CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Matthew G. Arnall

Project Number

J1801

Project Title

Stealth: Applying Wave Theory to Affect Visibility

Abstract

Objectives/Goals

My objective was to show how to make an object invisible or less visible. I believed that an object should become less visible by changing its angle of incidence to a light source, which by applying the Law of Reflection, should change the amount of light reflected back to the eye or any other sensor.

Methods/Materials

I fashioned objects from identical size pieces of white foam board: one being a single plane object, and the others being two-plane objects with different interior angles. I set each object on a stand at a fixed distance from my light source. At night in the dark, I shined the light on each object. I varied the angle of incidence of the single plane object and measured the reflected light at each of those angles using a lux meter. For each of the two-plane objects, I recorded lux meter readings for light reflected from both the interior as well as the exterior angles.

Results

The angle of incidence of the object to the light correlated directly to the measured amount of light reflected back from the object. For the single plane object, it was a linear correlation. For the two-plane objects, it appeared to be a parabolic correlation.

Conclusions/Discussion

Light behaves like a wave, and an object can become less visible, or invisible, by changing its angle of incidence to a light source.

Summary Statement

My project applies wave principles to reduce the visibility of an object.

Help Received

Father helped construct test objects and helped locate research materials on the internet, bought a lux meter and photographed me doing testing. Mother helped glue display items on board, and helped type my report and type this form.

Name(s)

Namrata R. Balasingam

Project Number

J1802

Project Title

The Physics of the Party Balloon: On Laplace's Law, Nonlinear Elasticity, and Their Uses in Physiology and Medicine

Abstract

Objectives/Goals

Balloons are similar to many mammalian organs such as the heart, bladder, lungs and arteries. Balloons are also used in angioplasty to unclog blocked arteries. In all of these cases, the function of the balloon-like vessel depends strongly on the relationship between the pressure within it, and its size. In this experiment, I have used party balloons as model systems to investigate this relationship

My main question was about how the pressure within an inflating balloon depends on its radius. I investigated this question using 12" spherical party balloons. I then asked further questions: How does the pressure-radius curve change as (a) the manufactured size of the balloon, (b) the shape of the balloon, and (c) the wall thickness of the balloon are changed? I used party balloons of different sizes, and shapes.

Methods/Materials

I built a U-tube manometer using commonly available materials. I attached the balloon under test, and a bike pump to this setup. I inflated the balloon in small increments and recorded its pressure, and radius. I did this until the balloon was fully inflated. I repeated this for each balloon three times. I collected over 500 data points for all the variations in my experiment.

Results

The experimental pressure-radius curves I obtained were surprisingly complex. I used Laplace's Law ($P=2T/R$) - where P is the pressure, T is the wall tension, and R is the balloon radius - to analyze my results. The wall tension T is a function of R. So I needed to use a law of elasticity along with Laplace to model my experimental data. First I tried the famous Hooke's Law, which is a linear law of elasticity. This failed to fit my data. I then tried different nonlinear theories of elasticity and Mooney and Rivlin, and obtained progressively better fits.

Conclusions/Discussion

I found that the manufactured size of a balloon does not affect the pressure-radius curve much. I showed that Laplace's Law itself has to be modified to account for geometrical differences between spheres, and cylinders. I found that the pressure required to inflate a balloon depends linearly on wall thickness. Medical balloons are smaller, and are made of more exotic materials. However, the theoretical methods I have used to study party balloons are conceptually similar to those used by professional medical balloon designers.

Summary Statement

I showed that Laplace's Law, and a suitable nonlinear theory of elasticity can be used to model the complicated pressure-size behavior of an elastic container.

Help Received

I would like to thank my advisors Ms. Pelayo, and Dr. Srithara (MD) for their valuable advice on this project. I would also like to thank my dad Dr. Pratheep Balasingam, and my mom for their support, and encouragement.

Name(s)

Samantha S. Brennan

Project Number

J1803

Project Title

Which Roof Color Is Most Effective and Least Effective at Absorbing the Sun's Energy?

Abstract

Objectives/Goals

My project was to determine which roof color is the most effective and least effective at absorbing the sun's energy. I predicted that black would be the most effective and white would be the least effive at absorbing the sun's energy.

Methods/Materials

Nine pieces of 10 cm by 10 cm metal about 1 mm thick; One 10 cm by 10 cm strip of aluminum foil; 33 cm by 33 cm of a wooden board about 25 mm thick; Gold spray paint; Black paint; White paint; Gray paint; Blue paint; Yellow paint; Red paint; 2 screws; A screwdriver; Elmers glue; Wood glue; Skill saw for cutting wood; Drill; 6 mm drill bit; Two metal hinges; A 10 cm by 10 cm piece of grass.

Results

As I had predicted white was the least effective at absorbing the sun's enegry and black was the most effective at absorbing the sun's energy. The average temperature of black was 35.1 degrees C. The next hottest temperature was red with an average temperature of 31.2 degrees C. Then, gray with an average temperature of 30.7 degrees C, blue with 30.1 degrees C, gold with 29.7 degrees C, grass with 27.0 degrees C and aluminum foil tied with yellow. Their average temperature was 26.5 degrees C and white was the least effective at absorbing the sun's energy. White's average temperature was 24.7 degrees C.

