Acrylic Hollow Prism

P2-7020

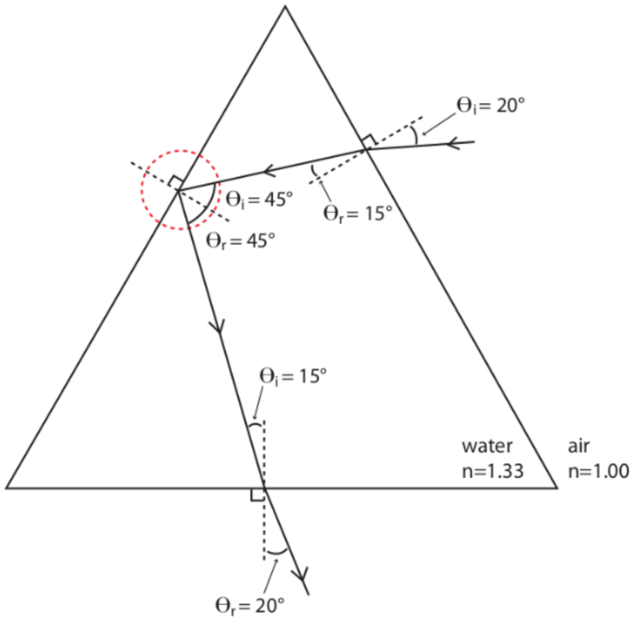
INSTRUCTIONAL GUIDE

Background

At first, Sir Isaac Newton believed that white light was colorless and that the prisms alone produced the colored spectrum. However, Newton's experiments convinced him that all the colors already existed in the light, and that light consisted of particles of different colors traveling with different speeds through the prism. Later, scientists Young and Fresnel showed that color is determined by light's wavelength, not particles of different sizes as Newton had thought.

When white light enters a prism, it exits as a spectrum of colors. This is due to a phenomenon called dispersion. A medium that causes dispersion is known as refractive, because it has a characteristic known as an index of refraction (n). This refractive index is dependent on the wavelength of light moving through a medium, and so light that is white in air is separated when it enters a refractive medium such as water. We can predict where light rays go using Snell's Law, which uses indices of refraction as a factor to represent how much a light ray slows down when it enters a refractive medium (see the ray-tracing diagram below). Different media have different indices of refraction and will slow down the light entering them by different amounts

Experiment



This hollow prism can be filled with various substances; water, various oils, corn syrup, alcohols, etc. for light experiments. White light can be passed through the prism to demonstrate dispersion. Using a red and a green laser, you can demonstrate the refraction of separate colors in the prism and how the colors (wavelengths) are not altered by the prism. In addition, prisms are used in fine quality optical instruments as "mirrors" demonstrating a phenomenon known as total internal reflection.

For example, total internal reflection can be demonstrated when the angle of incidence, θ_i, is greater than the critical angle, θ_C. For water, the critical angle is 42°. This angle is measured from the normal, or perpendicular line to the edge of the prism. On the reverse, we see a diagram that shows the normal lines (dotted) and where total internal reflection is taking place (circled in red). The light ray as pictured will not pass out of the prism, but will reflect completely as if the surface were a mirror.