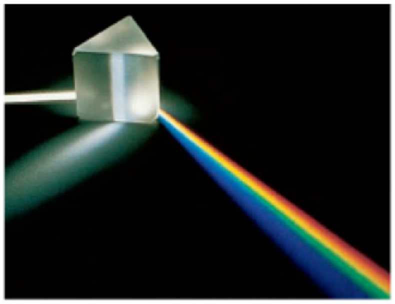

FIGURE 24–13 White light passing through a prism is broken down into its constituent colors.

[The wavelengths of visible light are measured in air to be 400 nm to 750 nm, and this range is what we usually quote. But, as we shall see in Chapter 25, the interior of the eye is filled with a fluid with index of refraction $n \approx 1.4$, so the wavelengths where they actually reach our retinas are smaller by this factor, Eq. 24–1.]

A prism separates white light into a rainbow of colors, as shown in Fig. 24–13. This happens because the index of refraction of a material depends on the wavelength, as shown for several materials in Fig. 24–14. White light is a mixture of all visible wavelengths, and when incident on a prism, as in Fig. 24–15, the different wavelengths are bent to varying degrees. Because the index of refraction is greater for the shorter wavelengths, violet light is bent the most and red the least. This spreading of white light into the full spectrum is called **dispersion**.

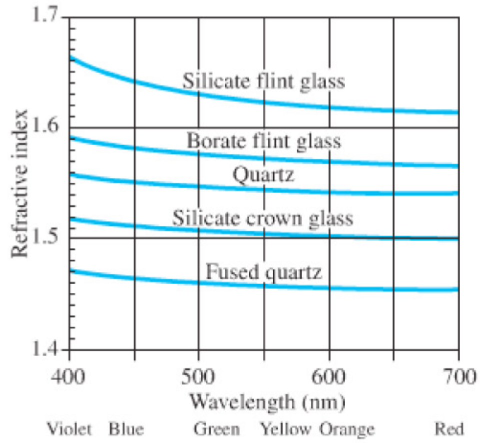


FIGURE 24–14 Index of refraction as a function of wavelength for various transparent solids.

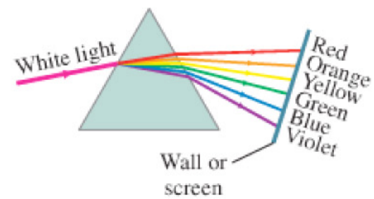


FIGURE 24–15 White light dispersed by a prism into the visible spectrum.

PHYSICS APPLIED
*Rainbows*

Rainbows are a spectacular example of dispersion—by drops of water. You can see rainbows when you look at falling water droplets with the Sun behind you. Figure 24–16 shows how red and violet rays are bent by spherical water droplets and are reflected off the back surface. Red is bent the least and so reaches the observer's eyes from droplets higher in the sky, as shown in the diagram. Thus the top of the rainbow is red.

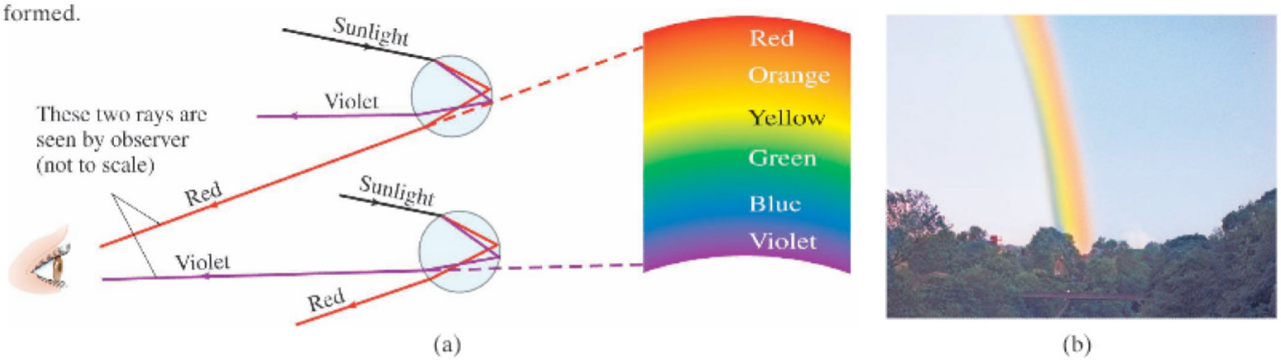


FIGURE 24–16 (a) Ray diagram explaining how a rainbow (b) is formed.

FIGURE 24–17 Diamond.

Diamonds achieve their brilliance (Fig. 24–17) from a combination of dispersion and total internal reflection. Because diamonds have a very high index of refraction of about 2.4, the critical angle for total internal reflection is only 25°. The light dispersed into a spectrum inside the diamond therefore strikes many of the internal surfaces before it strikes one at less than 25° and emerges. After many such reflections, the light has traveled far enough that the colors have become sufficiently separated to be seen individually and brilliantly by the eye after leaving the crystal.