

PRACTICE C

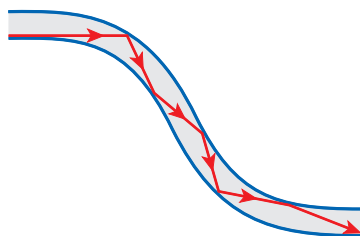
Critical Angle

1. Glycerine is used to make soap and other personal care products. Find the critical angle for light traveling from glycerine ($n = 1.473$) into air.
2. Calculate the critical angle for light traveling from glycerine ($n = 1.473$) into water ($n = 1.333$).
3. Ice has a lower index of refraction than water. Find the critical angle for light traveling from ice ($n = 1.309$) into air.
4. Which has a smaller critical angle in air, diamond ($n = 2.419$) or cubic zirconia ($n = 2.20$)? Show your work.

Why it Matters

Fiber Optics

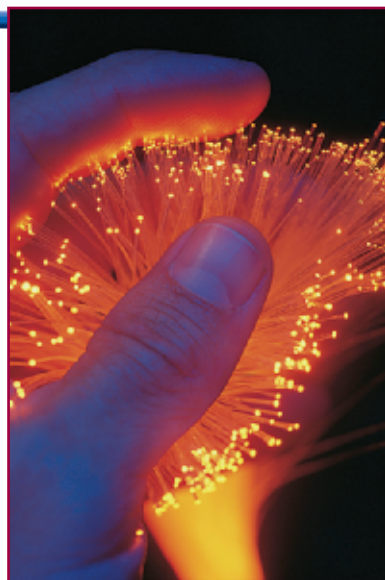
Another interesting application of total internal reflection is the use of glass or transparent plastic rods, like the ones shown in the photograph, to transfer light from one place to another. As indicated in the illustration below, light is confined to traveling within the rods, even around gentle curves, as a result of successive internal



Light is guided along a fiber by multiple internal reflections.

reflections. Such a *light pipe* can be flexible if thin fibers rather than thick rods are used. If a bundle of parallel fibers is used to construct an optical transmission line, images can be transferred from one point to another.

This technique is used in a technology known as *fiber optics*. Very little light intensity is lost in these fibers as a result of reflections on the sides. Any loss of intensity is due essentially to reflections from the two ends and absorption by the fiber material. Fiber-optic devices are particularly useful for viewing images produced at inaccessible locations. For example, a fiber-optic cable can be threaded through the esophagus and into the stomach to look for ulcers.



Fiber optic cables are widely used in telecommunications because the fibers can carry much higher volumes of telephone calls and computer signals than can electrical wires.