Name_____

Phys 2010 (NSCC), Fall 2006
Problem Set #14

1. A bat can detect small objects such as an insect whose size is approximately equal to one wavelength of the sound the bat makes. If bats emit chirps at a frequency of 60.0 kHz, and if the speed of sound in air is $340\,\frac{\mathrm{m}}{\mathrm{s}}$, what is the smallest insect a bat can detect?

2. If the frequency of oscillation of the wave emitted by an FM radio station is 103.7 MHz, determine (a) the waves's period of vibration and (b) its wavelength. (Radio waves travel at the speed of light, $3.00 \times 10^8\,\frac{\mathrm{m}}{\mathrm{s}}$.)

3. Transverse waves with a speed of 80.0 $\frac{\text{m}}{\text{s}}$ are to be produced on a stretched string. A 5.00-m length of string with a total mass of 0.060 kg is used. What is the required tension in the string?

4. For the string in Problem 3, find the wave speed if the tension is 100.0 N.

5. An outside speaker (which you can consider to be an isotropic source) emits sound waves with a power output of 150 W. Find the intensity 20.0 m from the source.

6. For the situation given in problem 5 (same sound source and distance) what is the intensity level in decibels at that distance?

7. A commuter train passes a passenger platform at a constant speed of $45.0\,\frac{\text{m}}{\text{s}}$. The train horn is sounded at its characteristic frequency of 420 Hz. What frequency is heard by a person on the platform as the train approaches?

8. For the train horn described in problem 7, what frequency is heard by someone on the platform if the train is receding (i.e. moving away) at a speed of $30.0\,\frac{\text{m}}{\text{s}}$?