CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Alexandra L. Simon

Project Number
J1533

Project Title
Density's Effect on Amplitude: The Untold Story

Abstract

Objectives/Goals
The objective is to test jars full of helium, air, and carbon dioxide, all different densities, to see if density affects the amplitude of buzzing in the jar. I believe the density of a medium does affect the amplitude of sound traveling through it. The amplitude of the buzzing in CO(2) will be greater than the buzzing in air, which will be greater than in helium because the more dense the medium, the faster sound travels. If sound travels quickly, it's carrying a large amount of energy. The greater amount of energy sound carries, the greater its amplitude.

Methods/Materials
3 half gallon jars and lids, 3 microphone transducers(16 VDC),more than .5 gallon of helium, 1 oscilloscope, 4 small chunks dry ice, 3 electrical buzzers(20 VAC)

Results
The sound wave of the buzzing was shown on the divisions of the oscilloscope screen. The crests and troughs of the wave in each division were recorded in mV. The average amplitude of buzzing in helium was 1.03125 mV. The average amplitude of buzzing in air was 1.25 mV. The average in CO(2) was 0.5125 mV. CO(2) has the lowest amplitude, helium has the middle amplitude, and air has the highest. The CO(2) was in the form of dry ice, so the jar got very cold. At -37°C it has a density of 1.1 grams per liter, but it was found on a website that at 25°C, the density of CO(2) is 1.527 grams per liter. CO(2) is in it#s most dense state from 0°C to 4°C when it is in the form of dry ice because it is a solid. It's believed that as the temperature of CO(2) increases, the density increases. Another reason why the amplitude of the buzzing in CO(2) was low is there was a small amount of frost on the buzzer. If the buzzer was so cold it had frost on it, the cold may have been restricting the buzzer#s oscillations. This would appear to be a low amplitude, when in fact the buzzer is not making as much noise because of the low temperature.

Conclusions/Discussion
The hypothesis was partially correct. It was found that while density does have an affect on the amplitude of sound traveling in a medium, temperature also has an affect on it. While the buzzing had a higher amplitude in air than helium, the buzzing in CO(2) had the lowest amplitude of the three. The buzzing in CO(2) may have been affected by a small bit of experimental error. Therefore, the density of a medium does affect the amplitude of sound traveling through it, but density can vary based on temperature, pressure, or altitude.

Summary Statement
To see if the density of a medium, in this case a gas, effects the amplitude of sound, in this case buzzing, in that medium.

Help Received
Mr. Raymond Hunter helped recommend and obtain many of the electrical devices in the experiment from Mouser Electronics, an electrical supply catalogue. Used the oscilloscope at St. Margaret's Episcopal School under the supervision of Mr. Joseph Ingalls.