Conclusions/Discussion

All nine roof colors were exposed to the same outside conditions. As predicted, white would absorb the least amount of sun#s energy and black would absorb the most. In this experiment there was a trend. This trend showed that all of the darker colors had higher temperatures than the lighter colors. Darker colors absorb the sun#s energy more than lighter colors which reflect the sun#s energy. The high and the low points on the graph symbolize another trend. The hotter and sunnier the day was, the higher the temperatures were. This data did support my hypothesis because black absorbed the greatest amount of sun#s energy and white absorbed the least amount of the sun#s energy. If this experiment were to be repeated, the wood that held the nine pieces of metal would have been bolted down because the grass kept falling off of the stand due to the wind. The practical application of this experiment helps the subject determine the best roof color. Not only can this apply to a subject#s roof color, but on hot days dark colored clothing should not be worn, especially outside because they will absorb heat.

Summary Statement

Out of nine different roof colors tested, black was found to be the most effective and white was found to be the least effective at absorbing the sun's energy due to the different amounts of absorbtion from the visible light spectrum.

Help Received

Parents bought all my materials. My dad helped me build the stand that held my experiment.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Sarane M. Caratan

Project Number
J1804

Project Title
Action of Refraction

Abstract

Objectives/Goals
The objective was to determine if light, passing through a prism filled with water refracts more when the density of the water inside of a prism is increased. I believe that as the density of water is increased the light will refract more and have a higher index of refraction.

Methods/Materials
I constructed a glass equilateral prism. It was placed on a paper taped to a counter and I placed a laser behind the prism. I then taped a piece of paper to the wall directly in front of the prism. With the prism filled with air I turned the laser on and marked the point it struck on the paper in front of it. I then filled the prism with water only, 5%, 10%, and 15% solutions of sugar and water. With the prism filled with one of the mediums I turned the laser on and marked the point on the paper in front of it. This procedure was repeated three times for water, each of the solutions and when the prism was filled with air.

Results
The laser passed straight through the prism when it was filled with air. The index of refraction was 1. When the light went through the prism filled with water the index of refraction was 1.33. This means that light traveling through air travels 1.33 times faster than when it is traveling through water. The solutions of 5%, 10%, 15% produced indices of refraction of 1.36, 1.38, and 1.4. Notice the equal .02 increment of the index of refraction corresponding with the equal 5% increments of the density of water. The equal increments were not only measured by the index of refraction but you could visually see it by measuring the equal distance the light moved over on the wall with each change in density.

Conclusions/Discussion
The light refraction increased as the density of the medium increased. Equal increments in density yielded equal increases in the refraction of the light.

Summary Statement
It is about measuring the increase in light refraction when the density of the medium that it passes through is increased.

Help Received
None

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Andrew M. Cohen

Project Number

J1805

Project Title

Effect of External Magnetic Fields on Superconducting Transitions

Abstract

Objectives/Goals

My experiment involves measuring how a yttrium-based ceramic (YBCO) superconductor is affected by an external magnetic field. To do this, I measured the temperature at which the YBCO superconductor transitions (Tc) when you change the external magnetic field. I wanted to use my results to develop an equation to show how Tc changes based on an external magnetic field.

Methods/Materials

I used a YBCO superconductor disk with attached leads, which were wired up through three hand-held multivolt meters. One meter was wired to the temperature probe. A second meter was wired to circuit including a DC current source with a 100 ohm resistor; and the third meter was wired to a circuit to measure voltage across the YBCO disk. I used combinations of very strong rare-earth magnets that were attached to an optical breadboard to create an external magnetic field which I measured in Gauss using a Hall meter. During my experiments, the YBCO disk, which was in a styrofoam cup with glass beads and liquid nitrogen to cool the disk, was placed next to the magnets where I had measured the magnetic field. I was able to find the critical temperature by recording readings for temperature and volts across the disk. I did two to three runs each for a baseline with no magnetic field and four magnetic fields of increasing strength.

Results

I found that the critical temperature was generally slightly lower as the magnetic field increased. This is what I had hypothesized based on preliminary research. However, I was not able to quantify my results because the temperature change was not statistically significant.

Conclusions/Discussion

Although the critical temperature for the YBCO disk decreased as the magnetic field increased, I was not able to quantify my results or develop an equation for the relationship between Tc and an external magnetic field. I did some additional research and found that to see the change in critical temperature better I would have needed stronger magnets such as an electromagnet. I would need to do additional runs using at least two magnetic fields over two Tesla. I also learned that published measurements of the effect of an external field on yttrium-based superconductors had been done using thin-film versions, not YBCO disks.

Summary Statement

I wanted to find out if an external magnetic field has an effect on the critical temperature of a yttrium-based high temperature superconductor.

Help Received

Used space, lab equipment, and supplies at the microfluidics/nanotechnology lab at UCSB under supervision of PhD candidates Michael Gary and Viva Horowitz; parents provided transportation, supplies, and report editing assistance.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Sofia L. Donovan

Project Number
J1806

Project Title
Refraction and Salinity

Abstract

Objectives/Goals
My project is asking what the effect of the addition of salt is on the angle of refraction through water. Before I began my experiment, I hypothesized that if the concentration of salt is increased, then the angle of refraction through the water will increase as well.

