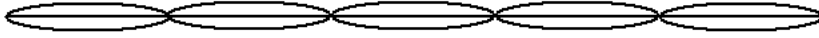


Unit 5 Sound and Waves Exam Review 2023

1. Calculate the frequency and period of a tuning fork that vibrates 18000 times in 2.00 minutes
2. 30 Hz waves move along a slinky with a wavelength of 48.0 cm. What is the speed of these waves?
3. If a wave travels at 25 m/s and has a period of 2.0 s, what is its wavelength?
4. How fast is the speed of sound if the temperature of air is -22°C ?
5. The period of a wave is 3.5 seconds and the speed is 18 m/s. Determine the wavelength.
6. The speed of sound in a fresh-water lake is 1500 m/s. Ultrasonic sound is sent from the surface of the lake to the bottom. The sound returns in 0.2 s.
 - a. How deep is the lake?
 - b. How far can sound travel in 1.5 s? (Assume temperature is 20°C)
7. A baby's heart beats with a frequency of 2.4 Hz. What is the period of the heart beat?
8. In a certain standing wave pattern. The distance from one node to the next is 2.0 m. What is the wavelength of one of the standing waves?
9. The wavelength of a certain sound is 0.3 m. If the speed through a certain material is 240 m/s, calculate the frequency of the sound wave
10. Ocean waves that measure 12 m from crest to adjacent crest pass by a fixed point every 2.0s. What is the speed of the waves?
11. Calculate the period of each of the following motions.
 - a. A child while skipping jumps off the ground 80 times in 120 s.
 - b. A man shovels at a rate of 15 shovel fulls per minute.
12. Calculate the wavelength of a wave if its frequency is 1.5 Hz and its speed is 4.8 km/s.
13. A sound wave has a wavelength 0.500 m and a speed of 0.47m/s. Find the frequency of the sound wave.
14. A pendulum makes 100 vibrations in 10s. What is its period? What is its frequency?
15. A physics student standing 100 m from the school building shouts "**physics is done!!**" and records the echo returning 0.58 seconds later. Calculate
 - a) the speed of sound
 - b) the air temperature
 - c) If the frequency of the sound is 150 Hz, calculate the wavelength of the sound.
16. The frequency produced by a vibrating string is 400 Hz. What will its frequency be, if its length is doubled?
17. For a string fixed at both ends resonating at its 3rd harmonic, sketch wave pattern labeling all nodes and antinodes.
18. For a 35 cm long air column closed at one end, determine the frequency of the 5th Harmonic if the speed of sound is 340 m/s. Draw a diagram representing this wave pattern. Repeat the same for 7th harmonic
19. The speed of sound in sea water is 1214 m/s. If a sound wave hits an undersea cliff 0.36 s after it was emitted, how far away is the cliff from its source?
20. An ambulance moving at 100 km/hr, with siren blazing at a steady 850 Hz, approaches and passes a person standing on the side of the road.
 - a) If the temperature of the air is 15°C , what is the speed of sound?
 - b) what frequency will the person hear as the ambulance approaches?
 - c) what frequency will the person hear after the ambulance passes by?
 - d) Also what is the ambulance's Mach number?

21. 88 cm long string shown below vibrates at a frequency of 1024 Hz in the mode shown. Find:



- (a) The speed of the wave
- (b) The frequency of 10th overtone.

22. An ambulance has just passed by your home. You detect that the frequency of the receding siren is 900 Hz. If you know that the frequency of the ambulance's siren is 950 Hz, how fast is the ambulance moving? The temperature of the air in this case is 5°C.

23. On a nice summer day when the temperature is 23°C, you purse your lips and whistle across the top of an empty pop bottle that is 29 cm tall. What must be the frequency of your whistle to make the air in the bottle vibrate in the fourth resonant length? Draw a diagram representing this wave pattern.

24. How fast is a car moving and in what direction if the frequency of its horn drops from 900 Hz to 875 Hz, as heard by a stationary listener? The air temperature is 0°C.

25. Tsunamis are fast moving ocean waves typically caused by underwater earthquakes. One particular tsunami traveled a distance of 3250 Km in 4.6 h and its wavelength was determined to be 640 Km. What was the frequency of this tsunami?

26. While standing near a railroad crossing, a person hears a distant train horn. According to the train's engineer, the frequency emitted by the horn is 440 Hz. The train is traveling at 20.0 m/s and the speed of sound is 346 m/s.

- a) What would be the frequency of the train's horn if the train were at rest?
- b) What is the adjusted frequency that reaches the bystander as the train approaches the crossing?
- c) What is the adjusted frequency that reaches the bystander once the train has passed the crossing?

27. A cop car's siren has a frequency of 700 Hz. If you are standing on the sidewalk as the cop car approaches you at a speed of 15.0 m/s, what frequency would you hear? The speed of sound is 343 m/s.

28. For a 35 cm long open air column, determine the frequency of the 5th Harmonic if the speed of sound is 340 m/s. Draw a diagram representing this wave pattern.

29. An aircraft is flying at Mach 1.14 in air at a temperature of -58.4°C. What is the speed of sound at that temperature? What is the speed of the aircraft?

30. An aircraft is flying at 923 km/h in air at a temperature of -47.5°C. What is the speed of sound at this temperature? What is the Mach number at this speed?

