SAINT JOSEPH'S PREPARATORY SCHOOL
PHYSICS – February, 2012

The Speed of Sound in Air

NAME: _____ DATE: _____ PERIOD: _____

Introduction:

The speed of sound in air can be measured indirectly if a way can be found to determine both the frequency and the wavelength of a particular sound wave. If both of these can be measured, then the equation $v = f\lambda$ can be used to calculate the velocity.

In this experiment, an apparatus similar to what is shown in the picture will be used. A tuning fork will be used to control the frequency of the sound wave whose speed will be measured. Several important characteristics of wave behavior are necessary for this measurement to work.

A standing wave will be produced in the column of air in the apparatus. Resonance will insure that the frequency of the standing wave is the same as that of the tuning fork. The presence of real but invisible nodes and anti-nodes in the column of air will make it possible to measure the wavelength of a sound even though it cannot be seen.

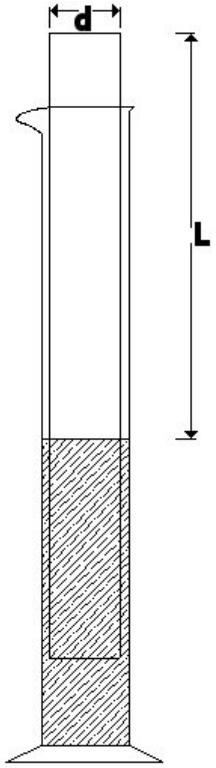
Since the actual vibration of air in a cylinder is complicated by the three dimensional nature of the cylinder, it is necessary to correct for the diameter of the air column.

Procedure:

- Set up the apparatus as directed. Use the diagram as a guide.
- Measure the **inner diameter** (i.d.) of the PVC pipe.
- Determine the ***shortest*** column of air with which the tuning fork resonates.
- Calculate the wavelength from this equation: $\lambda = 4(L + 0.3d)$.
- Record the temperature of the room.
- Calculate the speed of sound from these data.
- Repeat the measurement with several different tuning forks.

Questions:

1. How could this experiment be adjusted to determine whether the speed of sound in air is dependent on its frequency? Do your results indicate an answer to this question?
2. How could this experiment be adjusted to determine whether the speed of sound is dependent on atmospheric pressure?
3. Assuming that the speed of sound in air in m/s can be determined from the equation $v = 331.5 + 0.607C$ where C is the temperature of the air in degrees Celsius; how can the experiment be adjusted to determine the frequency of an unmarked tuning fork?



frequency	length of air column	diameter of tube	wavelength	room temperature	speed of sound