Sound Waves Practice Problems

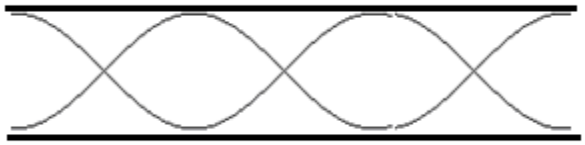
PSI Physics Name_____

In the following problems the speed of sound in air is 340 m/s.

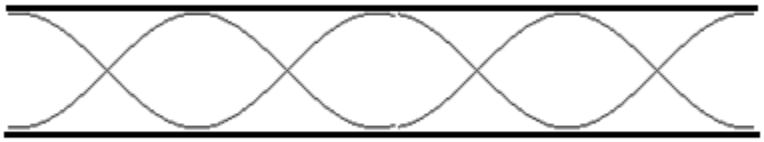
1. What is the wavelength of a sound wave with a frequency of 430 Hz?
2. What is the wavelength of an ultrasonic wave with a frequency of 35 kHz?
3. What is the wavelength of an infrasonic wave with a frequency of 15 Hz?
4. What is the frequency of a sound wave with a wavelength of 0.5 m?
5. What is the frequency of a sound wave with a wavelength of 1.7 m?
6. An echo off a building is heard 5.0s after the sound is created. How far is the building from the observer?
7. An echo off a building is heard 8.0s after the sound is created. How far is the building from the observer?
8. A student hears thunder 8.0s after seeing a flash of lightning. How far is the student from the lightning strike?
9. A sound is heard 2.5 s after seeing the flash of an explosion. How far is the explosion?
10. A pipe open on both ends has a length L. What are the wavelengths of the first three resonance frequencies?
11. A pipe closed on one end has a length L. What are the wavelengths of the first thee harmonics?
12. A pipe open on both ends has a length of 1.0 m. What are the first three resonance frequencies?
13. A pipe open on both ends has a length of 0.85 m. What are the first three resonance frequencies?
14. A pipe closed on one end has a length of 0.50 m. What are the three lowest tones produced by the pipe?
15. A pipe closed on one end has a length of 0.25 m. What are the three lowest tones produced by the pipe?
16. The frequency of the fourth harmonic in an open pipe is 800 Hz. What is the length of the pipe?
17. The frequency of the fifth harmonic in an open pipe is 1500 Hz. What is the length of the pipe?
18. The frequency of the third harmonic in a pipe closed on one end is 900 Hz. What is the length of the pipe?
19. The frequency of the third harmonic in a pipe closed on one end is 1400 Hz. What is the length of the pipe?
20. In an experiment to determine the speed of sound in air a glass pipe was partially submerged into water and then struck by a tuning fork. The frequency of the tuning fork is 256 Hz. What is the speed of sound if the first harmonic was heard when the air column is 0.33 m long?
21. In an experiment to determine the speed of sound in air a glass pipe was partially submerged into water and then struck by a tuning fork. The frequency of the tuning fork is 320 Hz. What is the speed of sound if the first harmonic was heard when the air column is 0.26 m long?
22. Two tuning forks vibrate at frequencies of 512 Hz and 510 Hz. What is the beat frequency?
23. Two tuning forks vibrate at frequencies of 320 Hz and 316 Hz. What is the beat frequency?

General Problems

1. A sound wave resonates in a pipe open on both ends as shown. The length of the pipe is 1.8 m.

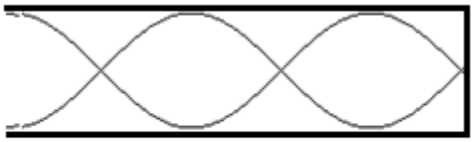


   a. Which harmonic is shown in the pipe?
   b. What is the wavelength of the sound?
   c. What is the fundamental frequency?
   d. What is the fifth harmonic?

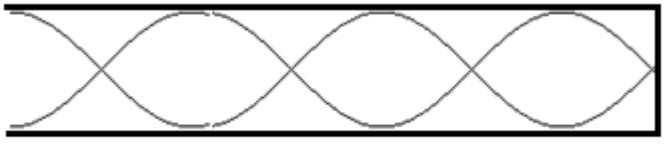


2. A sound wave resonates in a pipe open on both ends as shown above. The length of the pipe is 2.4 m.
   a. Which harmonic is shown in the pipe?
   b. What is the wavelength of the sound?
   c. What is the fundamental frequency?
   d. What is the third harmonic?

3. A sound wave resonates in a pipe closed on one end as shown. The length of the pipe is 1.5 m.



   a. Which harmonic is shown in the pipe?
   b. What is the wavelength of the sound?
   c. What is the fundamental frequency?
   d. What is the seventh harmonic?



4. A sound wave resonates in a pipe closed on one end as shown above. The length of the pipe is 2.1 m.
   a. Which harmonic is shown in the pipe?
   b. What is the wavelength of the sound?
   c. What is the fundamental frequency?
   d. What is the third harmonic?

Sound Waves Answers

1) .79 m
2) .0097 m
3) 22.67 m
4) 680 Hz
5) 200 Hz
6) 850 m
7) 1360 m
8) 2720 m
9) 850 m
10) 2L, L, 2L/3
11) 4L, 4L/3, 4L/5
12) 170, 340, 510 Hz
13) 200, 400, 600 Hz
14) 170, 510, 850 Hz
15) 340, 1020, 1700 Hz
16) .85 m
17) .567 m
18) .283 m
19) .182 m
20) 337.92 m/s
21) 332.8 m/s
22) 2 Hz
23) 4 Hz

General Problems

1)
    a. 3rd
    b. 1.2m
    c. 94.4 Hz
    d. 472.22 Hz
2)
    a. 4th
    b. 1.2m
    c. 70.83 Hz
    d. 212.5 Hz
3)
    a. 5th
    b. 1.2 m
    c. 56.66 Hz
    d. 396.67 Hz
4)
    a. 7th
    b. 1.2 m
    c. 40.47 Hz
    d. 121.43 Hz