Chapter 16 Tutorial

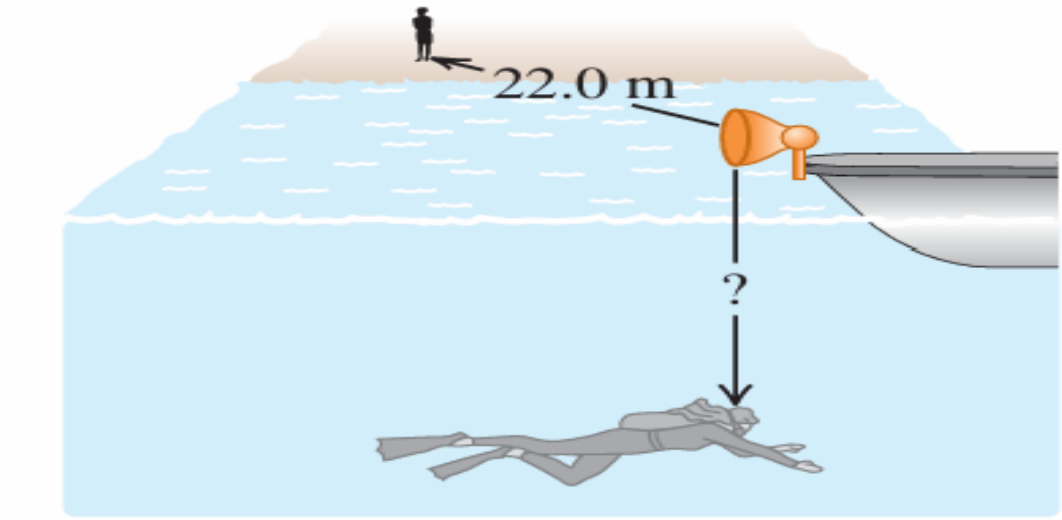
Waves II

Chapter 16 : Sound and Hearing

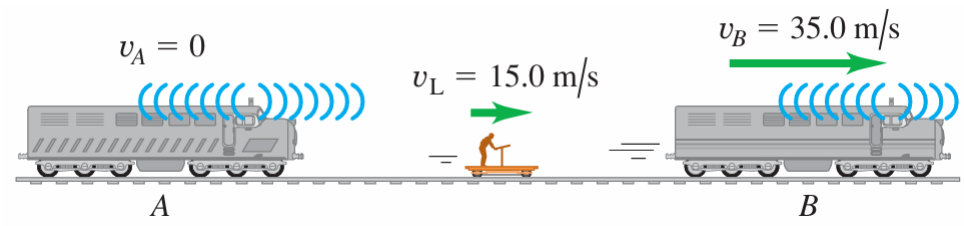
Quesition 1: Sound waves in air with frequency 1000 Hz, a displacement amplitude of 1.2×10^{-8} m produces a pressure of 3.0×10^{-2} Pa (let us suppose for this case v_{air} = 344 m/s)

(a) What is the wavelength of these waves?
(b) For 1000-Hz waves in air, what displacement amplitude would be needed for the pressure amplitude to be at the pain threshold, which is 30 Pa?
(c) For what wavelength and frequency will waves with a displacement amplitude of 1.2×10−8 m produces a pressure amplitude of 1.5×10^{-3} Pa?

Question 2: A submerged scuba diver hears the sound of a boat horn directly above her on the surface of the lake. At the same time, a friend on dry land 22.0m from the boat also hears the horn. The horn is 1.2 m above the surface of the water. What is the distance from the horn to the diver? Both air and water are at 20 C. (speed of sound in water for this case v_{water} = 1482 m/s).



Question 3: Two train whistles, A and B, each have a frequency of 392 Hz. A is stationary and B is moving toward the right (away from A) at a speed of 35.0 m/s. A listener is between the two whistles and is moving toward the right with a speed of 15 m/s. No wind is blowing. (a) What is the frequency from A as heard by the listener? (b) What is the frequency from B as heard by the listener? (c) What is the beat frequency detected by the listener?



Question 4: The shock-wave cone created by the space shuttle at one instant during its re-entry into the atmosphere makes an angle of 58^0 with its direction of motion. The speed of sound at this altitude is 331 m/s.

a) What is the Mach number of the shuttle at this instant.
b) How fast (in m/s and in mi/h) is it traveling relative to the atmosphere?
c) What would be its Mach number and the angle of its shock-wave cone if it flew at the same speed but at low altitude where the speed of sound is 344 m/s?