

Sound Lab

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March 2016

1 Problem

The objective is to measure the speed of sound by determining the wavelength of a sound, made by tuning forks with different frequencies.

2 Background Information

Sound is a wave, which travels through space by colliding with particles. Sound is a longitudinal wave, what means that it passes through space and makes particles move back and forth, so they are not moving up or down. Sound wave has energy, what allows it to change the position of particles, which are affected by the wave. Sound travels at a certain speed, which is about 340 m/s in the air.

3 Definitions

Wavelength- the distance over which the wave's shape repeats.

Sound- a vibration that propagates as a typically audible mechanical wave of pressure and displacement, through a medium such as air or water.

Speed- distance travelled per unit time.

Wave- a repeated disturbance that spreads out and transfers energy as it moves forwards.

Resonance- a phenomenon that occurs when a vibrating system or external force drives another system to oscillate with greater amplitude at a specific preferential frequency.

Wave peak- the maximum value, either positive or negative , that a waveform attains.

Frequency- the number of occurrences of a repeating event per unit time.

4 Materials

Tuning forks with different frequencies, tube, water, cylinder, ruler, pen, notebook.

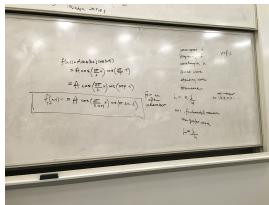
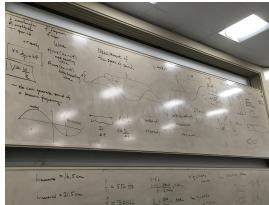
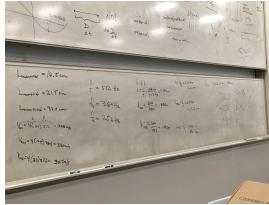
5 Method

To calculate the speed of sound, we can use many different methods, but the one we decided to use allows to measure the speed of sound by determining the wavelength of a tuning fork with given frequency.

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

To determine the wavelength, we found the smallest distance between the water level and the end of tube, filled with water at different levels in a way, the resonance of fork is at the peak, when it is held at the end of a tube. The distance of a water level and the end of the tube is the quarter of the wavelength of the sound of a fork, according to the fact that the wave is at the peak during the strongest resonance at the shortest resonating distance. So if we multiply the distance by four, we get the value of the wavelength. We plug it in the formula and find the speed of sound. We conducted the experiment three times with different tuning forks to have more accurate results.

6 Data



7 Results

The speed of sound from the calculations was:

$$V_1 = 338m/s$$

$$V_2 = 330m/s$$

$$V_3 = 327m/s$$

8 Discussion of Error

There are many sources of error in the experiment. It is clear, because the results were different from actual speed of sound. Some forks were damaged and bended, so the waves they produced were not at a given frequency. The tube was not symmetrical. It had an edge for a comfortable water emission. That affected the wave, which was traveling in the tube. The bottom of the tube was filled with water to make different levels of tube depth, however, water was unstable and refraction of the wave was not at the constant angle. It changed all the time.

9 Conclusion

The experiment was successful at determining the speed of sound. The results were not exact due to the possible sources of error, discussed above. The speed of sound was determined with a method, which requires to know some properties of sound, like its wavelength to be able to calculate the speed. Including the limitations, which we had, the experiment was more accurate than expected. The Lab allowed us to see the effects, sound has in the tube and how it can be used to determine the properties of sound.

10 Bliography

Definitions are from:

en.wikibooks.org

en.wikipedia.org

physics.about.com

whatis.techtarget.com