

# Polarization

## Definition:

The phenomenon of confining the vibrations of a wave to a single plane perpendicular to its propagation is called as polarization.

- Polarization can be observed only in transverse waves
- Polarization phenomenon confirms the transverse nature of a wave.

[A wave that can be polarized is a transverse wave.]

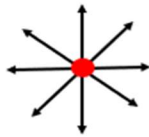
✓ In light, the vibrations are of electric and magnetic fields (*perpendicular to each other and at the same time are perpendicular to the direction of propagation of the wave*). Here, the plane of vibrations in an electric (oscillating electric field) is perpendicular to the direction of propagation of the light wave. Therefore, light is a transverse wave.

- In longitudinal waves (like sound) vibration occurs only along the direction of propagation of wave. Hence, they cannot be polarized.

## Unpolarized light:

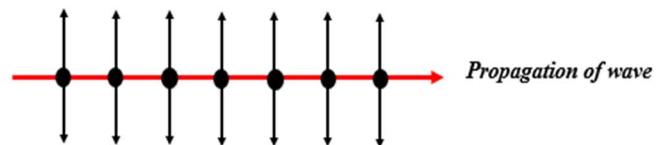
The light which consists vibrations in every plane perpendicular to the direction of propagation of wave (light) is called as unpolarized light.

- The natural light (white light from cloudless sky) is an unpolarized light.



The dot ● represent the direction of propagation of wave.  
[Perpendicular and outward of plane of paper]

The arrows represent the direction of propagation of wave.  
[Vibrating in the plane of paper]

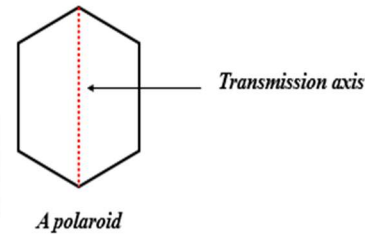


The dots and arrows indicate the vibrations.  
[Dots: vibrations perpendicular to the paper]  
[Arrows: vibrations in the plane of paper]

## Polaroid [or polarizer] [A tourmaline crystal]:

The device used to produce plane polarized light is called as polaroid. The polaroid, basically, interacts with electric fields associated with the light waves.

- All lights with electric field vector ( $\vec{E}$ ) parallel to the transmission axis are transmitted. While, EF vector perpendicular to the transmission axis are absorbed.



A polaroid

## Polarized light [plane polarized light]:

The light which consists vibrations in single plane perpendicular to the direction of propagation of wave (light) is called as polarized light.

- ✓ When an unpolarized light is passed through a polarizer, the vibration parallel to the transmission axis of the polarizer is allowed to pass through it and other vibrations are absorbed. The transmitted vibrations yield (give) polarized light [plane polarized light].

