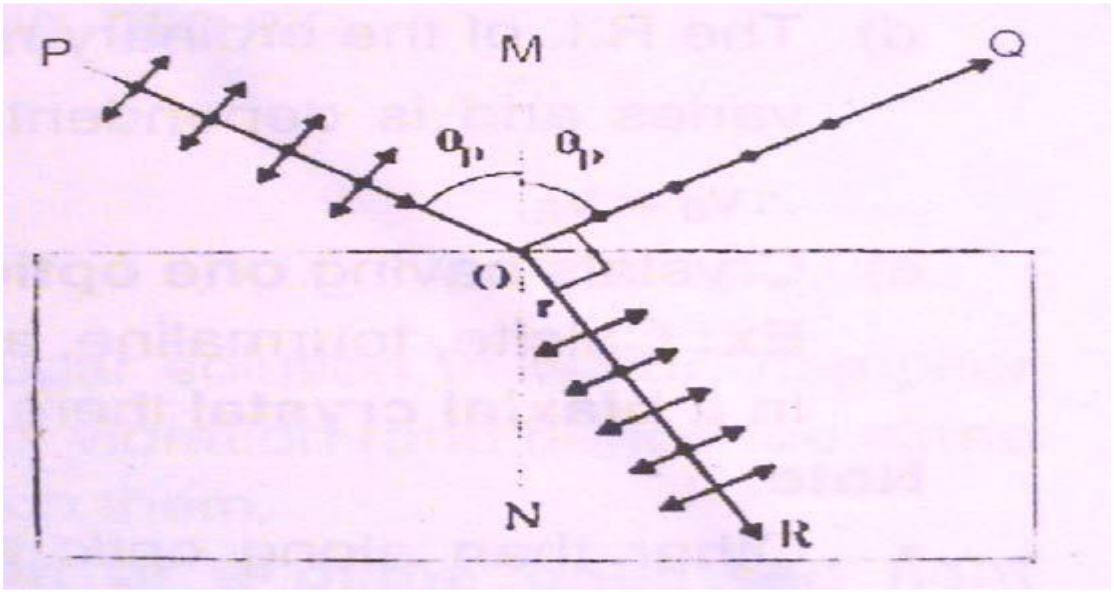
Methods of producing plane polarized light

The different methods of producing plane polarized light are
i. Reflection
ii. Refraction
iii. Double refraction and
iv. Selective absorption

1. Polarization by Reflection:-

When ordinary or unpolarized light is made to fall on the surface, (transparent) part of the light is reflected and the other part is refracted. For small angles of incidence the reflected ray is partially polarized. The degree of polarization depends on the angle of incidence. As angle of incidence is increased, the degree of polarization also increases. For one particular angle of incidence called the polarizing angle $P\theta$, the reflected light is completely plane polarized. This was discovered by Malus in the Year 1808. Later Brewster showed that at polarizing angle $P\theta$, the reflected and refracted light are perpendicular to each other. Polarized reflected light has vibrations parallel to surface and perpendicular to the plane of paper. The refracted ray is partially polarized.

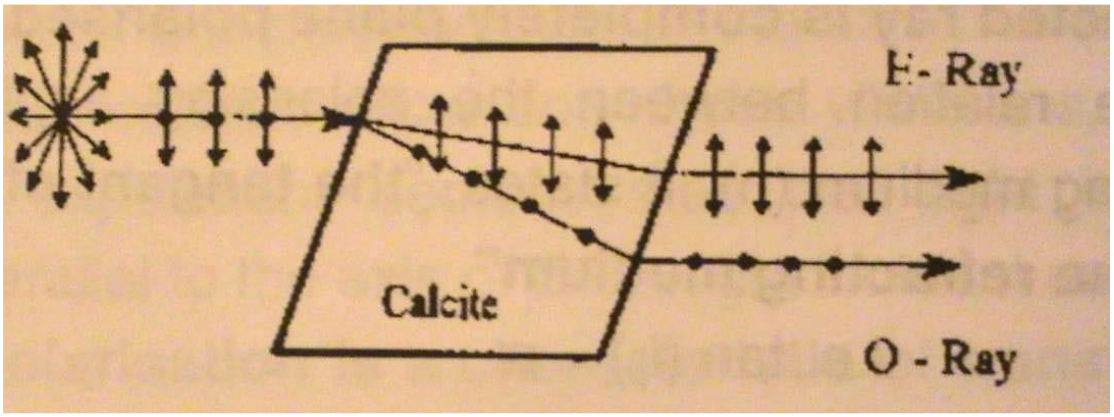


2. Polarization by pile of plates:-

Plane polarized light can be produced using pile of plates arrangement. The pile of plates arrangement consists of number of thin glass plates placed parallel to one another obliquely inside a hallow tube. When a beam of unpolarized light is incident on the 1st plate at polarizing angle, the 1st glass plate reflects 15% of the incident vibrations lying in a plane perpendicular to the plane of incidence and transmits 85% of them 100% of the vibrations in the plane of incidence are transmitted. This process is repeated at each glass plate. As a result the light emerging out of the last plate is nearly 100% plane polarized

3- Polarization by Double refraction:-

Certain crystals like quartz, mica, calcite have the property of producing two refracted rays for every ray that is incident on them.
The phenomenon of refraction where in two refracted rays are produced for a given incident ray is called double refraction or birefringence. The two refracted rays are plane polarized in mutual perpendicular planes. By eliminating one of the them, plane polarized light can be obtained. The crystals which exhibit this property are called doubly refracting crystals.



4- Polarization by Selective absorption (or) Dichroism:-

When unpolarized light is incident on a doubly refracting crystal it splits up into ordinary and extra-ordinary ray that are plane polarized in mutually perpendicular planes. As these rays pass through a crystal of suitable thickness, they are absorbed to different extents. This property is called as dichroism. And the crystal is said to be dichroic.
E. g. Tourmaline crystal