

**II. Multiple Choice (Choose the one best answer for each question.)**

8. Which sound has the fastest speed in air at  $0.0\text{ }^{\circ}\text{C}$ ?  
A. 220 Hz tuning fork      B. 440 Hz tuning      C. It is the same for both
9. Which sound has the largest wavelength in air at  $0.0\text{ }^{\circ}\text{C}$ ?  
A. 220 Hz tuning fork      B. 440 Hz tuning      C. It is the same for both
10. Which sound has the largest frequency in air at  $0.0\text{ }^{\circ}\text{C}$ ?  
A. 220 Hz tuning fork      B. 440 Hz tuning      C. It is the same for both
11. As the temperature of the air decreases, the speed of sound  
A. increases      B. decreases      C. stays the same
12. How many beats/sec are heard when two tuning forks of 512 Hz and 508 Hz are sounded simultaneously?  
A. 1 Hz      B. 2 Hz      C. 4 Hz      D. 510 Hz      E. 1020 Hz
13. How many wavelengths will fit inside a tube with one closed when you have resonance at the fundamental frequency?  
A.  $1/4$       B.  $1/2$       C.  $3/4$       D. 1      E.  $5/4$
14. When shaking a string at one end that is attached to a post at the other end with just the right frequency to form a standing wave, the parts of the string that have maximum movement are called  
A. fundamentals      B. harmonics      C. nodes      D. antinodes
15. Transverse waves have a disturbance that is  
A. in the same direction as the motion of the wave.  
B. perpendicular to the direction of motion of the wave.  
C. counterclockwise to the direction of the wave.  
D. clockwise to the direction of the wave.
16. Sound waves are an example of a longitudinal wave.  
A. True      B. False      C. Unable to determine
17. Water waves are an example of a longitudinal wave.  
A. True      B. False      C. Unable to determine
18. When two waves are added together, you can get  
A. constructive interference.      B. destructive interference.  
C. standing waves.      D. All of the above.

19. A sound source moving away from you (compared to the same sound source at rest) will have  
 A. a higher pitch    B. a lower speed of sound    C. a lower frequency  
 D. a smaller wavelength    E. the same frequency
20. As the frequency of a tone increases,  
 A. the speed of sound increases.    B. the speed of sound decreases.  
 C. the frequency decreases.    D. the wavelength increases.  
 E. the wavelength decreases.

**III. Problems:**

- At 35.0 °C, how much time will elapse between the firing of a gun and return of its echo from a cliff that is 2.60 km away?
- Find the length of an organ pipe closed at one end that produces a fundamental frequency of 262 Hz (i.e. middle C) when the air temperature is 24.0°C.
- Calculate the speed of sound on a day when a 963 Hz frequency has a wavelength of 0.351 m.
- What is the wavelength of a water wave that has a frequency of 0.200 Hz and a speed of 3.00 m/s?
- The human range for hearing is commonly given as 20 to 20,000 Hz (though there is considerable variation between individuals, especially at high frequencies). At 22.0 °C, what is the wavelength range for human hearing?

8. Given  $v = 90.0$  m/s and the graph on the right, find...

- A.  $\lambda$     B.  $f$     C.  $T$     D.  $A$

