The Velocity of Sound

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February 2016

1 Problem

How to get the speed of sound by just in classroom?

2 Background

We want to do search about the speed of sound, and we are limited at one room. We cannot use timer to measure the time. We have water, long tube and different frequencies tuning forks. We supposed to design a experiment to measure and calculate velocity of sound.

3 Definition

Sound is a vibration that propagates as a typically audible mechanical wave of pressure and displacement, through a medium such as air or water. In physiology and psychology, sound is the reception of such waves and their perception by the brain. Sound is one of the longitudinal waves which travels in the form of compression and rarefaction.
v refers to wave speed, in this experiment we use it to definite the speed of sound.
f refers to frequency, it is how many times you finish change in unit time. It is a way to show period motion.
wavelength is distance between two nearby wave peaks
L is just a specific quantity which is forth of wavelength or wavelength, because the wave we produce is one forth of wavelength. It was considered as half of first harmonic standing wave

4 Materials

1.tuning fork
2.measuring glass
3.tone of water
4.ruler

5 Method

First we calculate the standard wavelength and L by using the standard sound velocity. V=340m/s and the frequency is showed on the tuning forks.

$$V = f\lambda$$

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

$$L = \frac{\lambda}{4}$$

We used the different frequency tuning forks. We changed the height of water in measuring glass in order to change the wavelength of

wave. And then we used our ear to compare different wavelength sounds produced by different frequency tuning forks to find most suitable sound. It very hard to describe what is the sound we are looking for, but clearly the sound which we are looking for is different.

6 Data

Tuning Fork number	Frequency	$\lambda(when velocity of sound is 340 m/s)$	L
1	512Hz	0.664m	0.166m
2	384Hz	0.888m	0.222m
3	256Hz	1.332m	0.333m

Table 1: The Theoretical Results

Tuning fork number	Frequency	L	λ	V
1	512Hz	0.165m	0.66m	338m/s
2	384Hz	0.215m	0.86m	330m/s
3	256Hz	0.320m	1.28m	327m/s

Table 2: Experimental Results

7 Results

In theoretical results, we assumed that the speed of sound. We use the Vsound=340m/s to calculate the wavelength of sound wave, and then we can know the first harmonic standing wave.
And in experiential result, we use water to limit the wavelength of sound. After we heard the best sound we use ruler to measure the distance between tuning fork and level of water, and this distance is one forth of wavelength. So that we can get wavelength, and then we use following formulation.

$$V = fv$$

$$V = 0.66 \times 512 = 338$$

$$V = 0.86 \times 384 = 330$$

$$V = 1.28 \times 256 = 327$$

8 Discussion Of Error

Clearly, the results that we get from experiment are not same, therefore there must be some errors in this experiment.
1. The frequencies of tuning forks are not accurate.
2. The tuning forks are shape changing.
3. Our ears make mistakes, because people's ears are very easy to be misled. And we use our ears to decide which sound is what we are looking for is not exact.
4. Also we used our hands to hit tuning fork because we don't tool. But I think we cannot control the strength of hitting tuning fork so that the sound may be influenced by strength of hitting tuning fork. Maybe bigger strength of hitting tuning fork will make sound louder so that misled our ear to think that sound is best.

9 Conclusion

This experiment told us the real is not always same as theory. And even though the experimental results are not same or accurate, we still can find the speed of sound will decrease when sound move in air. I calculate the average of sound speed is 333.66. And this experiment help me to review the first harmonic standing wave, which we learned last year.