CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
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Project Number
J1801

Project Title
Applying Wave Refraction Principles including Snell's Law to Differentiate Unknown Materials

Abstract

Objectives/Goals
The objective is to apply refraction principles, including Snell#s Law, and basic trigonometric principles, to differentiate known and unknown materials and their properties.

Methods/Materials
First, I used a laser to measure refraction in seven containers of a sugar water solution of varying densities. Second, in a rectangular glass container of oil and water, I directed a laser at an angle into the liquid and reflected it off of a mirror at the bottom of the container. I then measured the angle of refraction of the laser through each of the layers of oil and water, and measured the distance between the point of entry of the laser into the liquid and the point of exit of the reflected laser out of the liquid, and also measured the depths of the respective layers of oil and water.

Results
In my sugar solutions, I found that refraction correlated directly to the density of the solution. In the container of oil and water, I found that by measuring the angle of the laser entering the surface, measuring the distance between that point and the point of exit of the reflected laser, and measuring the depths of the respective layers, I could determine the identity of the lower layer liquid. Alternately, by knowing the identity of the liquids, I could then separately calculate the depths of the layers of the liquids.

Conclusions/Discussion
My first experiment with sugar water confirmed that density of a material directly correlated to the level of its refractivity. My second experiment confirmed that with the application of Snell's Law and basic trigonometric principles, I could identify an unknown subsurface material knowing just some basic data. My original idea of this experiment was application of these principles to identifying subsurface strata in the Earth, and also quantifying materials and their properties such as polar ice caps.

Summary Statement
Applying wave refraction principles, including Snell's Law, to differentiate materials and their properties.

Help Received
Mother and father helped type report and prepare layout of project board. Father helped prepare test taking equipment and double-checked some measurements. Sister took photos.