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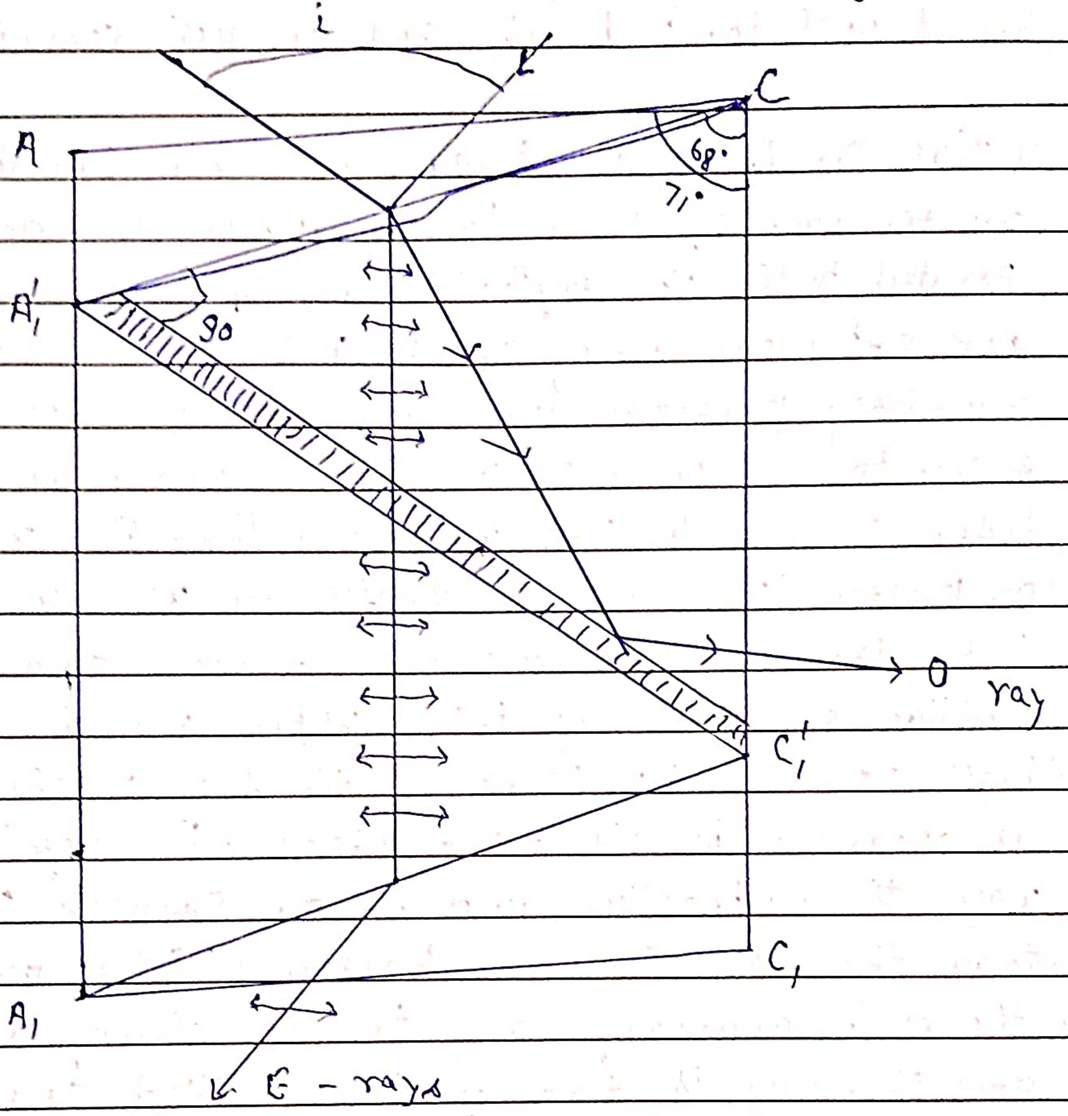
## * Nicol's Prism :—

Nicol's Prism is a device in which ordinary component of light is refracted and is cut off by total reflection, while the extra ordinary component is allowed to pass through. The construction of a Nicol Prism has been shown in the figure.




The construction of Nicol consists essentially of rhombohedron of cabcite crystal whose length is about three times its breadth. The pricipal section $ACC_1A_1A$ is parallelogram whose angles are 71' and 109°. The two end faces of the rhomb are cut down so that the original principal section $ACC_1A_1$ of it is Now reduced to $A'CC_1A_1$ and its angle reduces to 68°. The crystal is so obtained to cut into two portions by a plane $A_1'C_1'$ perpendicular to both the principal section and the end faces of the rhomb. The cut surfaces are lightly polished and cemented together by a layer of Canada Balsam makes an angle 90° with the reduced end faces. The principal section of the crystal coincides with the principal planes of both ordinary and extra ordinary rays. The sides of the prism are coated with lamp black and are kept covered with brass.

Action of Nicol as Polariser :- An incident ray falling on the end of Nicol Prism moves in a direction nearly parallel to the its length. The ray is divided into ordinary and extra ordinary components whose vibrations are respectively perpendicular and parallel to the principal section to the Nicol prism. For ordinary ray, the refractive index of calcite (1.66) is greater than the refractive index of Balsam (1.55). So the ordinary ray is refracted into the rare medium to denser and is in a position of suffering total reflection. The totally reflected light passes out through the side of the prism and is absorbed by the lamp black. For extra ordinary ray, the refractive index of calcite (1.48) is less than that of Canada Balsam (1.55), and thus the extra ordinary ray travels from rare to denser and this ray is finally transmitted and emerges out of the opposite end face. The vibration of this emergent light is parallel to the shorter diagonal $A_1C_1$ of the face $A_1B_1$ of the face. Thus we get a plane polarised light whose vibrations are parallel to the shorter diagonal of the crystal.

Action of Nicol as Analyser :-

Nicol Prism can also be used as an

analyser i.e. to detect whether a given light is plane polarised or not.

Let us suppose that a plane polarized light be made incident on one face of a Nicol, so that the direction of its vibration of amplitudes makes an angle $\theta$ with the principal section of Nicol. The two resolved components $a\cos\theta$ and $a\sin\theta$ are respectively parallel and perpendicular to the principle section of the Nicol. The component $a\cos\theta$ which is parallel to the principal section will be freely transmitted as E-ray while the component $a\sin\theta$, which is perpendicular to the principal section of Nicol will behave as the O-ray and will be cut off by the total reflection.

If Now Nicol is rotated with the ordinary rays as axis, the value of $\theta$ will change. When $\theta = 0$ i.e. when the principal section of Nicol is ~~perpendicular to the refraction~~ parallel to the vibration of incident light. The amplitude of the transmitted components will be a, which is maximum and hence the field would be bright. But when $\theta = 90°$ i.e. when the principal section of Nicol is perpendicul to the ~~Nicol~~ refraction of incident light. The amplitude of transmitted components is zero and the field will be dark.

Thus, it can be concluded that if the incident light be plane polarised, the intensity of the light transmitted through the Nicol will be greatest in one position and is zero in other position. If the incident light be unpolarised or common light, then for any position of Nicol, the vibration of the incident light can be resolved parallel and perpendicular to its pricipal section and the resultant amplitude of these two perpendicular components will always be equal.

The parallel components will pass through the Nicol, while the perpendicular components will be refused transmission and the field remain equally bright. The transmitted light will be plane polarised whose vibration will remain parallel to the principal section of Nicol.

Thus, by using Nicol, we can detect whether the given light is plane polarised or unpolarised.