

Waves Problem Set

1. Light has a velocity of 3.00×10^8 m/s in a vacuum. A helium-neon laser has a wavelength of 633 nm. What is its frequency? What is its period?
(4.74×10^{14} Hz, 2.11×10^{-15} s)
2. The velocity of a longitudinal wave in steel is 5.96×10^3 m/s. Calculate
 - (a) the wavelength of a 800 Hz sound wave in steel. (7.45 m)
 - (b) the wavelength of the same frequency in air ($v = 343$ m/s). (0.428 m)
 - (c) the frequency of a sound wave which has a .300 m wave length in steel. (1.99×10^4 Hz)
3. 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 s)
4. 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)
5. You see a flash of lightning and then hear the thunder 10.0 seconds later. Estimate the distance to the lightning stroke. (~ 3 km)
6. 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)
7. 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)
8. 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.
 - (a) How far out of tune is the note on the piano? (4 Hz)
 - (b) What are the possible frequencies for the note? (436 Hz, 444 Hz)
9. 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? (205 Hz)
10. 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)
11. Show what happens when each pair of pulses below overlap.

