Speed of sound
Physics 12

Daria Khon

March 1, 2016

1 Introduction

Sound is a longitudinal wave, which is created by a vibrating object. Measuring its speed in the air is the question of identifying wave properties such as its frequency,f, wavelength, *lambda*.

Therefore, using following materials and procedure, the speed of sound in the air was attempted to be determined, with reference to the main wave equation:

$$c = \lambda f$$

where instead of speed of light, speed of sound,v, would be determined.

2 Materials

- Graduated cylinder
- Frequency generator app ("F Generator")
- Water
- Ruler

3 Method

- Fill the graduated cylinder with water
- Generate frequency
- Collect data
- Ruler

4 Data

4.1 Collected data

Trial	Length, m	Resonant f, Hz
1	0.170	485
2	0.230	350
3	0.280	308
4	0.380	223

Table 1: Collected data

4.2 Processed data

Trial	Length, m	Resonant f, Hz	Wavelength,m	Speed (v), m/s
1	0.170	485	0.68	330
2	0.230	350	0.92	332
3	0.280	308	1.12	345
4	0.380	223	1.52	359

Table 2: Processed data, calculated speed

Sample calculations:

For Wavelength calculation:

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

(Trial 1) $\lambda = 0.17 * 4 = 0.68m$

For Speed calculations:

$v = \lambda * f$

(Trial 3) $v = 1.12 * 0.280 = 345m/s$

5 Analysis

The speed of sound in the air is faster when there is less distance to travel. Therefore the bigger the distance was between level of water and frequency generator, the bigger was wavelength and thus smaller frequency was generated.

Random error should also be considered in this experiment. Since frequency generator was never placed at the same height from the graduated cylinder, which created an error in the initial measurement of length. This could have affected accuracy of wavelength and speed evaluation.

6 Conclusion

This experiment showed how through wave equation, the speed of sound in the air can be evaluated.

This method is the simplest one to use for such measurements and was proved to be simple enough to perform in the classroom environment. For future evaluation more accurate measurements should be applied and relevant several trials