\sin\theta_p}{\cos\theta_p} = \frac{\sin\theta_p}{\sin r}$$

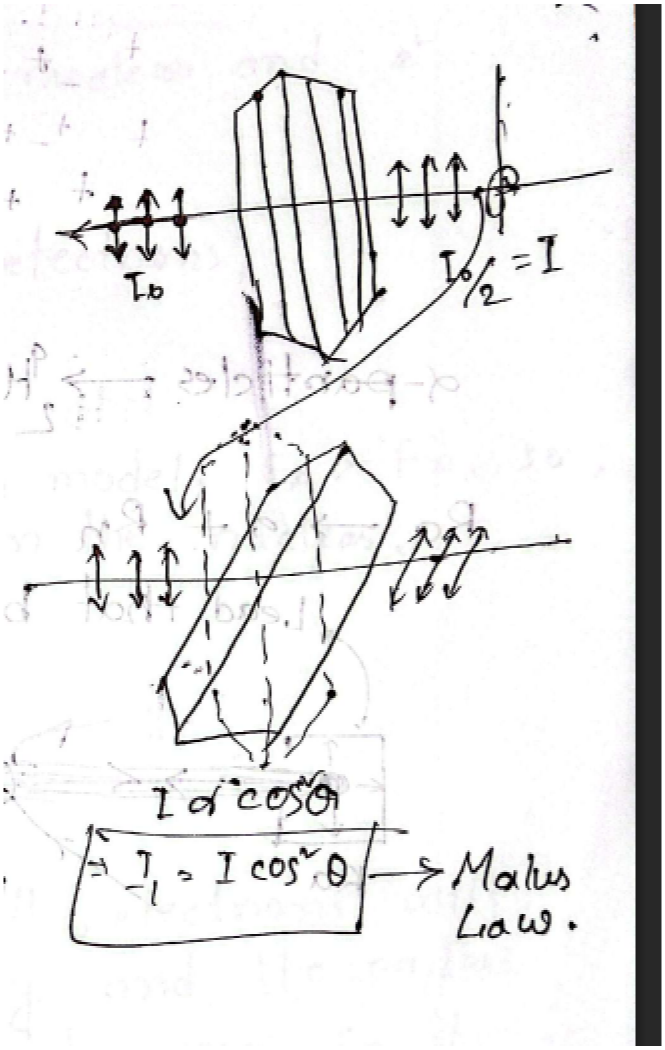
$$\Rightarrow \sin r = \cos\theta_p$$

$$\Rightarrow = \sin r = \sin(90^\circ - \theta_p)$$

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

Pile of Glass Plate





Maximum intensity is found when the angle between the polarizer and analyser is 0°.

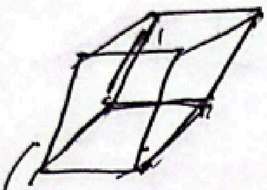
If the initial intensity of a ray is I_o
Then after going through polarizer the intensity become, $I = I_o/2$

Let the angle between polarizer and analyser be θ then the intensity after going through the analyser would be,

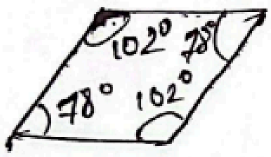
$$I_1 = I\cos^2\theta$$

Calcite Crystal $\rightarrow$ Iceland Spar

Hexagonal $(a = b \neq c)$
Small piece acts like Rhombohedron $(a = b \neq c, \alpha = \beta = \gamma \neq 90^\circ$