Methods/Materials
Cut off the top and two sides of a cardboard box, giving me a small compartment in which to do my experiment. Draw two perpendicular lines on a sheet of paper and align an open glass box filled with 440 mL of water with one of the lines, keeping the box center to the other line. Line up the laser pointer from an angle so that it enters the box at the line opposite to the glass box. Use a pen to mark where the laser pointer should enter every time. Shine the laser into the glass box at the correct point and make a dot with a colored marker on the paper where the laser emerges from the opposite side of the glass box. Add 40 grams (10% salt concentration) to the water and repeat step 4, but using a different colored marker. Add another 40 grams (20% salt concentration) and repeat step 4, then add another 40 grams (30% salt concentration) and repeat step 4, all the way up to 100% salt concentration, using a different colored marker for each percentage of salt concentration. Remove the paper and replace it with a new one and repeat steps 2 and 3. Complete 10 trials of steps 3, 4, 5, 6 and 7. When you finish all 10 trials, draw lines from the colored dots to the point where the two perpendicular lines meet. Then measure the angle for each dot on each paper and record it on your data table.

Materials: open glass box, 440 mL of water, 1 laser pointer, Ruler, Colored markers, Cardboard box, Table Salt, Spoon, Protractor, Pencils, Pens

Results
My data and graph show that the angle of refraction decreased on an average of .96 degrees each time the concentration of salt increased. I was surprised by this. My graph shows a linear relationship.

Conclusions/Discussion
I hypothesized that if salt is added to water, then the angle of refraction through the water will increase. My hypothesis was incorrect. The angle of refraction decreases as the concentration of salt increases.

Summary Statement
This project measures the impact of salinity on the refraction of light while shining a laser pointer through salt water.

Help Received
Mother purchased materials and clarified what I didn't understand.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Rae J. Holcomb

Project Number

J1808

Project Title

Sweetness and Light

Abstract

Objectives/Goals

The objective was to determine how the density of a sugar-water solution and the color of laser light shone through the solution affect the angle of deflection of the light.

Methods/Materials

Light from red, green, and blue lasers was shone through a sugar-water solution contained in a square glass vessel and onto a backboard behind it. This was done for four different concentrations of sugar-water, each repeated for three trials. The change in position of the spot of light on the backboard was measured and used to calculate the angle of deflection of the light.

Results

The angle of deflection was greatest for the red laser, intermediate for the green laser, and the blue laser deflected the least. The solution with the highest concentration of sugar had the smallest angle of deflection. As the solutions became less concentrated, the angle of deflection increased. Of all the solutions, the plain water solution with no sugar had the greatest angle of deflection.

Conclusions/Discussion

I had hypothesized that the angle of deflection would be greatest for the red laser, intermediate for the green laser, and smallest for the blue laser. My experiment proved this to be true. I had also hypothesized that as the concentration of the sugar-water solution increased, the angle of deflection would also increase. It turned out that as the density of the liquid increased the angle of deflection decreased. This was because as the concentration of the solution increased, the difference of the density between the liquid and the glass decreased, which meant that the light beam experienced less displacement due to refraction.

Summary Statement

My project is about the refraction of different colors of laser light through different concentrations of sugar-water solutions.

Help Received

Dad supervised safe usage of lasers during experiment. Mom helped assemble backboard. Neighbor donated equipment.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Miguel Jinich

Project Number

J1809

Project Title

Speed Measurements Using a Strobe Light

Abstract

Objectives/Goals

If it's possible to measure the speed of an object moving in a linear path with a strobe light, then it's possible measure the speed of an object moving in a circular path.

Methods/Materials

To study circular motion, a pendulum with a radius of 2.086 meters was constructed in front of a dark sheet with a scale. To study linear motion, a rod was attached to a remote control car. A camera and strobe light were used to measure the motion of the pendulum and of the car. The test was completed 50 times for each. A stopwatch was used for the car and changes in angles for the pendulum. Results were compared to photographs and to formulae acquired through research.

Results

For linear motion, the difference between the actual speed and the strobe light's photographs had an error of 11.01%; small enough to display the strobe's ability to measure linear speed. For circular motion, the difference between the formula and the photographs at the bottom of the swing had an error of 18.43%; small enough to show the strobe light can measure speed in circular motion when variations are factored in.

Conclusions/Discussion

My hypothesis that it is possible to measure linear and angular speed accurately was correct. Not surprisingly because through research, I discovered that the strobe light could measure variables needed to calculate speed. I am pleased with my results because I achieved my goal of displaying my hypothesis.

Summary Statement

I tested a strobe light with a camera to see if it is possible to measure linear and tangential speed.

Help Received

Father helped execute experiment; 3 teachers at school helped me research, develope, and finish project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Vadim Korolik

Project Number
J1810

Project Title
Refraction of Light: Using Refraction of Light to Study Diffusion in Liquids

Abstract

Objectives/Goals
to test the hypotheses:
refraction of light strongly depends on liquid properties, the nature of the solution;
refraction of light is larger for solutions with higher densities;
refraction of light can be used to determine solution concentration and to measure diffusion.

Methods/Materials
The setup included blue, green, and red laser pointers, mirrors with appropriate rotational adjustments, a container filled with different sugar and salt solutions. The deflection of light passing various salt and sugar solutions was measured.

Results
The laser light deflection for sugar solutions showed that deflection strongly depends on the solution concentration, its density and weakly depends on the light wavelength. Comparison between sugar and salt solutions showed that refraction of light depends on the nature of the solute: sugar solutions refract light more than salt solutions of the same concentration and density.
From the geometry of the experimental setup and the measured deflection values, the index of refraction for different sugar solutions was calculated.
Calculated values were compared to literature values and appeared very similar.
Also, the concentration of the unknown sugar solution was determined by measuring the deflection of the laser beam with that solution and comparing it with the deflections vs. weight percent graph. The concentration was determined correctly.
In another experiment, the light bending was observed for the sugar solution with the strong concentration difference between the top and the bottom of the container. The light bending disappeared after the concentration became the same due to the diffusion.

