Polaroid Glasses

Apparatus

several pairs of Polaroid sunglasses and some non-polaroid glasses

Action

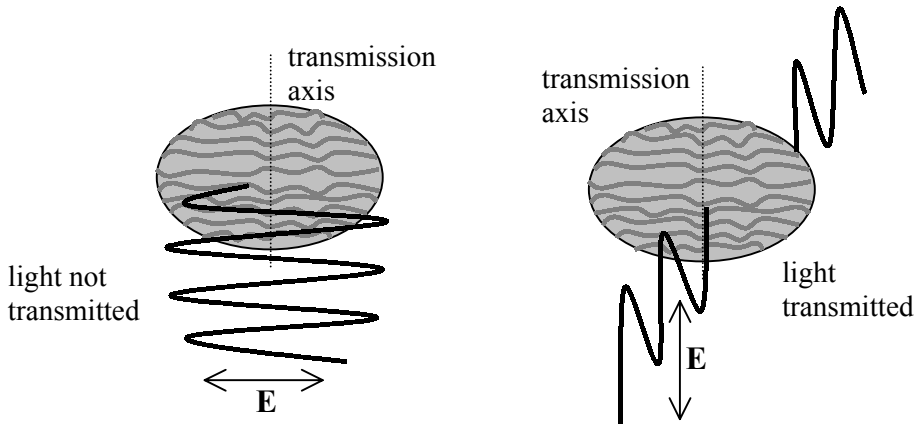
The students look through the various pairs of glasses, and determine which ones are Polaroid and which are not. By observing a reflection of sunlight off a desk top they can determine the axis of polarization of the glasses. The students look at a patch of glare through the glasses, and observe the effect of turning the lenses through 90^o.

The Physics

A pair of polaroid glasses can be found by holding two pairs of glasses at right angles and looking at a light source. When a pair is found such that light does not pass through them when the lenses are at right angles, both are polaroids. Once one pair is identified, one of the sets of polaroid glasses can be used to test the others.

Polaroid sunglasses use long chain molecules in a coating on the lenses. These molecules are aligned and have delocalised electrons, which are free to move along the chains. When light is incident on the lenses, electric fields parallel to the direction of the chains cause the electrons to oscillate, and lose energy to the electrons. Hence electric fields parallel to the molecular chains do not pass through the lenses. The transmission axis is perpendicular to the direction of the molecular chains. Electric fields in this direction pass through the lenses. Hence the lenses transmit light which has its electric field oscillating in one direction but not the other.

Sunglasses are useful for cutting out glare. The glare is due to light reflected from the horizontal surface, which is mostly horizontally polarised. Glare from water or shiny horizontal surfaces is effectively reduced by good sunglasses. Hence the transmission axis for the glasses must be vertical.



Accompanying sheet

Polaroid Glasses

Experiment with looking through the glasses.

Which ones are Polaroid, and which are not?
How can you tell?

Observe a patch of "glare" from a desk near the window.
Rotate the glasses while looking through them at the glare?
Determine which way the transmission axis of the glasses goes.