The Speed of Sound

Purpose: The purpose of this activity is to determine the speed of sound using the principle of resonance

Materials: Resonance tube (around 50 cm long), large graduated cylinder, meter stick, tuning forks (256 hz or above)

Procedure: In this experiment you will use the principle of resonance to determine the wavelength of a sound wave. Knowing the wavelength and frequency of a sound wave allows you to calculate the speed of sound. You are familiar with the applications of resonance, but perhaps never knew what it was called. By holding a vibrating tuning fork over an open tube of water and adjusting the length of the tube, it is possible to get the air column to vibrate at its resonant frequency. This will be noticed because the volume becomes louder at the proper length. For a tube closed on one end and open on the other (called a closed tube), resonance occurs when the tube is 1/4 the size of the wavelength of the sound.

1. Fill the cylinder with water to about 2/3 of its capacity. Place the resonance tube in the water. You can vary the length of the air column by moving the tube up and down.

2. Strike the tuning fork with something soft but firm (like the bottom of your shoe). With the tuning fork held horizontally, near the open tube, move both the fork and tube up and down. Find the air column length that gives the loudest sound.

3. Measure the distance from the top of the tube to the water for the loudest sound.

4. To this length add 4/10 the diameter of the tube to correct for the small amount of air just above the tube that also vibrates.

5. This length represents 1/4 wavelength. Calculate the wavelength of that sound.

6. Using the frequency given on the tuning fork, and the calculated wavelength, calculate the speed of sound in air.

7. Read the thermostat in the classroom to get the temperature in the room. Compare the value calculated for the speed of sound in air to the accepted value of the speed of sound in air given by the equation speed of sound = 332 m/s +.6 m/s * temp.

7. Repeat for a total of three different frequencies.

8. Go outside and repeat the experiment. Get the temperature outside and compare the new values.