SPEED OF SOUND

Objective

To determine the speed of sound in air by means of a resonating air column at room temperature.

Equipment

Tube, clamps, flexible tubing, water, a thermometer, water jug, meter stick and two tuning forks

Procedure

1. Measure and record the temperature of the room. Measure and record the radius of the tube.

2. With the column full of water, strike the tuning fork on the heel of your hand. ***DO NOT HIT THE TUNING FORK AGAINST A HARD SURFACE,*** this can permanently damage the tuning fork and produce harmonics of the fundamental frequency (stamped on the tuning fork) which will confuse the interpretation of your data. Touch the tuning fork near the base to damp out the harmonics.

3. Hold the tuning fork approximately two centimeters from the open end of the tube, with the tines of the fork perpendicular to the axis of the tube. Listen near the edge of the tube for a sudden increase of sound intensity as the water level in the tube is lowered. This will occur when the length of the air column in the tube is one of the resonant lengths. Mark this point with a rubber band and measure the distance from the top of the tube.

4. Continue to lower the water level until you find the next increase in sound intensity. Again, mark this point with a rubber band and measure the distance from the top of the tube.

5. Try to find at least one more resonance length.

6. Repeat using the other tuning fork.

Graphs and Diagrams

1. Plot the frequency versus 1/wavelength (calculation 1).

Questions and Calculations

1. Knowing what fraction of a wavelength that fits inside the air column, the wavelength can be computed for each of your measurements. To find the correct wavelength from your measurements you will need to make a small adjustment because the center of the anti-node is not exactly at the end of the tube but slightly beyond it. A good approximation to use is to add six-tenths of the radius of the tube to your measurements. compute the corrected wavelength for each measurement.

2. From the graph, find the speed of sound. The speed of sound in dry air at 0C is 331.5 m/s and increases 0.6 m/s for each C rise in temperature, thus v(T)=(331.5+0.6T)m/s. Compare your value of the speed of sound and the value calculated using this formula.

3. If the room temperature were lowered how would this effect the experiment? How would your measurements change?

4. If you were underwater and had a trapped column of air, you could repeat this experiment. Except, this time the sound waves would be traveling through water and not air. How would the results be affected, if at all? Explain.

5. Suppose you performed this experiment on the Moon. How would your results differ?