Speed of Sound Lab

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1 Objective

Measure the speed of sound. Specifically we look at sound waves, standing waves, wavelengths, amplitude, period, frequency, and resonance. These are defined in 1.1:

1.1 Definitions

Wavelength λ−the distance between one peak of a wave to the next corresponding peak

Amplitude A−the maximum amount of displacement of a particle on the medium from its rest position.

Period T−the time for a particle on a medium to make one complete vibrational cycle.

Frequency f−a measurement of how often the particles of a medium vibrate when a wave passes through the medium.

Sound Wave - the pattern of disturbance caused by the movement of energy traveling through a medium (such as air, water, or any other liquid or solid matter) as it propagates away from the source of the sound.

Standing Wave - a vibrational pattern created within a medium when the vibrational frequency of the source causes reflected waves from one end of the medium to interfere with incident waves from the source. This interference occurs in such a manner that specific points along the medium appear to be standing still.

Resonance - when one object vibrating at the same natural frequency of a second object forces that second object into vibrational motion

2 Simulation

Materials: tuning fork, graduated cylinder filled with water, a roll of blue tape

Method: Strike the tuning fork against the roll of blue tape, which gives a distinctive sound. While the sound is resonating, bring the fork and above the graduated cylinder and observe for an increase of the sound. Take out or add more water and repeat the process by striking the fork again. Keep adjusting the volume of the water until the maximum volume of the sound is obtained.

3 Data

Frequency (Hz)	Measurement of L (cm)
512	16.5
384	21.5
256	32

Table 1 : Results of the experiment

4 Calculations

$$\lambda = \frac{v}{f}$$

$$L_{512} = \frac{340m/s}{512Hz} = 0.664m$$

$$L_{512} = \frac{\lambda}{4} = 0.166m = 16.6cm$$

$$L_{384} = \frac{340m/s}{384Hz} = 0.888m$$

$$L_{384} = \frac{\lambda}{4} = 0.222m = 22.2cm$$

$$L_{256} = \frac{340m/s}{256Hz} = 1.332m$$

$$L_{256} = \frac{\lambda}{4} = 0.333m = 33.3cm$$

$$V = \lambda f$$

$$V_{512} = 4(0.165)512 = 338m/s$$

$$V_{384} = 4(0.165)384 = 330m/s$$

$$V_{256} = 4(0.165)256 = 328m/s$$

5 Results and Conclusions

Frequency (Hz)	Measurement of L (cm)	Velocity obtained (m/s)
512	16.5	338
384	21.5	330
256	32	328

Table 2 : Results of the calculations

6 Discussion of Error

Like in any other experiment, there was room for error in our attempts at finding the speed of sound. One of that factors that may have contributed to the inaccuracy of the results could have been the condition of the tuning fork as the object was slightly bend around the edges when it was used. This could have affected the resonance of the sound produced.
In addition, the volume of the water was observed by the naked eye; hence the measurement of the water might not have been entirely accurate, and this in turn may have jeopardized the results.

7 References

http://hyperphysics.phy-astr.gsu.edu/hbase/class/phscilab/restube2.html
http://www.physicsclassroom.com/class/waves/Lesson-4/Formation-of-Standing-Waves
http://physics.info/waves-standing/