Frequency-Lab

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1 Problem

Measure the speed of sound in the air

2 Background

Definitions

Wave speed:Wave speed is a measure of how fast a wave travels. It is calculated as a ratio of how far a wave travels to the time it takes the wave to travel that distance.
Wave length:the wavelength of a sinusoidal wave is the spatial period of the wave—the distance over which the Wave shape repeats, and the inverse of the spatial frequency.
Frequency:Frequency describes the number of waves that pass a fixed place in a given amount of time.
Standing waves:A standing wave is one in which two waves superimpose to produce a wave that varies in amplitude but does not propagate.

3 Introduction

In this lab, we will be measuring the speed of sound in the air by using Phone's App(f generator). It is possible to investigate sound waves by creating standing waves in a column of air. If the air column is driven by a sound wave of the right frequency, a standing wave will be produced in the column which results in an audible tone. The process is closely related to what happens in a wind instrument like a flute, clarinet, trombone, or organ. We will use a glass tube partially filled with water. The water level represents a closed end of the air column, and can be varied in order to adjust the length of the column. If we hold a vibrating tuning fork over the column and vary the water level, we will hear a louder sound whenever the column length is right for standing waves at the frequency of the tuning fork. The water line is always a node, having zero amplitude. When the sound is the loudest, the amplitude of the wave is greatest at the mouth of the tube. The actual position of the node will depend on the wavelength, but the relative spacing of the resonances will always be the same fraction of a wavelength, L=$\lambda_{\overline{4}}$

4 Equation

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

$$V = \lambda \times f$$

5 Material

- F generator
- Ruler
- Glass column connected to a water reservoir

6 method

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7 table

Length	Frequency
0.23m	350Hz
0.38m	223Hz
0.17m	485Hz

Table 1: Frequency and length

8 Calculation

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

$$\lambda = 4 \times L = 0.23m \times 4 = 0.92m$$

$$v = \lambda \times f = o.92 \times 350 = 322m/s$$

$$\lambda = 4 \times L = 0.38m \times 4 = 0.1.52m$$

$$v = \lambda \times f = 1.52 \times 223 = 339m/s$$

$$\lambda = 4 \times L = 0.0.17m \times 4 = 0.68m$$

$$v = \lambda \times f = o.68 \times 485 = 329.8m/s$$

9 result

Based on our experiment, the speed of the sound should between 332m/s to 338m/s.

10 Error

We may have some errors, because we measure the frequency by using our ears.

11 Conclusion

This lab taught me a lot about resonance. I learned that speed of sound is changed according to the temperature in the room at the time. And sometime we can really judge which frequency is loudest.