PHYSICS IN MOTION
gpb.org/physics-motion

Unit 6E
Standing Waves and Resonance
Resonance in a Closed Tube Lab

Name:

Date:

In today's activity, you will be determining the speed of sound in air by using resonance and creating a standing wave in an closed-ended tube.

Materials:

- pvc pipe
- large graduated cylinder
- tuning forks
- ruler
- thermometer

Pre-Lab:

1. Draw a diagram of the standing wave with the fundamental frequency in a closed-ended tube:

2. What is the equation for the wavelength of the standing wave in this tube?

Procedure:

1. Determine the actual speed of sound in the classroom using the temperature.

Temperature = ______________________

$v_{sound} = 331\ {}^{m}\!/_{s} + (0.6\ {}^{m}\!/_{s\,^\circ C})(Temperature)$

v_{sound} = ______________________

questions continued on next page

PHYSICS IN MOTION
gpb.org/physics-motion

Unit 6E
Standing Waves and Resonance
Resonance in a Closed Tube Lab

Name:

Date:

Procedure:

2. Using different tuning forks, adjust the length of the air column in the PVC pipe in order for resonance to occur. Remember what must be on the open end of the tube!

   Make note of the frequency of the tuning fork, and for the length of the column of air in the PVC pipe. Determine the speed of sound in air from these measurements.

Frequency (Hz)	Air Column Length (m)	Wavelength (m)	Speed of Sound in Air (m/s)

3. Calculate the average of your experimentally determined speed of sound values in the table above.

4. Find the percent error of your experimental value to the actual speed of sound in air.

$$\textit{percent error} = \frac{\text{actual value - experimental value}}{\text{actual value}} \times 100\%$$

Questions to consider:

1. Would the speed of sound be faster or slower if the temperature of the room was warmer?

2. How would the speed of sound compare if there was a humidifier in the room that made the humidity of the air greater?

3. Did the higher or lower frequency tuning fork have a speed of sound value closer to the actual speed of sound? Explain why this might have occurred.