ARBOR SCIENTIFIC

Sound Pipe

P7-7200

INSTRUCTIONAL GUIDE

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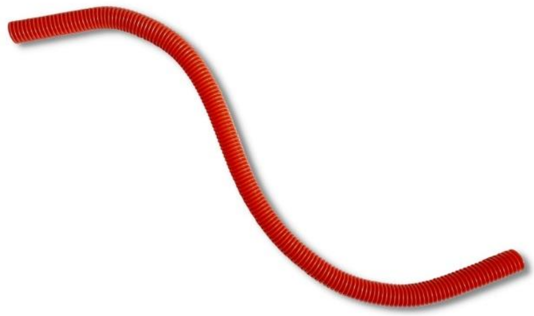


Background

What makes the Sound Pipe produce sounds? The answer is a combination of resonance and Bernoulli's principle.

When you twirl the Sound Pipe, the outer end moves faster than the end in your hand. Bernoulli's principle states that the faster a fluid (like air) moves across a surface, the lower the pressure on the surface will be. With higher pressure occurring at the end of the tube held in your hand, the pressure differential results in air rushing up the tube. The faster you twirl the Sound Pipe, the greater the pressure differential, increasing the speed of air moving up the tube.

Introduction

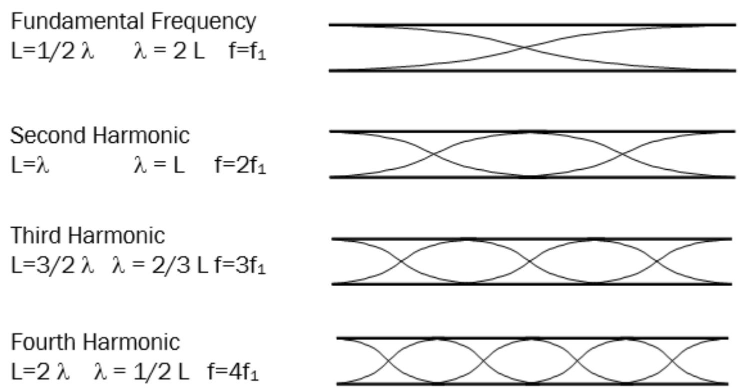
Turbulence is created when air travels through the tube. This turbulence is compounded by the ridges in the sides of the tube. These turbulences produce areas of high and low pressure which when traveling along the tube form the vibrations known as waves. Sound waves traveling out the open ends of the tube partially reflect into the tube. (Because we can hear the sound outside the tube, we know the reflection is not complete.) If the wavelength of the reflected wave matches the wavelength of the incoming wave, these waves reinforce one another, producing sound waves of greater amplitude (sound waves loud enough to hear) and that is what is called resonance.

Waves of many different wavelengths are produced, but only waves whose wavelengths fit the length of the tube (or a whole number of half wavelengths) will be reinforced by the reflected waves. The lowest frequency for which the waves resonate is called the fundamental.

As the speed of the air moving up the tube increases, a different set of wavelengths is produced by the faster-moving air. Higher frequencies, related to the fundamental, will also resonate and are called overtones of the fundamental. Since the length of the tube dictates these frequencies, only these select sound waves will be heard. The diagrams below show the different wavelengths that resonate in an open-ended tube.

Activities

1. Hold the Sound Pipe at one end and twirl it around. Slowly at first. Gradually increase the rate at which you twirl the tube. Try to produce 5 separate standing wave frequencies.
2. Place the stationary end of the tube over a table on which small torn-up pieces of paper have been placed. Twirling the outer end of the Sound Pipe will vacuum the paper off the table, spraying it out the other end.



Related Products

Resonance Bowl (P7-7510) See water dance to the vibrations from your hands with the Resonance Bowl! A fun and effective way to demonstrate the behavior of waves and their interactions.

Set of 8 Boomwhackers (P7-7400) Demonstrate open- and closed-piped resonance with these colorful tubes. When whacked against the floor or your knee, each tube produces a clear tone. Students can even play songs!

Singing Rods (Set of 2) (P7-7250) A must for explorations of sound and waves, these rods are an easy way to demonstrate longitudinal waves as opposed to transverse waves. They're ideal for teaching about nodes and anti-nodes in standing waves.