In this section of Resonance, we invite readers to pose questions likely to be raised in a classroom situation. We may suggest strategies for dealing with them, or invite responses, or both. "Classroom" is equally a forum for raising broader issues and sharing personal experiences and viewpoints on matters related to teaching and learning science.

Polarization of Light — An Experimental Approach

This article briefly explains the theory of polarization with an emphasis on experimental aspects pertaining to colour separation and viewing optical stresses. These experiments can be conducted very easily using simple materials available in the local market. A high school student or any interested person can perform these experiments. Although the experiments are based on the basic theory explained in standard text books on physics, these books do not suggest the kind of experiments described here.

Introduction

Waves can be classified as longitudinal and transverse. A sound wave in a fluid is an example of a longitudinal wave, while light is an example of a transverse wave. Another example of a transverse wave is a jerk given at one end to a taut string which is fixed at the other end. Certain phenomena such as reflection, interference and diffraction can be observed with any type of wave. However, there is one phenomenon which is based on the transverse nature of waves and that is polarization. Obviously, this can be observed only in case of light, not sound in air.
Explanation

Let us assume we are in a room with a window having vertical bars only. A long string is tied at one end to a tree outside and the other end is in the room. The string is kept taut by pulling it by hand.

In the first stage, we give a vertical jerk to the string. The oscillation will be in a vertical direction and will travel along the length of the string. This is transverse vibration and is perpendicular to the direction of propagation of the oscillation. Clearly, this oscillatory motion will pass through the window bars since they are also vertical and will not obstruct the motion. If a horizontal jerk is given to the string, the oscillation will not pass through the window as the vertical bars will oppose it.

In the second stage, we consider that there is one more window beyond the first window with its bars horizontal. Now, if we repeat our experiment, the oscillations will pass only through the first window but not through the second window.

Here we have considered the waves or disturbance created in the string, which is of transverse nature. Light waves are also transverse waves. The difference between our example and the light waves is that the string motion was only up and down while for the light it is present in all possible directions perpendicular to the direction of propagation of light. There are special ‘windows’ which will allow only a particular direction of vibration to pass through it. Such a ‘window’ is called a ‘Polarizer’ or a ‘Polaroid’. Figure 1 shows the mechanism of polarization.

Polarization in Nature

In nature, there are two simple ways to get polarized light. One is scattering of light by air. The sunlight is scattered by air and we get sky light as polarized light. Another example is the phenomenon of reflection of light from nonmetallic surfaces.