STANDING WAVES

Consider a string that is attached on one end to a rigid support and that is shaken up and down in a regular motion at the other end. The regular motion produces waves of a certain frequency, wavelength, and amplitude traveling down the string. When the waves reach the other end, they are reflected back toward the oncoming waves. If the string is vibrated at exactly the right frequency, a **standing wave**—a resultant wave pattern that appears to be stationary on the string—is produced. The standing wave consists of alternating regions of constructive and destructive interference.

standing wave

a wave pattern that results when two waves of the same frequency, wavelength, and amplitude travel in opposite directions and interfere

node

a point in a standing wave that maintains zero displacement

antinode

a point in a standing wave, halfway between two nodes, at which the largest displacement occurs

Standing waves have nodes and antinodes

Figure 20(a) shows four possible standing waves for a given string length. The points at which complete destructive interference happens are called **nodes.** There is no motion in the string at the nodes. But midway between two adjacent nodes, the string vibrates with the largest amplitude. These points are called **antinodes.**

Figure 20(b) shows the oscillation of the second case shown in **Figure 20(a)** during half a cycle. All points on the string oscillate vertically with the same frequency, except for the nodes, which are stationary. In this case, there are three nodes (N) and two antinodes (A), as illustrated in the figure.

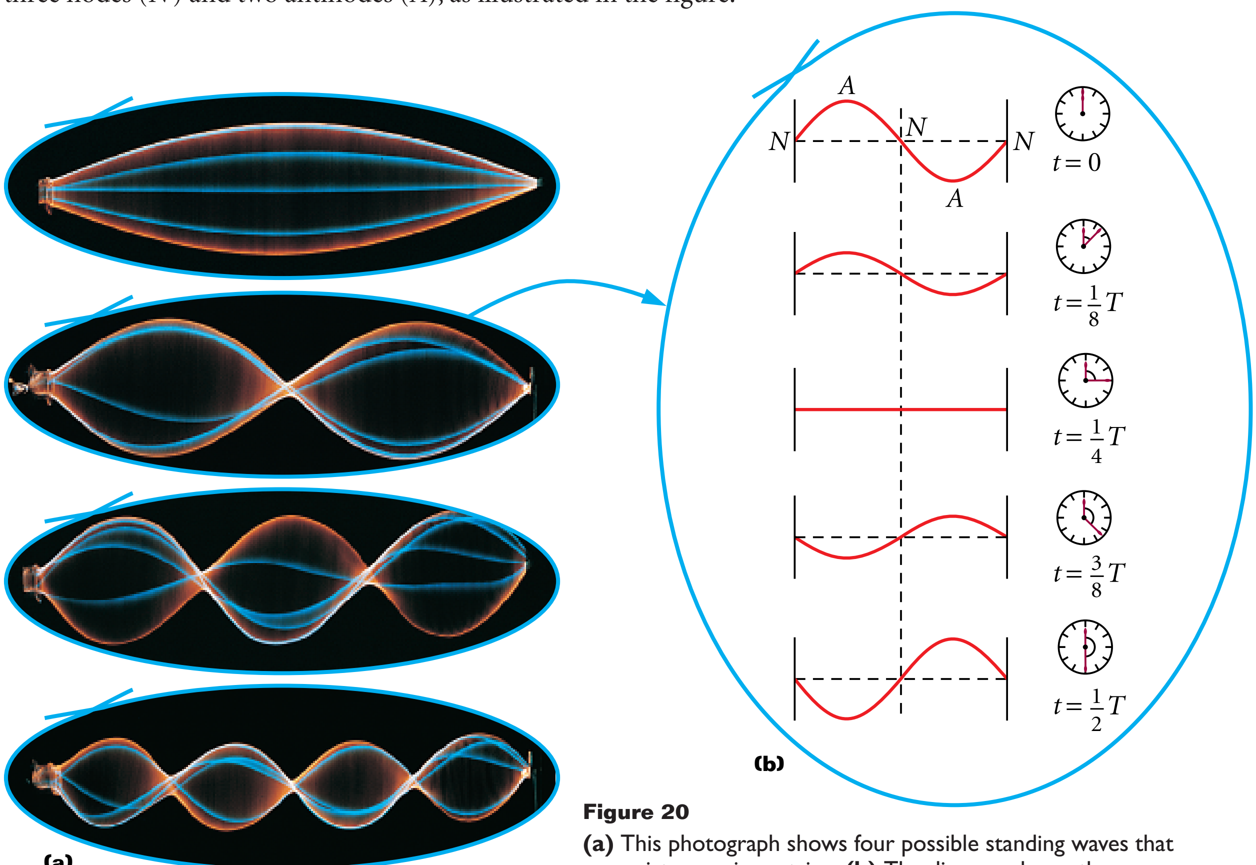

Figure 20
(a) This photograph shows four possible standing waves that can exist on a given string. **(b)** The diagram shows the progression of the second standing wave for one-half of a cycle.