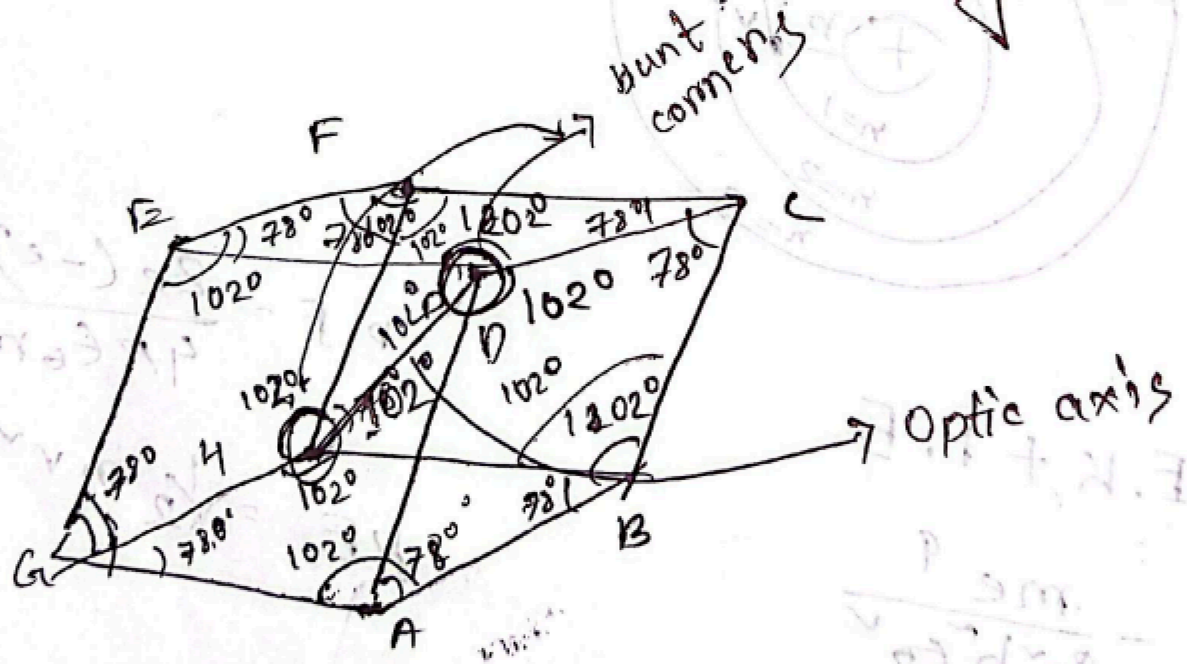
It is bounded by six Parallegram.



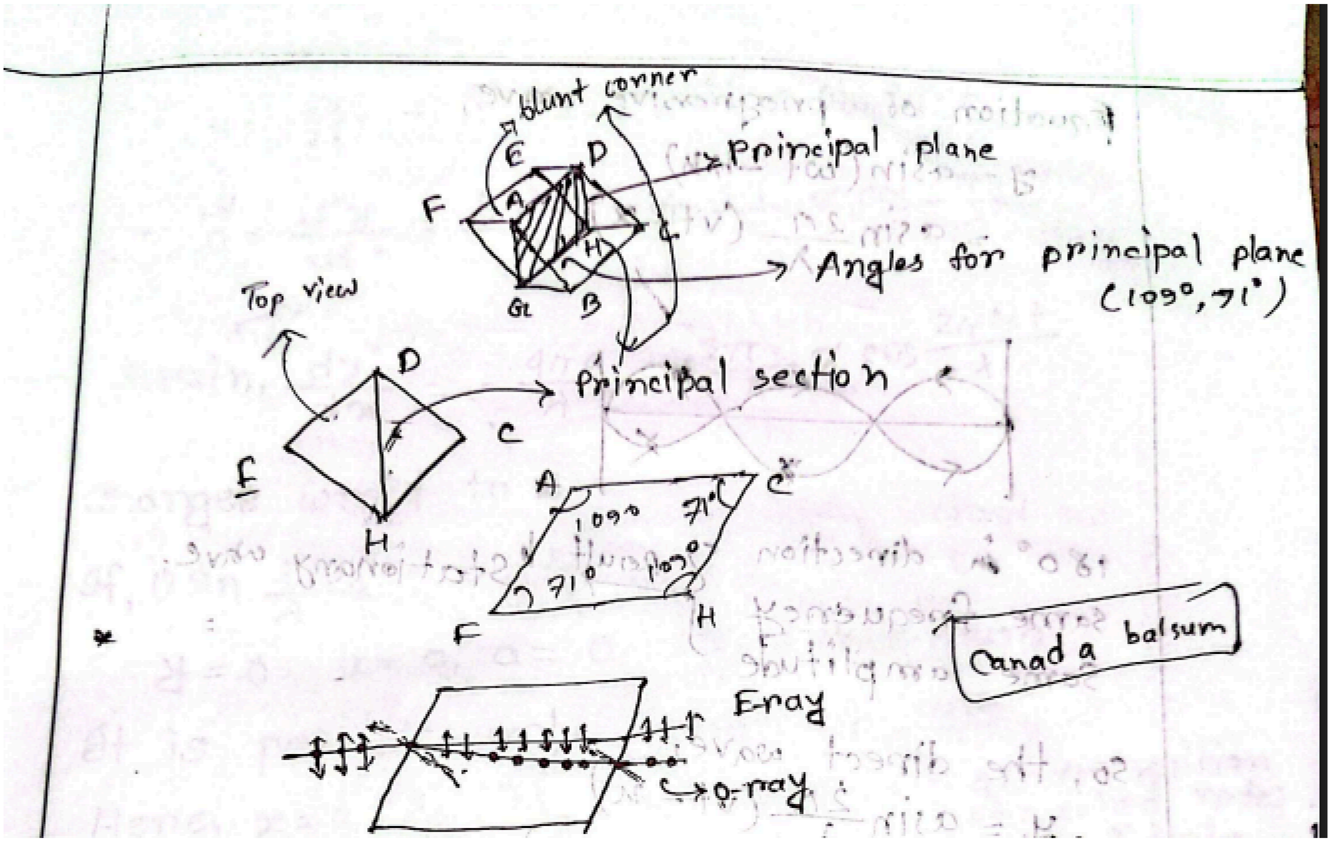
There are 8 corners.

