Class Problems For January 7 & 9

1. In seismology, the P wave is a longitudinal wave. As a P wave travels through the Earth, the relative motion between the P wave and the particles is

   A. parallel.

   B. perpendicular.

   C. first parallel, then perpendicular.

   D. first perpendicular, then parallel.

2. Which of the following is a false statement?

   A. Sound waves are longitudinal pressure waves.

   B. Sound waves are transverse pressure waves.

   C. Light travels very much faster than sound.

   D. The transverse waves on a vibrating string are different from sound waves.

   E. “Pitch" (in music) and frequency have approximately the same meaning.

3. As the temperature of the air increases, what happens to the velocity of sound? (Assume that all other factors remain constant.)

   A, It increases.

   B. It decreases.

   C. It does not change.

   D. It increases when atmospheric pressure is high and decreases when the pressure is low.

4. A horizontal cord 5.00 m long has a mass of 1.45g. What must be the tension in the chord if the wavelength of a 120 Hz wave is 60.0 cm?

5. A cord of mass 0.65 kg is stretched between two supports 28 m apart. If the tension in the cord is 150 N, how long will it take a pulse to travel from one support to the other?

6. A guitar string is 90 cm long and has a mass of 3.6 g. The distance from the bridge to the support post is L = 62 cm, and the string is under a tension of 520 N. What are the frequencies of the fundamental and first two overtones?

7. A sound wave is traveling in warm air when it hits a layer of cold, dense air. If the sound wave hits the cold air interface at an angle of 25°, what is the angle of refraction? Assume that the cold air temperature is -10 °C and the warm air temperature is +10 °C. The speed of sound as a function of temperature can be approximated by $v = (331 + 0.60\ T)$ m/s, where T is in °C.

8. The speed of an ultrasonic sound of frequency 45 kHz in air is 352 m/s. What is the air temperature?

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9. An explosion occurs at a distance of 6.00 km from a person. How long after the explosion does the person hear it assuming the air temperature is 14.0 °C?

10. What is the wavelength in air of a sound wave of frequency 500 Hz at 20 °C?

12. A person riding a power mower may be subjected to a sound intensity of $2x10^{-2}$ W/m^2. What is the sound level in db to which the person is subjected?

13. A barking dog delivers about 1 mW of power, which is assumed to be uniformly distributed in all directions. What is the intensity level at a distance 5.00 m from the dog?

14. A 3.00-m long pipe is in a room where the temperature is 20 C. What is the fundamental frequency if the pipe is open at both ends?

15. A certain organ pipe is tuned to emit a frequency of 196 Hz. When it and a G string of a violin are sounded together, ten beats are heard in a time of exactly 8 s. If the beats become slower as the violin string is slowly tightened, what was the original frequency of the violin string?

16. A police car has an 800-Hz siren. It is traveling at 35 m/s on a day when the speed of sound through air is 340 m/s. The car approaches and passes an observer who is standing along the roadside. What change of frequency does the observer hear?