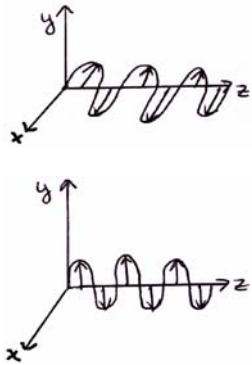


Linear Polarizers: Information & Instructions

What is polarization?

Light is a transverse wave, which means that the electric field of the light is always perpendicular to the direction of travel of the light. To picture this, imagine two people holding a jump rope. One person holds their end still, while the other person begins to move their arm up and down. The wave that has been created in the rope appears to be moving down the rope, but the individual bumps in the rope are moving up and down.



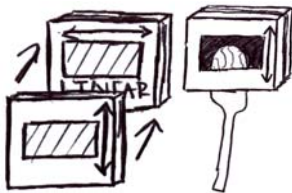
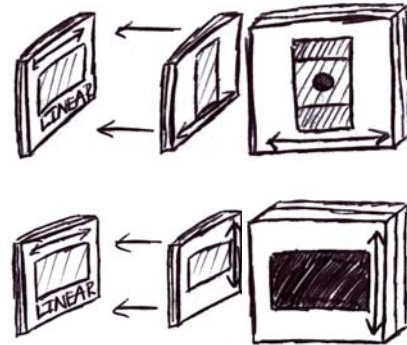
Although the electric field must always be perpendicular to the direction of propagation, it does not necessarily have to be oriented the same way at every point in time. As long as the two fields are perpendicular, the electric field can point in any direction at any point in time. For example, the electric field could be pointing horizontally (along the x-axis) at one point in time, and then be pointing vertically (along the y-axis) at another point in time. When the direction in which the electric field points is always parallel to some line in the x-y plane then we can say that the light is linearly polarized (see the pictures to the left for examples). Sunlight is unpolarized, as are most overhead lights. However, there are certain ways in which sunlight (and other light) can become polarized, and one of those ways is with a linear polarizer.

What is a linear polarizer?

Linear polarizers are materials that transmit only one particular polarization of light (i.e. light vibrating in one direction). You may notice a marking on the polarizers you were given; this marking is used to distinguish the axis of polarization. If the arrow is pointing horizontally, the polarizer will pass only the horizontal component of light, and it will completely block the vertical component. If the polarizer is rotated so that the arrow is pointing vertically, the polarizer will pass the vertical component of light and block the horizontal component.

How to use your linear polarizers to create a linear polariscope

A **linear polariscope** is a combination of two linear polarizers that can be thought of as a polarizer and an analyzer. The first polarizer (the first one which the light you are observing passes through) polarizes the light by blocking one component of it. The second polarizer can be used to analyze this light, meaning it can be used to tell which way the light is now polarized. Try making a polariscope by taking two sheets of polarizer and putting them together so their axes of polarization are parallel. Place the sheets on an overhead projector or hold them up to a ceiling light and notice that you can see through them. Now rotate the second polarizer until its axis of polarization is perpendicular to that of the first, and try looking through again. You will see that all light is blocked from passing through!



Some objects, for example transparent plastic objects, become birefringent when they are under stress, which means they will change the polarization of light passing through them. Polariscopes can be used to analyze this. Set up your polariscope so that the axes of the two linear polarizers are perpendicular. Observe the stress in small plastic objects, such as clear plastic silverware, by placing them in between the two polarizers in your polariscope. Each color you see corresponds to a different amount of stress.