

Lab #15 Resonance in a Closed Pipe

Lab Goals:

- To understand resonance and standing waves
- To produce standing waves in a closed pipe

Lab Procedure:

1. Record range and precision of instruments.
2. Record room temperature.
3. Measure the inside diameter of PVC pipe. This will be used in formula for wavelength.
4. Fill cylinder with water and place PVC pipe in water.
5. Strike tuning fork and hold close to top of pipe.
6. Slowly raise pipe until it resonates (the amplitude with increase).
7. Find the place where it is the loudest and record the length of the air column in the pipe (ℓ). This is the length of tube that produces the fundamental frequency for that note.
8. Repeat for other tuning forks.
hint: The smallest length to produce resonance is approximately equal to one quarter the length of the sound wave.
9. Try to achieve 1st and 2nd overtones for one tuning fork and record results.
Resonance occurs in a closed pipe for the following series:
 $\frac{1}{4} \lambda, \frac{3}{4} \lambda, (2n+1)/4 \lambda, . . .$
10. Do calculations in data table. In formula for wavelength, d is inside diameter of tube.
11. Graph frequency vs wavelength for Table 1.

Data:

Note	frequency (f)	length (ℓ) of air	wavelength (λ) $\lambda = 4(\ell + .4 d)$	wave speed $v = \lambda f$

Summary:

- Did the wave speed vary according to frequency?
- Calculate the speed of sound using the room temperature. Compare that value to your calculated speeds.
- Evaluate your graph. What relationship is seen between wavelength and frequency?
- What is resonance and how is it evidenced in the closed pipe?