Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Chapter 15 Problems

Problem

1. How fast should a car move toward you for the car's horn to sound 2.88% higher in frequency than when the car is stationary? The speed of sound is 343 m/s.
2. How fast should a car move away from an observer for the car's horn to sound 2.48% lower in frequency than when the car is stationary? The speed of sound is 343 m/s.
3. A car moving at 16.0 m/s, passes an observer while its horn is pressed. Find the difference between the frequencies of sound heard when the car approaches and when it recedes from the stationary observer. The velocity of sound is 343 m/s and the frequency of the sound of the car's horn is 583 Hz.
4. A boy is blowing a whistle of frequency 536 Hz and walking toward a wall with a speed of 1.64 m/s. What frequency of the reflected sound will the boy hear if the speed of sound is 343 m/s?
5. A closed-pipe resonator has a length of 1.73 m. Calculate the frequency of its third harmonic if the velocity of sound is 343 m/s.
6. An open-pipe resonator has a length of 2.39 m. Calculate the frequency of its third harmonic if the velocity of sound is 343 m/s.
7. A string of length 2.35 m and mass 1.70×10^{-4} kg is stretched so that the tension in the string is 9.76 N. Calculate the frequency of the fundamental note of the string.
8. The third harmonic frequency of a closed-pipe resonator is equal to the fundamental frequency of an open-pipe resonator. The length of the closed-pipe resonator is 1.65 m. Calculate the length of the open-pipe resonator.
9. A train is moving at 23 m/s due east when it sounds a blast on its horn, frequency = 164 Hz. What frequency is heard by the driver of a car moving due east at 15 m/s along a road parallel to the tracks? Use 343 m/s for the speed of sound.

Table of Speeds of sound at 25°C

Copper	3560 m/s
Iron	5130 m/s
Gold	3240 m/s
Brass	4700 m/s
Lead	1322 m/s

10. A sound with a frequency of 256 Hz has a wavelength of 13.9 meters in a certain metal. Which metal is this likely to be? Explain your answer.
11. The harmonic series from a long tube is given below. Is this tube acting as an open-pipe resonator or a closed-pipe resonator? Explain your answer.
203 Hz, 609 Hz, 1015 Hz, 1421 Hz
12. A tuning fork (440 Hz) is struck over a closed-pipe resonator. If the speed of sound is 343 m/s, what is the shortest the column could be when it makes a loud tone?