CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
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Project Number
J1506

Project Title
Tuning into the Atomic Theory

Abstract

Objectives/Goals
For my experiment I asked the Question, "How does temperature effect the frequency of a scientific tuning fork? Is the frequency change linear or nonlinear?"

Methods/Materials
I tested six different tuning forks thirty times in five different temperatures ranging from 0 degrees to 100 degrees C. The six different tuning forks I tested were (C) 256 Hz, (C) 512 Hz, (G) 384 Hz, (E) 320 Hz, (E) 640 Hz, and (C) 1024 Hz. I tested them at 0 degrees C, 23 degrees C (room temperature), 48 degrees C, 66 degrees C, and 100 degrees C.

Results
Before I ran my experiment, I believed that my results would show an increase in frequency as there was an increase in temperature. As there was a decrease in temperature there would be a decrease in frequency. This was not so. Instead as the temperature increased, there was a decrease in the frequency; and as the temperature dropped, the frequency increased.

Conclusions/Discussion
This occurred because as atoms heat up they move father apart, and as they become colder they move closer together. Since they move farther apart as the temperature increases the volume of the tuning fork increases. This makes it so that the atoms that make up the tuning fork have a farther distance to travel and therefore the cycles per second (frequency) decreases. As the temperature drops and the atoms move closer together the atoms of the tuning fork collide more frequently since they have a shorter distance to travel, therefore allowing the cycles per second to increase. I also stated in my hypothesis that my data would create a linear relationship when graphed. This did occur, but through my research I have discovered that if I could have exceeded 100 degrees C and tested the tuning forks in subzero temperatures the data that I would collect would form a parabola. This would happen because at absolute zero (0 degrees K or -273 degrees C) there would be no atomic movement and as the tuning forks temperature approached its melting point the shape of the tuning fork changes and no vibration would occur. With the tuning forks original shape gone the frquency would be zero. This project has widened my knowledge of the atomic world and has allowed me to come to a better understanding of how humans perceive sound.

Summary Statement
Testing a select group of tuning forks in hot and cold water for changes in frequency.

Help Received
Father or mother helped record data during testing