Chapter 17
Example Problems

1. Calculate the wavelengths of the sounds at the extremes of the audible range for humans, 20.0 Hz and 2.00×10^4 Hz.

2. An electric spark jumps along a straight line of length L = 10 m, emitting a pulse of sound that travels radially outward from the spark. The power of this acoustic emission is $P_s = 1.6 \times 10^4$ W.
    a. What is the intensity of the sound when it reaches a distance 12 m from the spark?
    b. At what time rate is sound energy intercepted by an acoustic detector of aria 2.0 cm^2, aimed at the spark and located a distance of 12 m from the spark?

3. Bats navigate and search out prey by emitting, and then detecting reflections of, ultrasonic waves, which are sound waves with frequencies greater than can be heard by a human. Suppose a bat emits ultrasound at frequency 82.52 Hz while flying in a straight line with velocity 9.00 m/s as it chases a moth that flies in a straight line with velocity 8.00 m/s. What frequency does the moth detect?

4. A long metal pipe with one end open has a length of 16.0 m. Assume that the speed of sound in air is about 343 m/s.
    a. If the fifth harmonic has been set-up inside the pipe, what is the frequency of the sound wave produced by the pipe?
    b. If the both ends of the pipe were now opened, what would be the new frequency of the sound wave produced by the pipe?