

11. Find the speed of sound in water, which has a bulk modulus of $2.1 \times 10^9 \text{ N/m}^2$ at a temperature of 0°C and a density of $1.0 \times 10^3 \text{ kg/m}^3$.
Ans: (1.45 km/s)
12. Dolphins use sound waves to locate food. Experiments have shown that a dolphin can detect a 7.5 cm target 110 m away, even in murky water. For a bit of 'dinner' at this distance, how much time passes between the moment the dolphin emits a sound pulse and the moment the dolphin hears its reflection and thereby detects the distant target.
Ans: (0.15 s)
13. Your clock radio awakens you with a steady and irritating sound of frequency 600 Hz. One morning, it malfunctions and cannot be turned off. In frustration, you drop the clock radio out of your fourth-storey dorm window, 15.0 m from the ground. (a) As you listen to the falling clock radio, what frequency do you hear just before you hear the radio striking the ground? (b) At what rate does the frequency that you hear change with time just before you hear the radio striking the ground?
Ans: (571 Hz, -15.6 Hz/s).
14. Standing at a crosswalk, you hear a frequency of 560 Hz from the siren of an approaching ambulance. After the ambulance passes, the observed frequency of the siren is 480 Hz. Determine the ambulance's speed from these observations.
Ans: (26.4 m/s)
15. A tuning fork vibrating at 512 Hz falls from rest and accelerates at 9.80 m/s^2 . How far below the point of release is the tuning fork when waves of frequency 485 Hz reach the release point?
Ans: (19.3 m)
16. An experimenter wishes to generate in air a sound wave that has a displacement amplitude of $5.50 \times 10^{-6} \text{ m}$. The pressure amplitude is to be limited to 0.840 N/m^2 . What is the minimum wavelength the sound wave can have?
{Average density of air at 20°C , 1 atm. Pressure = 1.20 kg/m^3 }.
Ans: (5.81 m)
17. A sound wave in air has a pressure amplitude equal to $4.00 \times 10^{-3} \text{ n/m}^2$. Calculate the displacement amplitude of the wave at a frequency of 10.0 kHz.
Ans: ($1.55 \times 10^{-10} \text{ m}$)
18. Find the speed of sound in mercury, which has a bulk modulus of elasticity $2.80 \times 10^{10} \text{ N/m}^2$ approximately and a density of 13600 kg/m^3 .
Ans: 1.43 km/s)
19. Suppose you hear a clap of thunder 16.2 s after seeing the associated lighting stroke. The speed of sound wave in air is 343 m/s, and the speed of light is $3.00 \times 10^8 \text{ m/s}$. How far are you from the lighting stroke?
Ans: (5.56 km).
20. A point source emits sound waves with an average power output of 80.0 W. (a) Find the intensity at a distance of 3.00 m from the source. (b) Find the distance at which the intensity of sound is $1.00 \times 10^{-8} \text{ W/m}^2$.
Ans: (0.707 W/m^2 , $2.52 \times 10^4 \text{ m}$).