

POLARIZING FILM EXPERIMENTS

Directions:

Read this document as a group. Work together to prepare the needed elements of a lab report on a separate sheet of paper. Be sure to include all the parts of the lab report and in the correct order. Allow room for data table and diagrams.

Introduction:

The purpose of this lab to is familiarize you with the concept of polarizing.

Polarizing:

Waves that have been sorted by a filter to vibrate in only one plane are said to be polarized. All waves can be polarized. See diagram below for a simplification of this process.

This film sorts light waves so that only waves in a single plane can pass through it. The film has been treated to polarize, or *angularly select*, light rays passing through it. Thus, two pieces of film at right angles will block virtually all light. The film, like calcite crystal, causes double refraction of incident light and like tourmaline (another mineral), absorbs one of the two rays.

Polarizing film is widely used by industry to detect flaws and strain lines in transparent glass and plastic products. The item is placed between two films, and one is rotated until chromatic (color) patterns are observed. Strain free sections show little or no color. Poorly annealed glass or swiftly cooled plastic sections show vivid chromatic patterns.

Pre -lab Questions.

Name another area where polarizing film might be useful.

Why do light waves travel in more than one direction simultaneously?

Do you think it is possible to polarize waves in the non-visible spectrum?

Procedures:

Many simple experiments can be done using a cardboard tube 1 to 2" in diameter and 4 to 8" long.

Basic procedure. Do this first

Tape a mounted polarizing film against one end of a tube.
Hold second film over near end of tube.
Point tube toward a light and rotate the loose film.
Notice light is eliminated as polarizers are in perfectly crossed positions.

Variable procedures do these later.

a.) Crumple a piece of cellophane or cellophane tape and insert it into a tube to light while rotating loose film against end. Note how cellophane changes colors. (Collect Data)

b.) A surprising effect can be observed by introducing a translucent film (eg. wax paper) between two polarizing films. The wax paper is mixer of light. Note It's effects on the light in your tube. (collect data)

c.) Polarizing film can reduce or eliminate glare from reflecting surfaces. Place a coin in a shallow dish of water and place the dish beneath a light source. Adjust the light until its reflection obscures the coin. Now view the water surface through a single polarizing film. Note whether the coin becomes more visible. What happens if you add a second polarizing film to the other end of your tube? (Data)

d.)**Rotating polarized light with Karo syrup.**To see the effect of wavelength on the rotation of polarized light by a thick solution of sugar, let the light from a nearby bulb shine through a container of KaroSyrup. Place a polarizing film on each side of the syrup **outside of the container**. Keep one polarizer steady while you rotate the other. What colors do you see ? **Note** how the colors change as you rotate the polarizer.

e.) Hold a mirror between your eye and the polarizer that you are rotating. Can you with careful adjustment get the light beam to split?

f.) Use the small clear plastic box filled with Karo syrup and a prism to make the next observations. Place the box above the light source. Place a piece of the polarizing film above and below the box but between the box and the light source. Rotate the polarizer above the box and observe the colors that you see. Draw a diagram of your observations.

g.) Repeat this Procedure with a prism **in** the box of Karo syrup. Put the polarizers above and below the prism but outside of the box. Carefully wash everything when you are finished.

Materials:

After having read the instructions above **highlight** the materials that you will need and then list them on a separate sheet of paper. Send your materials manager to collect the materials listed.

Purpose:

Now that you have read the instructions of the lab what do you think you will learn or understand from these experiments? Write out the purpose in the purpose section of the lab report.

Discussion/Conclusion :

1. After having completed these activities what did you learn about light and polarizing?
2. Where else have you seen polarizers or diffraction gradient used?
3. Are there things around your house that act like polarizers, what are they?