Figure 14.1 This tree fell some time ago. When it fell, particles in the air were disturbed by the energy of the tree hitting the ground. This disturbance of matter, which our ears have evolved to detect, is called sound. (B.A. Bowen Photography)

Chapter Outline

14.1 Speed of Sound, Frequency, and Wavelength

14.2 Sound Intensity and Sound Level

14.3 Doppler Effect and Sonic Booms

14.4 Sound Interference and Resonance

Introduction

Teacher Support

Teacher Support [BL][OL][AL] Begin by asking students the old philosophical question given at the start of the chapter, "If a tree falls in the forest and no one is there to hear it, does it make a sound?" Ask them to give reasons for their responses. Ask them if they have seen *Star Trek* or *Star Wars*. Show a clip where a battle scene is taking place and you are able to hear explosions. Ask students if it is possible to hear another spaceship explode in space. Why or why not? In the discussion, ask them to think about what defines *sound*. Explain that sound is a mechanical wave. Refresh their memory about different waves and their properties.

If a tree falls in a forest (see Figure 14.1) and no one is there to hear it, does it make a sound? The answer to this old philosophical question depends on how

you define sound. If sound only exists when someone is around to perceive it, then the falling tree produced no sound. However, in physics, we know that colliding objects can disturb the air, water or other matter surrounding them. As a result of the collision, the surrounding particles of matter began vibrating in a wave-like fashion. This is a sound wave. Consequently, if a tree collided with another object in space, no one would hear it, because no sound would be produced. This is because, in space, there is no air, water or other matter to be disturbed and produce sound waves. In this chapter, we'll learn more about the wave properties of sound, and explore hearing, as well as some special uses for sound.