SECTION 1

Refraction

SECTION OBJECTIVES

- Recognize situations in which refraction will occur.
- Identify which direction light will bend when it passes from one medium to another.
- Solve problems using Snell's law.

refraction

the bending of a wave front as the wave front passes between two substances in which the speed of the wave differs

REFRACTION OF LIGHT

Look at the tiny image of the flower that appears in the water droplet in **Figure 1.** The blurred flower can be seen in the background of the photo. Why does the flower look different when viewed through the droplet? This phenomenon occurs because light is bent at the boundary between the water and the air around it. The bending of light as it travels from one medium to another is called **refraction.**

If light travels from one transparent medium to another at any angle other than straight on (normal to the surface), the light ray changes direction when it meets the boundary. As in the case of reflection, the angles of the incoming and refracted rays are measured with respect to the normal. For studying refraction, the normal line is extended into the refracting medium, as shown in **Figure 2.** The angle between the refracted ray and the normal is called the *angle of refraction,* θ_r, and the angle of incidence is designated as θ_i.

Figure 1
The flower looks small when viewed through the water droplet. The light from the flower is bent because of the shape of the water droplet and the change in material as the light passes through the water.

Refraction occurs when light's velocity changes

Glass, water, ice, diamonds, and quartz are all examples of transparent media through which light can pass. The speed of light in each of these materials is different. The speed of light in water, for instance, is less than the speed of light in air. And the speed of light in glass is less than the speed of light in water.

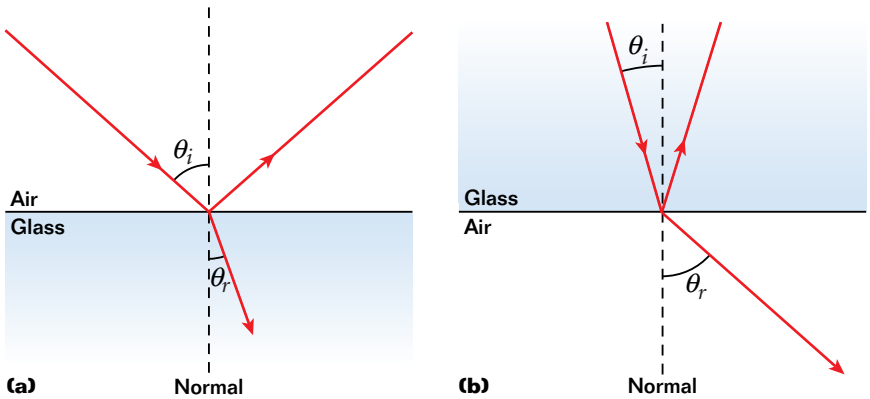

Figure 2
When light moves from one medium to another, part of it is reflected and part is refracted. **(a)** When the light ray moves from air into glass, the refracted portion is bent toward the normal, **(b)** whereas the path of the light ray moving from glass into air is bent away from the normal.