Hollow Prism

33-0235

BACKGROUND:

Sir Isaac Newton believed that white light was colorless and that the prisms alone produced the colored spectrum. Newton's experiments, however, 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.

Light changes speed as it moves from one substance to another (for example, from air into water). This change in speed causes the light to be bent (refracted) and enter the new substance at a different angle. Each wavelength or color of light that passes through a specific substance has its own optical density called the Index of Refraction. When white light is passed through a prism, each component color is refracted differently; red refracting less, violet refracting more. A spectrum of colors results because of the different speeds each color of light has in the substance; red with a faster speed, violet with a slower speed. This phenomenon of producing separating white light into its spectrum of colors is known as dispersion.

HOW TO USE:

Fill this equilateral prism with any liquid – water, mineral oil, glycerin, colored water, etc. and discover the resulting spectrum.

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, if the prism is filled with water, a laser could easily demonstrate this concept. Using the diagram as a guide, point the laser so that the light ray strikes the inside wall of the prism at an angle greater than 42º (Critical Angle…The angle for which Total Internal Reflection will occur in water). The light ray will not pass out of the prism, but reflect completely as if the surface was a perfect mirror.