Conclusions/Discussion
Deflection of light strongly depends on the solution. concentration and density and weakly depends on the light wavelength. Refraction of light depends on the nature of the solution. For salt and sugar solutions of the same concentrations and density, deflection of the laser beam is larger for sugar solutions. The index of refraction of sugar solutions is larger compared to the index of refraction of salt solutions. Dependence of Index of Refraction on concentrations can be used to build a device for concentration measurements. Refraction of light can be used to study diffusion in liquids.

Summary Statement
Deflection of light passing through various sugar, salt solutions including solutions with non-uniform concentrations were studied.

Help Received
Father helped me find mirrors and mounts; Mother bought an optical wooden stand; Sister mixed in the unknown sugar solutions.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Madeline C. Kuney

Project Number
J1811

Project Title
Solar Desalination: Taking the Salt Out of the Sea

Abstract

Objectives/Goals
I investigated whether a container's shape affects how much desalinated water ("D/W") is produced through solar desalination under set conditions. My hypothesis was that a broad/shallow bowl ("Broad Bowl") would produce more D/W than a narrow/deep bowl ("Narrow Bowl") because the sun will heat the larger, shallower water surface more quickly.

Methods/Materials
METHODS: Placed 1 cup (236.5ml) of sea water in 40 containers: 20 Broad Bowls (13cm water surface area ("WSA")) and 20 Narrow Bowls (9cm WSA) along with a metric measuring cup (the "Cup") to collect D/W. Added 3 drops of red coloring dye to distinguish between the sea water and D/W. Containers were covered with plastic wrap and a weight to make the plastic wrap sag so that D/W driped into the Cup. The 40 containers were exposed to the sun a set period of time and the D/W and environmental conditions were recorded every 2 hours. The total quantity of D/W in each container was recorded and the salinity of the sea water and D/W was measured by both an EC Meter and commercial laboratory.
MATERIALS: 5 gallons of sea water; 20 Broad and Narrow Bowls; 40 Cups, fishing weights, and rubber bands; water and air thermometers, EC Meter, aluminum foil, dye, paint.(See, detailed methods and materials list on Science Board and log book.)

Results
Sample One (3-day test) and Sample Two (2-day test) confirmed that the difference in WSA between the Broad and Narrow Bowls affected the quantity of D/W produced. The results for Sample Two were significantly different and more representative because I modified this experiment to make the slope of the weighted plastic wrap constant for both sized containers. Final measurements: Sample One: 1) Avg. Total Production ("ATP"): Broad Bowls 10.18ml, Narrow Bowls: 8.17ml; 2) Avg. Daily Production ("ADP"): Broad Bowls 3.393ml/day, Narrow Bowls 2.723ml/day. Sample Two (modified method): 1) ATP: Broad Bowls 15.35ml, Narrow Bowls 6.25ml; 2)ADP: Broad Bowls 7.675ml/day, Narrow Bowls 3.125ml/day.

Conclusions/Discussion
The container's shape and WSA affected how much D/W was produced with the Broad Bowls producing significantly more D/W than the Narrow Bowls.

Summary Statement
This project applies the process of solar desalination to sea water to investigate whether a container's shape affects the quantity of desalinated water produced under set conditions.

Help Received
My father assisted by driving me to Carpenteria to collect the five gallons of sea water, helping to paint the aluminum foil wrapped around the door, and working with me to record some of the measurements during my experiments. I contacted Zalco Laboratories, Inc. to arrange for them to measure the salinity.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Jason Lan

Project Number
J1812

Project Title
What Is the Relationship between the Angle of the Sun and the Time?

Abstract

Objectives/Goals
The objective is to determine the rate of change in the angle of the Sun.

Methods/Materials
A flagpole that measured 150 centimeters was set perpendicular to the ground. The length of the shadow measured and recorded at 2:00 pm every five minutes until 2:30 pm for ten days. The angle of the Sun that produced each length was then calculated using trigonometry.

Results
Each day the shadows were shorter and the angles were greater. This suggested that a day was shorter than 24 hours and so the earth would rotate more than a full rotation 24 hours later. The angle of the Sun changed at an average of .145 radians per hour (2d radians is a full rotation). If the angle of the Sun changes at this rate, it would be too slow to turn a full rotation in 24 hours. There must have been a flaw in the experiment to cause this.

Conclusions/Discussion
I think the reason my experiment did not turn out the way I had expected it to was because I was thinking that the Sun moves across the sky when actually the Earth is rotating. This alone was not the cause of the error; the Sun is moving across the sky relative to where I am on the surface of the Earth. The problem is that the rate of change would vary with the seasons caused by the tilt in the Earth's axis. Another varible is the longitute of the location where the experiment takes place. I believe that the closer you are to the equator, the closer to my hypothesis the results will be. Farther from the equator the rate of change would be different. If this is true, it would also be reasonable to suggest that if you tried this experiment many times and collected the data, trying the experiment again in a random location would show what longitute the experiment is taking place on.

Summary Statement
I tried to find how many radians the sun appears to move across the sky every hour.

Help Received
Mrs. Shah gave me the project board. My grandmother helped me take a few measurements when i had other activities and could not get home.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Niko Lopez

Project Number

J1813

Project Title

Visible Sound: Does the Surface Material Affect the Visible Patterns Created by Sound Vibrations?

