



LAB 42: REFRACTION OF SOUND

Lab 42: Refraction of Sound

This lab introduces students to refraction using something they can experience. They really do not understand what is going on when a pencil is put into water and appears to bend. It is difficult to see rays of light bending without the use of a laser or other expensive equipment. So for this first exposure to refraction, students will use sound instead.

Post-Lab Answers

1. When sound travels from air through the CO_2 -filled balloon, it gets focused. When sound travels from air through the helium balloon, it gets spread apart.
2. A hydrogen-filled balloon would spread the sound even more because it is even less dense than helium.
3. No. If you are in the water, the sound will simply bend, but not focus because the surface of the water is flat. Although sounds are different underwater, it is not because of this effect.

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QUESTION

How does sound bend as it passes from one medium to another? How can this be used as a model of how light acts?

SAFETY

Dispose of any popped balloon parts immediately after the lab.

MATERIALS

Helium balloon, empty balloon, glass or plastic soda bottle, vinegar (~125 ml), baking soda (~50 ml)

PROCEDURE

When light travels from one medium (material) to another medium with a different index of refraction, the light bends. This property can be used to focus light rays or spread them apart. The same thing happens with sound, but it is the density of the mediums that must be different.

1. Obtain a helium balloon. If you cannot find one, your teacher will have one available in class. Use a standard rubber balloon, not a metallic mylar balloon.
2. Fill a balloon with carbon dioxide. To do so, fill a small soda bottle with vinegar $\frac{3}{4}$ full. Roll up a medium handful of baking soda in a paper towel and twist it to fit through the neck of the bottle. Drop the baking soda into the bottle, remove the paper towel, and quickly put the balloon over the mouth. Wait for the balloon to stop inflating and tie it off.

NOTE: SAVE YOUR CO₂-FILLED BALLOON FOR LAB 43.

3. Set up a radio or television and stand so that one ear is facing its speaker. Hold the helium balloon 30 cm from the ear facing the sound source and record your observations. Then hold the carbon dioxide balloon 30 cm from the ear and record your observations.

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Post-Lab Questions

1. Helium is less dense than air. Carbon dioxide is more dense than air. When sound travels from air through the CO_2 -filled balloon, it gets _____ (focused/spread apart). When sound travels from air through the helium balloon, it gets _____ (focused/spread apart).
2. How would you expect a hydrogen-filled balloon to sound?
3. Does this help explain how it sounds when you're underwater and someone on the surface is yelling to you? Explain why or why not.