

## Solution

In this experiment the results from one experimental stage are used to solve problems in the following experimental stages. Without actually performing all parts of the experiment, solution cannot be meaningfully discussed.

It suffices that some transparent crystals are anisotropic, meaning their optical properties vary with the direction. Crystals which have this property are said to be doubly refracting or exhibit birefringence.

This phenomenon can be understood on the basis of wave theory. When a wavefront enters a birefringent material, two sets of Huygens wavelets propagate from every point of the entering wavefront causing the incident light to split into two components of two different velocities. In some crystals there is a particular direction (or rather a set of parallel directions) in which the velocities of the two components are the same. This direction is known as optic axes. The former is said to be uniaxial, and the latter biaxial.

If a plane polarized light (which may be white light or monochromatic light) is allowed to enter a uniaxial birefringent material, with its plane of polarization making some angle, say  $45^\circ$  with the optic axis, the incident light is splitted into two components (ordinary and extraordinary) travelling with two different velocities. Because of different velocities their phases differ.

Upon emerging from the crystal, the two components recombine to form a resultant wave. The phase difference between the two components causes the resultant wave to be either linearly or circularly or elliptical polarized depending on the phase difference between the two components. The type of polarization can be determined by means of an analyser which is a second polaroid sheet provided for this experiment.