

Open Tube Harmonics

Name _____ Date _____

Source Notes:

This lab was modeled after the “Speed of Sound” lab #30
“Laboratory Physics”, Murphy Doyle, Merrill, 1990.
ISBN 0-675-02477-3

This method was demonstrated with the sound sensors and experiments created by Pasco for their Science Workshop Software in 1996

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1997(?)
Modified 2010

Teacher Notes:

Modifications:

Pasco switched software to Data Studio so some modifications were added. The original .sws files were modified to the new .ds format. (around 2005?)

Grade

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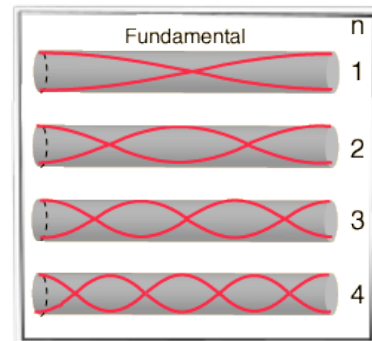
Purpose:

To measure the speed of sound at room temperature.

Theory:

A cylindrical air column with both ends open will vibrate with a fundamental mode such that the air column length is one half the wavelength of the sound wave. Each end of the column must be an antinode for the air motion since the ends are open to the atmosphere and cannot produce significant pressure changes. For the fundamental mode, there is one node at the center. The basic wave relationship leads to the frequency of the fundamental: $\lambda = (2/n) L$ The open air column can produce all harmonics. Open cylinders are employed musically in the flute, the recorder, and the open organ pipe.

<http://hyperphysics.phy-astr.gsu.edu/hbase/waves/opecol.html#c2>



Data:



Calculations:

	L_{tube} (cm)	d (cm)	T (s)	f (Hz)	L (m)	λ (m)	Speed (m/s)
1							
2							
$v_{\text{sound in air}} \approx 331.4 + 0.6T_C \text{ m/s}$					avg		
					actual		%

$$v = f\lambda$$

Conclusion (error analysis):

What was a possible source of error in this experiment?