Sound is an energy produced when an object vibrates. The particles of an object bump into each other and then move back and forth in the direction of the wave. Only the energy is transferred; the particles don't move with the wave. We're going to look at how to measure the lengths of the sound waves to find their velocity, or speed.

Sound Definitions:

Wave: A rhythmic disturbance that carries energy through matter or space. The wave transfers energy without transferring matter.

Compression Wave: A mechanical wave in which matter in the medium moves forward and backward in the same direction that the wave travels.

Mechanical Wave: Waves that use matter to transfer energy.

Frequency: The number of wavelengths that pass a given point in one second. Measured in Hertz.

Wavelength: Distance from one crest (or trough) to adjacent crest (or trough) in a transverse wave and distance from the middle of one compression (or rarefaction) to the middle of the next compression (or rarefaction) in a compressional wave.

Speed: The distance traveled by a wave in one second.

Sound Safety:

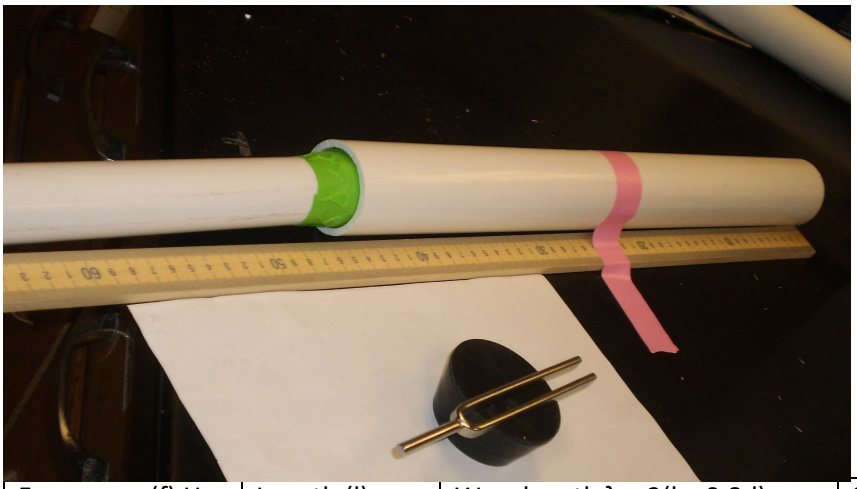
- Tuning forks should be struck only with the rubber mallets or rubber stopper. The bottom of a rubber soled shoe will also work well.
- Do not strike the tuning fork on a hard surface. You may break your fork!

Sound Procedure:

1. Measure the inner diameter of the sliding resonance tube, and record it on your data sheet.
2. Record the temperature of air in the room. You will convert this temperature to Celsius.
3. Choose a tuning fork between 256 Hz and 480 Hz, and record the frequency of the tuning fork.

Open Resonance Tube

1. Place the longer resonance tube horizontally on the lab table so that the end that contains the sliding inner tube extends about 1 inch past the edge of the table. Use tape to fasten the tube to the table so that the tube cannot move.
2. Strike the prongs of the tuning fork on the rubber, and hold the vibrating prongs at right angles to the mouth of the inner tube while adjusting the inner tube up and down to obtain the maximum sound.
3. Measure the length of the tube to the closest millimeter, and record the length.
4. Perform the calculations using the data you gathered and in the following table:
    a. To find temperature: °C = (°F – 32) x 5/9
    b. To find wavelength 2(length of tube at the loudest point + 0.8 x inside diameter of tube)
    c. To find speed: Frequeny x wavelength



Frequency (f) Hz	Length (l) cm	Wavelength $\lambda = 2(l + 0.8d)$ cm	Speed $s = f \times \lambda$
Average	Speed	(cm / s) →	

Closed Resonance Tube

1. Set the bottom of the shorter resonance tube vertically on the lab table so that the end that contains the sliding tube is at the top of the tube.
2. Using the same tuning fork frequencies from the Open Resonance Tube. Strike the prongs of the tuning fork on the rubber, and hold the vibrating prongs at right angles to the mouth of the tube while adjusting the inner tube up and down to obtain the maximum sound.
3. Measure the length of the tube to the closest millimeter, and record the measurement.
4. Perform the calculations using the data you gathered and in the following table:

d. To find temperature: °C = (°F – 32) x 5/9

e. To find wavelength 4(length of tube at the loudest point + 0.4 x inside diameter of tube)

f. To find speed: Frequeny x wavelength

Frequency (f) Hz	Length (l) cm	Wavelength λ = 4(l + 0.4d) cm	Speed s = f x λ
Average	Speed	(cm/s) →	

Take the average of three trials for each tube to find the approximate speed of sound. We are measuring the speed of sound in cm / s. To find the speed of sound in m / s, divide your answer by 100. Congratulations! You've found the speed of sound using the standard measurements of science!

Sound References:

- Physics experiments (sound) www.psi-net.org
- Resonance tube velocity of Sound http://hyperphysics.phy-astr.gsu.edu/hbase/Class/Phscilab/restube.html
- Physics classroom tutorial http://www.physicsclassroom.com/Class/sound/u11l5d.cfm