SECTION 1

Interference

SECTION OBJECTIVES

- **Describe how light waves interfere with each other to produce bright and dark fringes.**
- **Identify the conditions required for interference to occur.**
- **Predict the location of interference fringes using the equation for double-slit interference.**

Figure 1
Light waves interfere to form bands of color on a soap bubble's surface.

COMBINING LIGHT WAVES

You have probably noticed the bands of color that form on the surface of a soap bubble, as shown in **Figure 1.** Unlike the colors that appear when light passes through a refracting substance, these colors are the result of light waves combining with each other.

Interference takes place only between waves with the same wavelength

To understand how light waves combine with each other, let us review how other kinds of waves combine. If two waves with identical wavelengths interact, they combine to form a resultant wave. This resultant wave has the same wavelength as the component waves, but according to the superposition principle, its displacement at any instant equals the sum of the displacements of the component waves. The resultant wave is the consequence of the *interference* between the two waves.

Figure 2 can be used to describe pairs of mechanical waves or electromagnetic waves with the same wavelength. A light source that has a single wavelength is called *monochromatic,* which means single colored. In the case of *constructive interference,* the component waves combine to form a resultant wave with the same wavelength but with an amplitude that is greater than the amplitude of either of the individual component waves. For light, the result of constructive interference is light that is brighter than the light from the contributing waves. In the case of *destructive interference,* the resultant amplitude is less than the amplitude of the larger component wave. For light, the result of destructive interference is dimmer light or dark spots.

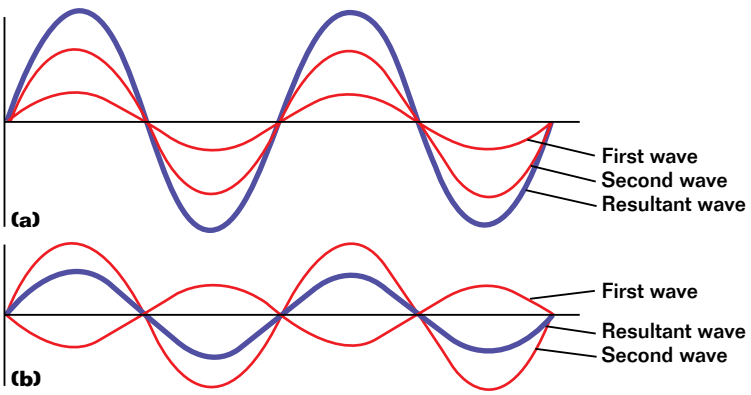

Figure 2
Two waves can interfere **(a)** constructively or **(b)** destructively. In interference, energy is not lost but is instead redistributed.