Standing Waves and the Speed of Sound

Objective: To use standing waves and fundamental frequencies to determine the speed of sound.

Procedure:

1. Immerse a glass tube into a graduated cylinder filled with water.
2. Hold a vibrating tuning fork above the cylinder and slowly raise the pipe until it resonates and the amplitude of the sound wave increases significantly. (In other words, it should be much louder)
   Note: Do not tap the tuning fork against a lab table or counter to set it in motion. Use your hand or a rubber mallet.
3. The shortest length at which the pipe resonates is known as the fundamental mode and is ¼ of a full wavelength. Measure the length of the air filled pipe.
4. With the same tuning fork, determine if there is a second location where the sound is significantly louder. You may have to use a larger tube and graduated cylinder to find the second location.

Data:

Note	Frequency - Hz	First Length – m (L)	Wavelength - m ($\lambda = 4L$)	Velocity – m/s ($v = f\lambda$)	Second Length – m (D)
C					
D					
E					
F					
G					
A					
B					

Questions:

1. Using *your data*, does the speed of sound depend on the frequency of the sound wave?

2. Looking at your data, what happens to the wavelength of sound as the frequency increased? Why?

3. Using your data, determine if there is a relationship between L (the length of the tube when the first sound was heard) and D (the length of the tube when the second sound was heard). If you notice a pattern, describe what might cause this.

4. Define a standing wave.

5. What type of interference is occurring at the location where you first hear the loud sound?

6. Determine the average of your values for the velocity of sound. Calculate the percent difference between your average value and the actual value for the speed of sound. Explicitly show each calculation.

Ex) $\frac{344m/s - Average\,Value}{344m/s} x100$ = ________ % Difference