Teacher Reference

Introduction:
A pair of polarizing filters is used initially to review or to introduce briefly the concept of polarization. The process of optical reflection polarizes light parallel to the reflecting surface. This is the reason that polarized sunglass lenses are uniformly oriented vertically, so that the glare of horizontally polarized light reflecting off of level ground or water is filtered out. The polarizing effect of reflection is demonstrated in contrast to the lack of polarization in refracted light. Variation of the incident angle is used to explore the variation of polarization over different amounts of reflection. The reflected angle at which polarization is maximized is called Brewster’s Angle.

A few common terms carry specific setup and procedure meanings in this lab:
“Position” is used uniformly to describe the placement of Polarizers, frequently associated with degrees of angle around the perimeter of the Ray Table.
“Orientation” is used uniformly to describe the relationship of a Polarizer to other polarizing components in the lab, always in terms of degrees of angular rotation away from a vertical zero degree reference.

These observations benefit tremendously from a darkened environment. Light intensity may be observed by looking through the Polarizer at the emerging light beams. In well-darkened environments, it may be possible to project the transmitted image of the illuminated slit on a small white card or paper out past the Polarizer. A comparative scale of relative “lightness” or “darkness” would be helpful for making moderately quantified observations of the transmitted light intensity in each case.

Equipment:
Optical Bench

Keywords:
polarization, incident, reflected, transmitted

Answers:
In the first setup, using two polarizers, the brightness should be greatest at 0 and 180 degrees, diminishing to quite dim at 90 degrees.

In the refractive setup, the brightness should be relatively constant, as refraction does not polarize light.

In the reflective setup, the maximum variation in brightness observed by turning the polarizer should be seen at incident angles of 50-60 degrees. This is roughly Brewster’s angle for this material. At angles further from these angles, you should see about the same brightness at all positionings of the polarizer.