There is two corners, where the plane meets with a similar angle of 102°

meets with a similiar angle of



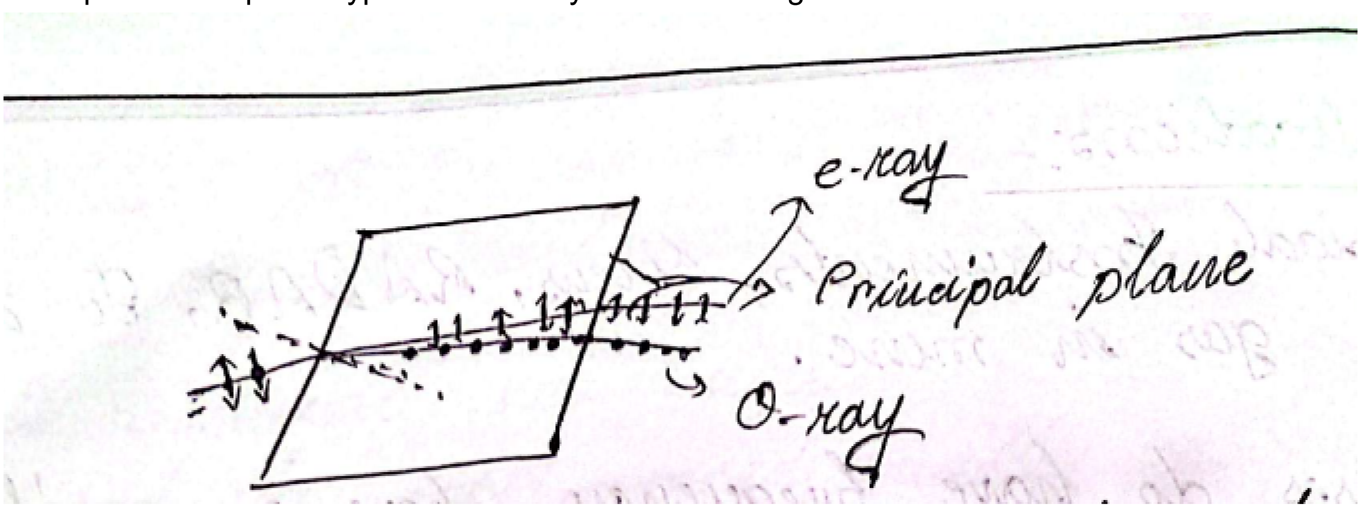
Principal Plane: The plane that contains optic axis is called principal plane.



E-ray: Do not follow the laws of refraction. Does not travel with same velocity. μ for e-ray, μ_e = 1.468

O-ray: Follow the laws of refraction. Travel with same velocity
μ for o-ray, μ_o = 1.658

Nicol prism is a special type of calcite crystal whose length is three times of the width



If the direction of incident ray is changed, then the velocity of e-ray also changes, but the velocity of o-ray remains constant.

We need a material of refractive index in between μ_e and μ_o so that internal reflection occurs for o-ray only.

Here, the transparent material used is Canada Balsam. It's refractive index is 1.550

If the critical angle is θ_c. Then,

$$\sin\theta_c = \frac{\mu_{CB}}{\mu_o}$$

$$\theta_c = 69^\circ$$