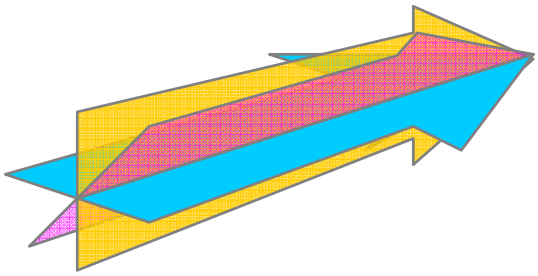
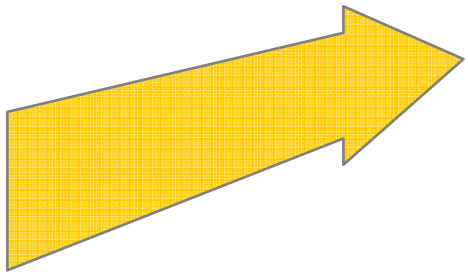
# Polarization

- In transverse waves particles move in a direction at right angles to the direction of the wave.
- However, these particles can be moving in different orientations – or planes – relative to the direction of the wave.
- When all the particles move in the same plane, a wave is said to be polarized.

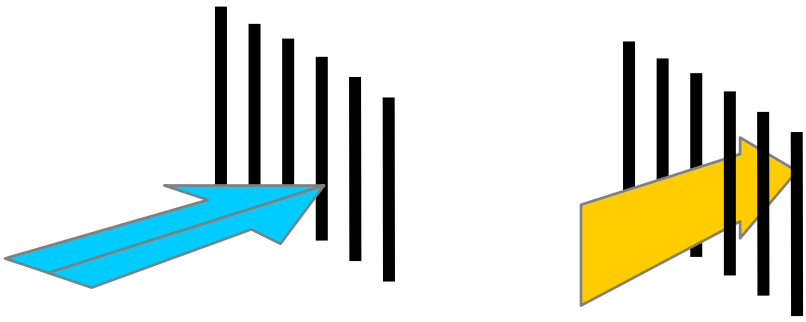


*This wave is not polarised, since particles are being displaced in three different planes.*



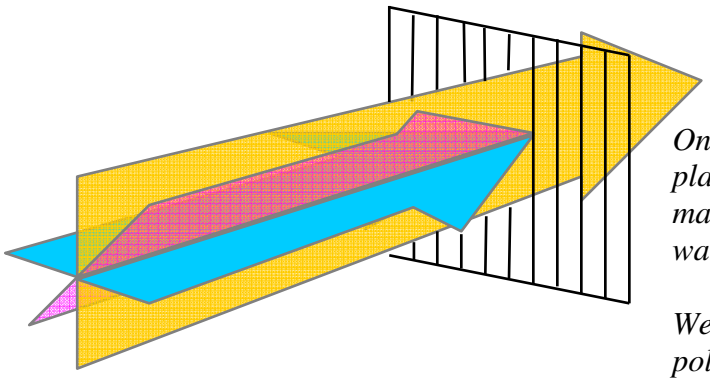
*This wave is polarised, since particles are being displaced in only one plane.*

- Plane polarized waves can be blocked by filters. For example a microwave can be blocked by a metal mesh, since the waves are not able to pass through the gaps – when the gaps are aligned perpendicular to the wave.



*Where the bars are perpendicular to the plane of polarization the wave cannot pass though.*

- Un-polarized waves can be polarized by a piece of polarized film ("Polaroid"). This film contains crystals which absorb waves in a given plane.
- White light is generally un-polarized, which waves travelling in random planes.



*Only waves in the vertical plane can pass through, making an un-polarized wave into a polarized one.*

*Were the resultant plane polarized wave to meet another Polaroid filter at $90^o$ to the first one, no light would pass through.*

- When light is reflected by a transparent insulator such as glass the reflected (and refracted) light is partially polarized. When the reflected and refracted beams of light are at right angles to each other the reflected light is completely polarized. The angle of incidence which produces this effect is called Brewster's Angle.
- This means that a Polaroid filter can block reflections – or glare – if used at the correct angle.
- For this reason anglers use Polaroid sunglasses since it reduces the glare on the water allowing them to see *into* the water better. Another application of Polaroid is in sheets used over computer monitors to cut the glare and thus make concentrating on the monitor easier.