**Practice Problems Chapter 14 Waves & Sound**

1. A piano emits frequencies that range from a low of about 28 Hz to a high of about 4200 Hz. Find the range of wavelengths in air attained by this instrument when the speed of sound in air is 340 m/s.
2. The speed of all electromagnetic waves in empty space is 3.00 x 108 m/s. Calculate the wavelength of electromagnetic waves emitted at the following frequencies?
3. Radio wave at 88.0 MHz
4. Visible light at 6.0 x 108 MHz
5. X Ray at 3.0 x 1012 MHz
6. Red light emitted by He-Ne laser has a wavelength of 633 nm in air and travels at 3.00 x 108 m/s. Find the frequency of the laser light.
7. A turning fork produces a sound with a frequency of 256 Hz and a wavelength in air of 1.35 m.
8. What value does this give for the speed of sound in air?
9. What would be the wavelength of this same sound in water in which sound travels at 1500 m/s?
10. Sound waves travel in air with a speed of 343 m/s. The lowest frequency sound we can hear is 20.0 Hz; the highest frequency is 20.0 kHz. Find the wavelength of sound for frequencies of 20.0 Hz and 20.0 kHz.
11. Two speakers separated by a distance of 4.30 m emit sound of frequency 221 Hz. The speakers are in phase with one another. A person listens from a location 2.80 m directly in front of one of the speakers. Does the person hear constructive or destructive interference?
12. A loudspeaker puts our 0.15 W of sound through a square area 2.0 m on each side. What is the intensity of this sound?
13. At a maximum level of loudness, the power output of a 75-piece orchestra radiated as sound is 70.0 W. What is the intensity of these sound waves to a listener who is sitting 25.0 m from the orchestra?
14. Calculate the intensity of the sound waves from an electric guitar’s amplifier at a distance of 5.0 M when its power output is equal to each of the follow value

a. 0.25 W

b. 0.50W

c.2.0 W

1. A crying child emits sound with an intensity of 8.0 x 10-6 w/m2 . Find **(a)** the intensity level in decibels for the child's sounds, and **(b)**the intensity level this child and its twin, both crying with identical intensities.
2. One of the harmonics on a string 1.30 m long has a frequency of 15.60 Hz. The next higher harmonic has a frequency of 23.40 Hz. Find **(a)** the fundamental frequency, and **(b)** the speed of waves on this string.
3. An empty pop bottle is to be used as a musical instrument in a band. In order to be tuned properly, the fundamental frequency of the bottle must be 440.0 Hz. If the bottle is 26.0 cm tall, how high should it be filled with water to produce the desired frequency?
4. An experimental way to tune the pop bottle from the above example is to compare its frequency with that of a 440.0 Hz tuning fork. Initially, a beat frequency of 4 Hz is heard. As a small amount of water is added to that already present, the beat frequency increases steadily to 5 Hz. What were the initial and final frequencies of the bottle?
5. A street musician sounds the A string of his violin, producing a tone of 440 Hz. What frequency does a bicyclist hear as he **(a)**approaches and **(b)** recedes from the musician with a speed of 11.0 m/s?
6. A car moving at 18 m/s sounds its 550 Hz horn. A bicyclist on the sidewalk, moving with a speed of 7.2 m/s, approaches the car. What frequency is heard by the bicyclist?