Abstract

Objectives/Goals

The objective of this project was to understand if the surface material of an object affected its ability to transmit vibrations.

Methods/Materials

I used 12"x12" metal and acrylic plates that were connected to a rig that was firmly mounted to a table. I poured salt evenly across the surface of the metal plate. I then used a violin bow and ran the bow down the side of the plate as if I was playing an instrument. I then experimented by placing my fingers in different places and bowing in different places to get different images. I repeated the same experiment with the acrylic plate.

Results

The metal plate created many more clear images than the acrylic plate did. The acrylic plate images were very slurred and uneven.

Conclusions/Discussion

My conclusion was that the surface material of an object has an effect on the objects ability to transmit vibrations, as seen by the metal and acrylic plates.

Summary Statement

My project is about weather the surface material of an object effects it's ability to transmit vibrations.

Help Received

Mother took me to the hardware store to have them help make rig.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Colin S. Mansour

Project Number

J1814

Project Title

Measuring Lasers: At the Speed of Light

Abstract

Objectives/Goals

The purpose of my science fair experiment was to find how much a laser light was slowed when moving through different densities of material. My hypothesis was that the laser light will travel half the speed when the light shined through the double density gelatin compared to when the light shined through the single density gelatin.

Methods/Materials

The constants and controls of my experiment were the angles at which the gelatin was positioned, angle of incidence, the type of laser used and the speed of light in air, vacuum. The variable in my experiment was the ratio of the gelatin mix to water. The single mix gelatin was a one to one ratio and the double mix gelatin was a two to one ratio of gelatin to water. The type of laser we used was a strait red laser level 30. The type of gelatin we used was Knox unflavored gelatin. To measure the responding variable, I measured and recorded the angle at which the light refracted. Snell's law equation was used to calculate the speed of light through the gelatin based on the measured angle of refraction.

Results

The results of my experiment were that the gelatin slowed the laser that went through the double mix more than the single mix. The laser light traveled 127,590 miles per second through the single gelatin mix and the laser light traveled 120,182 miles per second through the double gelatin mix. This shows a 6.2% slowing of the speed as a comparison from the single mix to the double mix.

Conclusions/Discussion

My project was about seeing if the different density of gelatin affected the speed of the laser. In my project using twice the gelatin mix only slowed the laser by 6.2 percent. This was hardly the 50 percent slowing I predicted in my hypothesis. This was significant because the single gelatin that I shot the laser through is a similar density to saline water, and the double gelatin mix was similar to the density of the inside of the eye. Understanding how lasers are affected by different densities may help doctors progress in the field of laser surgery.

Summary Statement

My project was about seeing if the different density of gelatin affected the speed of the laser.

Help Received

Mother helped assemble board and binder; Dad helped with math equations.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Cobalt J. McAvinue

Project Number

J1815

Project Title

Eta Equals F Over A Divided by Delta Vx Over Delta z (aka Viscosity)

Abstract

Objectives/Goals

I chose to do a project on viscosity. My question was #Does temperature affect the viscosity of a liquid?# My hypothesis was that a hot fluid would be less viscous than a cold fluid.

Methods/Materials

For the experiment, I used water, shampoo, honey and olive oil at 3 different temperatures: 60 degrees, 80 degrees, 110 degrees. I poured each of the liquids at varying temperatures down a slope and timed the liquids movement from line 1 to line 2 on this slope.

Results

I found that the flow time of the fluids decreased from cold to hot proving my hypothesis correct.

Conclusions/Discussion

My Conclusion is that the temperature of a fluid is a factor in determining the fluids viscosity. The higher the temperature of a fluid the less viscous it is.

Summary Statement

This project studies the affects of temperature on a fluids viscosity.

Help Received

My mon helped to heat the fluids.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

LeAnn Marie Medina Mendoza

Project Number

J1816

Project Title

Refraction in Saltwater

Abstract

Objectives/Goals

My hypothesis is that if I increase the salt concentration by 2.5% or add 5 grams the refracted ray will increase by 2 degrees.

Methods/Materials

First, I took a container of Morton Table Salt an then I measures 10 containers of these 5 different amounts: 1, 5, 10, 15, and 20 grams. After that, I will take the different amounts of salt and dissolve them into 90 degree Fahrenheit water; creating a 0.5%, 2.5%, 5%, 7.5% and 10% concentration. Then, I will take my red remote laser and point it into the water at an 80 degree angle. Using my protractor located in the front of my cup, I look to see the new refracted ray. I will then note the new angle and repeat this process for the different concentrations for 10 trails.

Results

In the end, I learned my hypothesis was incorrect. Actually, when I increased the salt concentration by 2.5% or added 5 grams into the solution, the refracted ray is about 1 degree more than the last five grams. My graph showed a direct relation; and didn't show anything out of the ordinary.

Conclusions/Discussion

While doing this experiment, everything went the way as planned, except it took longer than I expected. If I were to practice this experiment again, I would have had a 0% concentration, just to see if the 0.5% concentration affected the results. Also, I would not have procrastinated and spend my time wisely. I would have done this experiment again.

Summary Statement

I tested the how light refracts in various salt concentrations.

