Additional Exercises

A-1:	Find the wavelength of the ultrasonic wave emitted by a bat if it has a frequency of 4.0×10^4 Hz.
A-2:	Radio station KSON in San Diego broadcasts at both 1240 kHz (AM) and 97.3 MHz (FM). a) Which of these signals, AM or FM, has the longer wavelength? b) How long is each?
A-3:	What is the wavelength of a B note (frequency 494 Hz) played a) by a flute? b) If the flute and a sax play the same note, which of the following will be different: quality, pitch, or loudness?
A-4:	As an anchor is being hoisted out of the water, it hits the hull of the ship, causing the anchor to vibrate with a frequency of 150. Hz. If the speed of sound in sea water is 1520 m/s, how many wavelengths of sound will fit between the boat and the ocean bottom 395 m below?
A-5:	A popular pastime at sporting events is "the wave," a phenomenon where individuals in the crowd stand up and sit down in sequence, causing a giant ripple of people. If a continuous "wave" passes through a stadium of people with a speed of 20 m/s and a frequency of 0.5 Hz, what is the distance from "crest" to "crest" (in other words, the wavelength of the wave)?
A-6:	From his bedroom, Garth can hear the distant sound of a train horn as the train travels through the mountains on its way from Chattanooga to Nashville. The horn has a frequency of 800.0 Hz as the train rolls along at 20.00 m/s. What frequency does Garth hear as the train travels away?
A-7:	Erin is late to physics class and is coming down the hall as the bells are ringing. There are two bells in the hall, one at the far end, and one in front of the classroom she is approaching. Each rings with a frequency of 500.0 Hz. As Erin comes down the hallway with a speed of 1.000 m/s toward the classroom a) what frequency does she hear for each bell? b) What beat frequency does she hear?

A-8:	Karen flies a motorized toy airplane with a frequency of 200. Hz in a circle at a speed of 18.0 m/s. Caroline stands nearby and hears a Doppler shift as the plane approaches and recedes from her. What are the a) highest and b) lowest frequencies Caroline hears?
A-9:	Sonar detectors work by bouncing high-frequency sound waves of about 0.100 MHz off oncoming ships and detecting the frequency of the return signal. If a sonar detector receives a return signal of 0.101 MHz from a sub, how fast is the sub going? (Hint: Sonar travels in sea water at 1520 m/s).
A-10:	A fly traveling at 3.000 m/s is pursued by a bat traveling at 6.000 m/s who emits sound at an ultrasonic frequency of 50 000. Hz. If the fly could detect such a high frequency emission, what frequency would the fly hear as it is being pursued?
A-11:	Lars is jogging beside the railroad tracks at a speed of 2.00 m/s when he hears a train whistle behind him at a frequency of 2115 Hz. If the actual frequency of the train whistle is 2000. Hz, how fast is the train moving?
A-12:	Walter is a bass and can hit a low E that has a frequency of 82.4 Hz. Millie is a soprano and can sing as high as the third overtone of this note. What is the highest frequency that Millie can sing?
A-13:	Joyce, the church organist, is practicing on the organ and she finds that the first two overtones for the 370-Hz pipe are 1110 Hz and 1850 Hz. Is the organ pipe closed at one end or open at both ends?
A-14:	A train passes through a tunnel that is 550 m long. What is the fundamental frequency of vibrating air in the tunnel?
A-15:	Harvey, a harpist, plucks a 0.600-m-long string on his harp. The string has a first overtone of 1046.6 Hz. How fast does the vibration travel through the string?
A-16:	Reed arrives late to practice and finds that the orchestra has already tuned up and begun to play. As one oboist hits a D with a frequency of 293.7 Hz, Reed plays a note with a frequency of 291.2 Hz. What beat frequency is heard as the two instruments are playing side by side?

A1. 0.0085 m A3. a) 0.688 m A5. 40 m A7. a) Toward: 501.5 Hz Away: 498.5 Hz b) 3.0 Hz A9. 15.0 m/s A11. 20.4 m/s A15. 628 m/s