**Physics 112 Waves and Sound**

1. The velocity of a wave is 20 m/s.
   1. What is the wavelength if the frequency is 50 Hz? *(0.40 m)*
   2. What is the frequency if the wavelength is 2.5 m? *(8.0 Hz)*
2. A wave has a frequency of 1.5 x 10-3 Hz and a wavelength of 0.85 m. What is its velocity? What is its period? *(1.3 x 10-3 m/s, 6.7 x 102 s)*
3. If a wave has a period of 2.3 x 10-3 s and a speed of 330 m/s, what is its wavelength? What is its frequency? *(0.76 m, 4.3 x 102 Hz)*
4. Explain the difference between a transverse wave and a longitudinal wave and give an example of each.
5. Light has a velocity of 3.00 x 108 m/s in a vacuum. A helium-neon laser has a wavelength of 633 nm. What is its frequency? What is its period? *(4.74 x 1014 Hz, 2.11 x 10-15 s)*
6. What is the speed of sound at sea level when the temperature is 30°C? How long would it take sound to travel 1.0 km at this speed? *(348 m/s, 2.87-3 s)*
7. A note played by a piano has a frequency of 440 Hz. If the temperature is 20°C, what is the wavelength of the sound of this note? *(0.777 m)*
8. You see a flash of lightning and then hear the thunder 10.0 seconds later. Estimate the distance to the lightning stroke. *(~3 km)*
9. A man drops a stone down a well that is 300 m deep. If the temperature is 25.0°C, how much time will pass before he hears the sound of the rock striking the water?

*(8.69 s)*

1. A rifle is fired in a valley. The echo from one wall is heard in 2.0 s, and the echo from the other wall of the valley is heard 2.0 s after the first echo. How wide is the valley, if the temperature is a constant 20° C? *(1.0 km)*
2. The velocity of a longitudinal wave in steel is 5.96 x 103 m/s. Calculate
   1. the wavelength of a 800 Hz sound wave in steel. *(7.45 m)*
   2. the wavelength of the same frequency in air. *(0.428 m)*
   3. the frequency of a sound wave which has a .300 m wave length in steel. *(1.99 x 104Hz)*
3. One tuning fork has a frequency of 440 Hz. When the corresponding note (A above middle C) on the piano is played simultaneously with the tuning fork, there is a beat frequency of 4 beats per second.
   1. How far out of tune is the note on the piano? *(4 Hz)*
   2. What are the *possible* frequencies for the note? *(436 Hz, 444 Hz)*
4. You have two tuning forks. One has a known frequency of 200 Hz. When the second fork is played, there is a beat frequency of 5 beats per second. When a piece of gum is placed on the second fork, the beat frequency increases to 3 beats per second. What is the frequency of the second tuning fork? *(195 Hz)*
5. There are three tuning forks with the following frequencies: A) 242 Hz B) 247 Hz and C) unknown. If A and C are sounded together, there is a beat frequency of 2 beats per second. If B and C are sounded together, there is a beat frequency of 7 beats per second. What is the frequency of tuning fork C? *(240 Hz)*
6. Show what happens when each pair of pulses below overlap.

**Doppler Effect**

1. A source of sound and a detector are moving towards each other. The source has a frequency of 500 Hz, and a speed of 25 m/s. The speed of the observer is 20 m/s.. If the temperature is 20°C, what is the frequency of the sound heard by the observer? *(571 Hz)*
2. If in question one, the direction of both the source and the observer are reversed, but the speeds are the same, what would the observed frequency then be? *(439 Hz)*
3. You are travelling towards a stationary source of sound at 10 m/s. You observe a frequency of 392 Hz. What is the actual frequency being emitted (assume v = 342 m/s)? *(381 Hz)*