Help Received

Mom for being my support system. Dad for giving me inspiration for my project. Ms. Joan Tanis for giving me advice while doing my project. Rancho Del Rey Middle School for letting me use their electronic balance.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)	Project Number
Jennifer K. Rodstein	J1817

Project Title

Rememba' Mpemba! The Mpemba Effect

Abstract

Objectives/Goals

My Hypothesis- If hot and cold water are placed in the freezer at the same time, under the same identical conditions, except temperature, then the hot water will freeze solid before the cold water will.
My goal was to prove that the Mpemba Effect can occur, which is the phenomenon that hot water can freeze faster than cold water.

Methods/Materials

I heated 4 cups bottled water. I measured 2 Tb or 36 mL of cold 10 C bottled water into a 1/2 cup plastic container. When the hot water reached 100 C I scooped 2 Tb into an identical 1/2 cup plastic container. I drew a line at the water level and continued heating in the microwave to achieve 100 C. If water was lost I added boiling water to the line and continued heating. I then put the 100 C and the 10 C water in the freezer and recorded observations and temperatures every 10 min. Materials- 2 identical: 1/2 cup containers, Celsius thermometers; bottle water; freezer; stove; microwave; tablespoon; pot; timer.

Results

The hot water did freeze faster than the cold water. The hot water's temperature dropped significantly in the first 10 min. of freezing, due to evaporation, dissolved gases, convection currents, surroundings, and supercooling. I had 3 successful trials. In my 7 previous trials the hot water did not freeze before the cold water. I had to develop my own procedure, temperatures, and materials to find the correct conditions and variables to make my experiment work successfully! The hot water froze solid at 80 min. and the cold at 90 min.

Conclusions/Discussion

I was able to support my hypothesis and prove that the Mpemba Effect can occur. I learned about the job of a scientist by continually repeating trials and adjusting variables until I was able to create a successful experiment! Many things can be learned from my experiment including supercooling, when water freezes below 0 C; ice lattices that form when water tries to become solid but the molecules do not know how yet; and the 5 main causes of why the Mpemba Effect occurs.

Summary Statement

My project was testing the Mpemba Effect, if initially hot water can freeze faster than initially cold water.

Help Received

Teacher gave project guidelines

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

George Salazar, III

Project Number

J1818

Project Title

Fastest Way to Chill a Soda

Abstract

Objectives/Goals

What is the fastest way to bring a soda from room temperature to a drinkable temperature?

Methods/Materials

1.Prepare an ice-only bath by adding enough ice to a Styrofoam cooler to completely cover three cans of soda. 2.Prepare an ice-water bath by adding the same amount of ice to a second Styrofoam cooler, then covering the ice with water. 3.Use the instant read thermometer to measure the starting temperatures of: The freezer compartment, The refrigerator, The ice-only bath, The ice-water bath, and Each room-temperature can of soda. You'll need to open the cans of soda to take the temperature of the liquid inside. To minimize evaporation, snap on soda savers after taking the temperature. In each case, make sure that the temperature has stabilized before recording the result. For example, it may take a minute or two before the ice-water temperature reaches equilibrium when the water is first added to the ice. 4.Place three cans of soda in each of the cooling devices to be tested, i.e. The freezer compartment, The refrigerator, The ice-only bath, The ice-water bath. 5.Note the starting time for each cooling device. 6.At regular intervals, quickly remove each set of cans from their cooling container and measure the temperature of the soda. Take note of the time and the temperature of the soda, and then quickly put the cans back in the cooling device. Tips: Reduce the amount of time that the refrigerator and freezer doors are open. It is a good idea to periodically re-check the temperatures of the cooling container. 7.The experiment is complete when the temperature reading of the soda stabilizes. 8.For each cooling container, calculate the average temperature of the three soda cans for each time point.

To do this experiment you will need these things: 12 cans of soda at room temperature, Instant-read thermometer, Two Styrofoam coolers, Ice cubes, Water, Clock or timer, 4 soda savers.

Results

After eleven tests of each of the methods the ice-water brought the temperature of the soda down the quickest.

Conclusions/Discussion

My conclusion is that my hypothesis was correct the soda in ice water got cold the faster than all the other ways I tested.

Summary Statement

Bringing a soda from room temperature to an enjoyable drinkable temperature.

Help Received

My mom and dad helped me put the board together.

Name(s)

Maya R. Sankar

Project Number

J1819

Project Title

Earth's Energy: How Much Does the Distance of the Sun Affect the Amount of Light Received by the Earth?

Abstract

Objectives/Goals

The objective of my project was to assess whether the distance of the Sun was an important variable in the light received by the Earth. My hypothesis was that the distance of the Sun from the Earth was not very important to keeping our planet at an ideal energy level. It was backed up by research prior to the experiment showing that the distance of the Sun was the least important of three variables, the other two being the planet#s greenhouse strength and albedo (atmospheric reflectivity). The results of this experiment proved my hypothesis wrong.

Methods/Materials

I substituted a flashlight for the Sun, and utilized a globe to represent the Earth. I measured and recorded the amount of #solar energy# emitted from the flashlight that was received by a set amount of the globe#s surface area, namely a solar panel fixed to it. I measured the light by means of a digital display that was connected to the panel, and showed how many lumens (the amount of light that falls on a one foot by one foot square surface exactly one foot away from a lighted candle) of light hit it. I placed the flashlight upon thirteen science textbooks to help it achieve the required height.

Results

The distance of the Sun was clearly important. My greatest measure of light, 200 lumens, was taken at one meter between the two surfaces. My least measure of light, 5.3 lumens, was taken at three meters. This data was recorded at the closest and farthest distances from the light source that I measured. My results also showed that the distance of the Sun from the Earth could probably be graphed as a quadratic function. Pushing the Earth 0.25 meters away from the Sun would cause a smaller decrease in lumens if the Earth was already far away from the Sun than it would if the Earth were close to the Sun.

