Mohawk Valley Library System

SCIENCE @ THE LIBRARY

MEASURING THE SPEED OF SOUND IN AIR

The purpose of this experiment is to measure the speed of sound in air. The velocity with which sound travels in any medium may be determined if the frequency and the wavelength are known. The relationship between these quantities is:

v = fl where v = velocity of sound propagation
f = frequency
l = wavelength

In this experiment the velocity of sound in air is to be found by using tuning forks of known frequency. The wavelength of the sound will be determined by making use of the resonance of an air column.

MATERIALS:
Tuning forks (256 Hz, 512 Hz, 1024 Hz)
rubber mallet
cylindrical beaker
white plastic resonance tube (with blue markings on side - these were previously measured and marked to make it easier to show where certain tuning forks will resonate)
water

WHAT TO DO:

Fill the beaker 3/4 full of water.

Insert the white plastic resonance tube, noting the blue lettered markings on the side.

Choose one marking and locate a tuning fork with the same numbers on it. These are the frequency of the vibrations per minute.

Raise the inner tube so the marking is even with the top of the water.

Slowly change the level of the tube by continuing to hold the fork in one hand and raising the resonance tube with the other. Do not allow the vibrating tuning fork to touch the cylinder.

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(continued)

Change the level of the resonance tube until you hear strong resonance. Continue changing the level of the tube to catch harmonic repetitions (i.e. different octaves) of the same resonating frequency.

Experiment with other tuning forks and levels of the water.

OBSERVATIONS:

In this experiment we create longitudinal standing waves in a tube containing air. The tube is open at the top. By adjusting the amount of water in the tube one by lengthen or shorten the length, of the column of air in the tube. When the tuning fork is struck and held over the open end of the tube, it excites the air molecules in the tube and causes a sound wave to run down the length of the tube to the air-water boundary where it is reflected back up the length of the tube to the open end. By moving the inner plastic tube slowly up and down in the water, you will hear the change of the tuning fork. When you have the column of air just right, the tone will be clear.

FUTURE THOUGHT:

The familiar "sound of the sea" which is heard when a seashell is placed up to your ear is also explained by resonance. Even in an apparently quiet room, there are sound waves with a range of frequencies. These sounds are mostly inaudible due to their low intensity. This so-called background noise fills the seashell, causing vibrations within the seashell. But the seashell has a set of natural frequencies at which it will vibrate. If one of the frequencies in the room forces air within the seashell to vibrate at its natural frequency, a resonance situation is created. And always, the result of resonance is a big vibration - that is, a loud sound. In fact, the sound is loud enough to hear. So the next time you hear the "sound of the sea" in a seashell, remember that all that you are hearing is the amplification of one of the many background frequencies in the room.

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