SECTION 2

Diffraction

SECTION OBJECTIVES

- **Describe how light waves bend around obstacles and produce bright and dark fringes.**
- **Calculate the positions of fringes for a diffraction grating.**
- **Describe how diffraction determines an optical instrument's ability to resolve images.**

THE BENDING OF LIGHT WAVES

If you stand near the corner of a building, you can hear someone who is talking around the corner, but you cannot see the person. The reason is that sound waves are able to bend around the corner. In a similar fashion, water waves bend around obstacles, such as the barriers shown in **Figure 10.** Light waves can also bend around obstacles, but because of their short wavelengths, the amount they bend is too small to be easily observed.

If light traveled only in straight lines, you would not be able to observe an interference pattern in the double-slit demonstration. Instead, you would see two thin strips of light where each slit and the source were lined up perfectly. The rest of the screen would be completely dark. The edges of the slits would appear on the screen as sharply defined shadows. But this does not happen. Some of the light bends to the right and to the left as it passes through each slit.

The bending of light as it passes through each of the two slits can be understood using Huygens' principle, which states that any point on a wave front can be treated as a point source of waves. Because each slit serves as a point source of light, the waves spread out from the slits. The result is that light deviates from a straight-line path and enters the region that would otherwise be shadowed. This divergence of light from its initial direction of travel is called **diffraction.**

diffraction

a change in the direction of a wave when the wave encounters an obstacle, an opening, or an edge

In general, diffraction occurs when waves pass through small openings, around obstacles, or by sharp edges. When a wide slit (1 mm or more) is placed between a distant light source and a screen, the light produces a bright rectangle with clearly marked edges on the screen. But if the slit is gradually

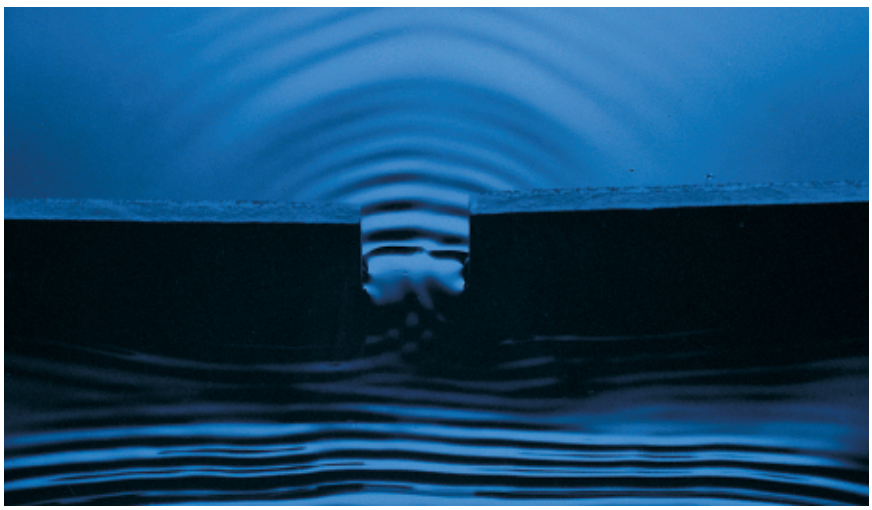

Figure 10
A property of all waves is that they bend, or *diffract,* around objects.