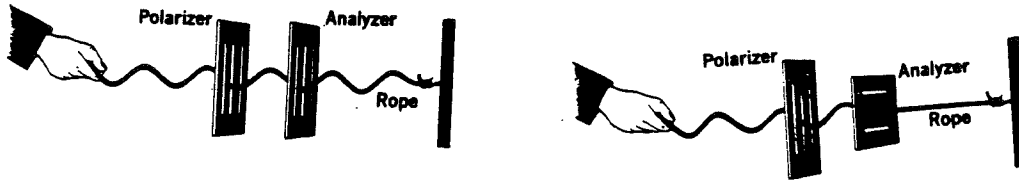


## SPASH PHYSICS POLARIZATION

Plane-polarized light is light in which the oscillations are confined to a single plane that is perpendicular to the line of propagation.

Polarization is a property of transverse waves.



The three ways to polarize light are:

1. **Selective absorption:** It has long been known that certain crystalline substances transmit light in one plane of polarization and absorb light in other polarization planes. Tourmaline is such a material. This property of crystals in which one polarized component of incident light is absorbed and the other is transmitted is called **dichroism**.
- 2.
3. **Polarization by reflection:** Sunlight reflected from the surface of calm water or from a level highway can be quite objectionable to the observer. Sunglasses made of polarizing films reduce the intensity of these reflections. By rotating the lenses slightly from side to side the reflections are seen to pass through a minimum, indicating that these rays are partially polarized.  
Ordinary light incident obliquely on the surface of a glass plate is partly reflected and partly refracted. Both the transmitted and the reflected beams are partly polarized.
3. **Polarization by refraction:** If a thick glass plate is placed on a printed page, the print viewed through the glass may appear displaced due to refraction. A natural crystal of calcite placed on the page shows two refracted images of the print. Upon entering a doubly refracting crystal such as calcite, a beam of unpolarized light can divide into two beams at the crystal surface. Analysis of these separate beams with polarizing disks reveals that they are plane-polarized with their planes of polarization perpendicular to each other.

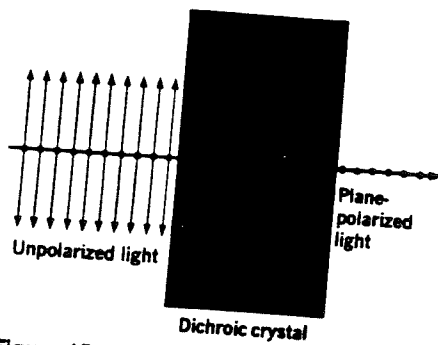
## INTERFERENCE PATTERNS

Materials, such as glass and lucite, that become doubly refracting when subjected to mechanical stress are said to be photoelastic. When a photoelastic material is placed between polarizing and analyzing disks, the strain patterns (and thus the stress distributions) are revealed by interference fringes. Those waves from the two beams having a phase difference of an odd number of half wavelengths interfere destructively, the corresponding color is removed, and its complement is observed.

Problems:

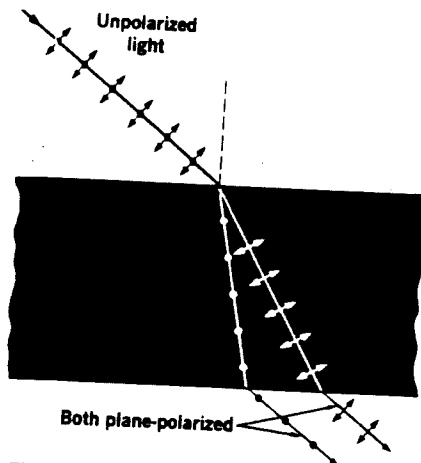
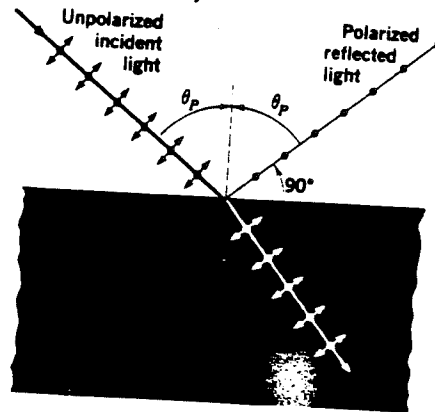
1. What time is required for sound to travel 5.00 km if the temperature of the air is 10 degrees C?
2. A locomotive approaches a crossing at 95 km/hr. Its horn has a frequency of 288 hz and the temperature is 15 degrees C. What is the frequency of the sound heard by the guard at the crossing?

## Selective absorption



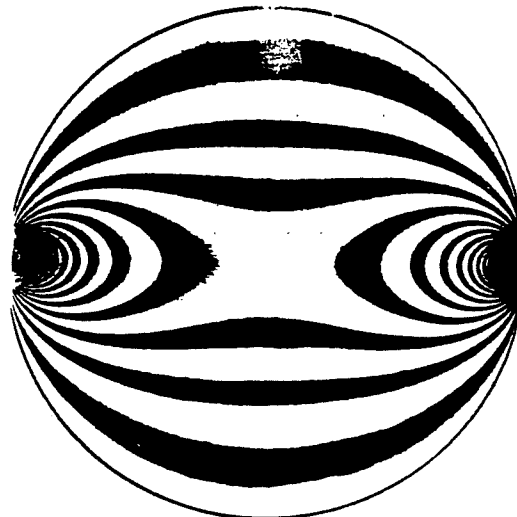
**Figure 15-11** Polarization by selective absorption.

**Figure 15-13** At the polarizing angle, the reflected light is completely polarized but of low intensity.



**Figure 15-15** Double refraction. Light in one polarization plane conforms to Snell's law; light in the other plane does not.

## Interference patterns



**Figure 15-16** Strain patterns in a cylindrical disk subjected to diametrical compression.