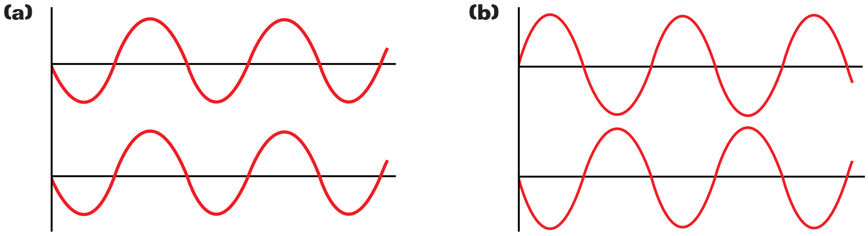

Figure 3
(a) The features of two waves in phase completely match, whereas **(b)** they are opposite each other in waves that are 180° out of phase.

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Waves must have a constant phase difference for interference to be observed

For two waves to produce a stable interference pattern, the phases of the individual waves must remain unchanged relative to one another. If the crest of one wave overlaps the crest of another wave, as in **Figure 3(a),** the two have a phase difference of 0° and are said to be *in phase.* If the crest of one wave overlaps the trough of the other wave, as in **Figure 3(b),** the two waves have a phase difference of 180° and are said to be *out of phase.*

Waves are said to have **coherence** when the phase difference between two waves is constant and the waves do not shift relative to each other as time passes. Sources of such waves are said to be *coherent.*

coherence
the correlation between the phases of two or more waves

When two light bulbs are placed side by side, no interference is observed, even if the lights are the same color. The reason is that the light waves from one bulb are emitted independently of the waves from the other bulb. Random changes occurring in the light from one bulb do not necessarily occur in the light from the other bulb. Thus, the phase difference between the light waves from the two bulbs is not constant. The light waves still interfere, but the conditions for the interference change with each phase change, and therefore, no single interference pattern is observed. Light sources of this type are said to be *incoherent.*

DEMONSTRATING INTERFERENCE

Interference in light waves from two sources can be demonstrated in the following way. Light from a single source is passed through a narrow slit and then through two narrow parallel slits. The slits serve as a pair of coherent light sources because the waves emerging from them come from the same source. Any random change in the light emitted by the source will occur in the two separate beams at the same time.

If monochromatic light is used, the light from the two slits produces a series of bright and dark parallel bands, or *fringes,* on a distant viewing screen, as shown in **Figure 4.** When the light from the two slits arrives at a point on the viewing screen where constructive interference occurs, a bright fringe appears

Figure 4
An interference pattern consists of alternating light and dark fringes.