Conclusions/Discussion

Looking at my graph, I conclude that the nonlinear function that governs it is due to a concept known to us as diffraction. When the light source is further away, there is a lesser amount of light in one cubic unit of space penetrated by the beam, and it [the beam] spreads out more. Diffraction is what leads me to conclude that, while the distance between the Earth and Sun is not as important a variable as some when considering the light received by our planet, it is definitely vital to getting just the right amount of energy to keep our planet capable of supporting life.

Summary Statement

My project proved, using a globe, solar panel, digital display and a flashlight, that the distance of the Sun is vital to getting the right amount of energy for our planet, yielding a quadratic function in its results, due to diffraction

Help Received

My mother read over the reports after I was done with them, and I used equipment belonging to Jane Lathrop Stanford Middle School and Ms. Noel Berghout under the guidance of Ms. Berghout.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Sukhdeep Singh

Project Number
J1820

Project Title
Energy Fruit

Abstract

Objectives/Goals
Question: What fruit or vegetable is the best conductor of electricity? The avocado will be the best conductor of electricity because of the high amount of iron.

Methods/Materials
Materials/Methods: I used a voltmeter, copper wire, wire cutters, galvanized nails, and alligator clips on ginger, potatoes, mandarin oranges, ruby grapefruit, bok choy, banana, avocado, white onion, and fuji apples. I put the nails and the wire into the fruit to measure the voltage. A 9 volt battery was attached to the alligator clips to close the circuit so voltage could be measured. This was repeated twenty times to see which fruit or vegetable conducted the electricity the strongest.

Results
Results: The project showed that ginger was the best and apples were the worst. The high were mandarin 2.18v, potato 1.72v, white onion 1.76v, ruby grapefruit 1.44v, avocado 2.33v, bok choy 2.03v, fuji apple 1.41v, banana 1.88v, and ginger 3.1v. The lows were mandarin 1.6v, potato 1.28v, white onion 1.49v, ruby grapefruit 1.2v, avocado 1.71v, bok choy 1.7v, fuji apple 0.77v, banana 1.69v, and ginger 1.79v.

Conclusions/Discussion
Conclusion: My hypothesis was not supported I stated avocado would have the most volts conducted due to its high percentage of copper, zinc, and iron, but it only got in the way. My data table shows that ginger 3.1volts beat the avocado 2.33volts by almost a volt.

Summary Statement
My project is about fruit conductors.

Help Received
my father bought the supplies.

Name(s)

Ryan D. Sloane

Project Number

J1821

Project Title

Up, Up, and Away

Abstract

Objectives/Goals

To predict gross lift for a hot air balloon before flight testing.

Methods/Materials

Measure the volume of the balloon. Test for temperature inside the balloon. Weigh the balloon. Calculate lift using a lift table and rule of thumb. Predict how much weight the balloon can lift. Perform flight test to test hypothesis.

Hot air balloon is a dry cleaning bag. Air is heated with a propane torch and metal pipe stand. Temperatures are measured with a instant read thermometer. Balance scale used for measuring balloon and lift weights. Lead weights and paperclips for flight test. Packing peanuts for measuring volume.

Results

I predicted a gross lift of 22.35 grams. My flight test successfully lifted 35 grams. I exceeded my prediction by 12.65 grams.

Conclusions/Discussion

The balloon was able to lift more weight that I predicted. The part of my project I probably needed to control better was the temperature inside the balloon. I tried to keep the inside temperature the same during the flight test, but I must have been heating the inside to a higher temperature than my thermometer was reading. A higher inside temperature would explain the extra lift.

Summary Statement

It is possible to calculate the lift for a hot air balloon using volume and air temperatures.

Help Received

My Dad helped with the design of the heating stand and operating the propane torch during testing.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Kaitlin R. Spencer

Project Number
J1822

Project Title
Music to My Ears

Abstract

Objectives/Goals
This Science Fair project was conducted to see how water affects the amplitude, frequency, and magnitude, of different monotone notes. Originally, it was thought that the higher the frequency, the more a notes# frequency would decrease when going through water.

Methods/Materials
When conducting the experiment, three monotone notes (100, 500, and 1000 Hz) were played through both water and air. The notes were recorded, and analyzed using MATLAB computer software.

Results
The data showed that none of the notes# frequencies were affected by either the air or water mediums, proving the original hypothesis incorrect. Along with frequency, the notes# magnitude did not show any noticeable differences. The amplitude decreased in all circumstances.

Conclusions/Discussion
Based on my data, I conclude that sound travels better in water than in air. I realized that humans simply perceive sound differently in water, or other mediums, than in air, because of our ears. Since sound travels faster in water than in air, and the sound#s frequency did not change, it can be deduced that the wavelength changes when going through water. These discoveries encourage future related studies.

Summary Statement
This Science Fair project illustrates the science of music and sound, and was conducted to see how water affects the amplitude, frequency, and magnitude, of different monotone notes.

Help Received
I received help from my Dad in programming MATLAB software, and my Mom when organizing my display board. I received advice and direction from Ms. Orsi, Mr. Schofield, Mr. Smalley, and Dr. Oliver. I used equipment from Mr. Smalley, and Jefferson Middle School, under the direction of Ms. Gilmore.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Kevin J. Tat

Project Number

J1823

Project Title

The Speed of Light in Gelatin

Abstract

Objectives/Goals

In my Project the Speed of Light in Gelatin, I will be aiming a laser through Gelatin, and by using Snell's Law and the formula for the Index of Refraction, I will be able to calculate the Speed of Light within the Gelatin.

Methods/Materials

Five samples of gelatin, each with dimensions: 7.6 cm x 7.6 cm x 7.6 cm, and each with a different amount of sugar in it (the range is 0-20 Grams of Sugar, with increments of 5 grams of sugar). The Gelatin is placed on a paper, which has a circle on it, that is labeled with all 360 degrees. Shoot the laser at the Gelatin at 45 degrees in respect to the normal and after finding the refractive angle, use Snell's Law and the Formula for Index of Refraction to calculate the Speed of Light within the Gelatin.

Results

Out of all the gelatin except the Control, which contained no sugar, the Gelatin with 5 Grams of Sugar had the fastest average Speed of Light. The Gelatin with 20 Grams of Sugar consitently had the slowest Speed of Light.

Conclusions/Discussion

My conclusion is that the more sugar a sample of gelatin contains, the slower the Speed of Light within it will be. Additionally, the larger the refractive angle within the gelatin is, the faster the Speed of Light will be within the Gelatin.

Summary Statement

In my project, "The Speed of Light in Gelatin," I will be measuring the Speed of Light in samples of Gelatin; each with different amounts of sugar in, by using the formulas derived from Snell's Law and the Index of Refraction.

Help Received

Father helped set up the board; make the gelatin; darken the room so I may see the Refractive Angle better. Teacher (Ms. Buck) helped answer my questions; reviewed my writing; gave helpful suggestions on how to control variables.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Irina O. Tchernoskoutova

Project Number
J1824

Project Title
Chladni Patterns

Abstract

Objectives/Goals
The main objective of the Chladni plates is to map out a series of nodes (places on the Chladni plate were there is no vibration) and modes (places on the Chladni plate in which there is vibration) on a thin sheet of metal sprinkled with salt and being fed waves of sound. The goal of this project is to help the viewer literally see sound and understand its dynamics.

Methods/Materials
I did two different experiments in which I will showcase and demonstrate at the fair that come from to very different time periods. The first was created by Ernst Chladni in 1784 with the original Chadni plate and the second is modernized. The first I used: a worker's bench, a screw clamp, 4 types of putty knifes, a violin bow, and iodized salt. The way the experiment is done is that with the screw clamp I attached the one of the putty knifes to the bench and poured salt on its edge, then I used the violin bow by bowing the edge of the knife where figures began to appear. The second I used more modern materials such as: a dismantled amplifier, a speaker, a length of cords, a thin sheet of metal, iodized salt, a microphone, and my voice. What I did was I took apart my amplifier and removed the speaker. I used long cords to keep the speaker connected so that I could manually control the sound. The I placed the thin sheet of metal atop the speaker and sprinkled a thin sheet of salt upon it. Then I turned on the amp and with a few more experiments figures had appeared.

Results
The result of this project happened to be that my hypothesis was correct which was that the higher the frequency then the more nodes there will become and the lower the frequency the more nodes there will become. Going through with the project was especially frustrating, but the results were rewarding, with the also the fact that most people doing this project cannot do it properly therefore this project usually has a small window for success rate.

Conclusions/Discussion
My conclusion for this project is to thank my family for referring me to do this project and also to my school and the Los Angeles County Science Fair for giving me an opportunity like this. This project was really inspired by love of music and also my knowledge of it proved very faithful to me in this project. You won't see the last of me after this project though, next year I coming back with an unforgettable project judges will be begging on their knees to see again.

Summary Statement
The chladni plates are tools used for acoustic engineering and help the viewer understand the dynamics and complexity of sound.

Help Received
My mother helped fund my project and my grandfather kept me from getting electricuted when I took apart the amplifier. (even though my hand did get shocked anyways)

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Sara Thomas

Project Number

J1825

Project Title

Candle Burning

Abstract

Objectives/Goals

If I increase the volume of air, then a candle would burn out more slowly. Adding carbon dioxide and oxygen will cause a candle to burn longer.

Methods/Materials

My first experiment was to put a glowing splint in a jar with hydrogen peroxide and activated charcoal and I found that the glowing splint relit. Then I selected 4 jars of increasing volume from 345cubic cm-1,750 cubic cm. I put a jar over the lit candle and recorded the burn time until the candle went out. I repeated this 5 times and calculated the average for the results. I did the same again with carbon dioxide added by mixing baking soda and vinegar.I repeated the procedure again with oxygen added by mixing hydrogen peroxide and activated charcoal.

Results

As I increased the size of the glass# volume of air, the candle burned for a longer time and provided more "fuel" for the candle to burn. When I added carbon dioxide I got the shortest burn times with some glasses burning out in less than 50% of the time with regular air. When I added oxygen I got the second shortest burn time. The oxygen results were surprising because I thought the candle would burn longer than regular air when oxygen was added.

Conclusions/Discussion

When I increased the volume of regular air, the candle had a longer burn time. Adding carbon dioxide caused the candle to have the shortest burn time. Surprisingly, adding oxygen caused the candle to have the second shortest burn time.

Summary Statement

Increasing the volume of air makes a candle burn longer; adding carbon dioxide and oxygen makes a candle burn out faster.

Help Received

My tutor, Andy Green guided me.