CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Aiden J. Aceves

Project Number
J1501

Project Title
From Ice Cubes to Icebergs: The Mathematics of Melting Ice

Abstract

Objectives/Goals
The objective is to determine how the rate at which a block of ice melts in it's water bath is related to the temperature of that water bath. Is the melt rate and water temperature relationship linear or exponential?

Methods/Materials
At regular intervals, I measured the weight of initially identical(in both shape and weight), frozen blocks of ice in a range of water temperatures between 32 and 85 degrees Fahrenheit. I measured the ambient air temperature and humidity in case they affected my results.

Results
At 32 degrees Fahrenheit the block of ice did not lose weight. The rate of ice weight loss increased rapidly as the temperature of the water bath was increased. The ambient air temperature and humidity did not appear to affect my results.

Conclusions/Discussion
The melting rate of an ice block follows an exponential (non-linear) curve in relationship to the water bath temperature.

Summary Statement
I determined the relationship between the melt rate of ice and it's water bath.

Help Received
Father helped refine the project goals, record data and choose appropriate mathmatical software to help exlpain results.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Naneh T. Apkarian

Project Number
J1502

Project Title
Is It Possible for a Wave (or Particle) to Be in Two Places at the Same Time?

Abstract

Objectives/Goals
This project is to determine whether or not a photon can cause it's own interference, effectively being in two places at the same time.

Methods/Materials
Using two slits and a helium:neon laser, photos were obtained showing the interference patterns. The photos were analyzed. The laser was then attenuated using glass filters, and more photos were taken. These photos, and their data were compared, to reach a result.`

Results
Even when only one photon at a time was traveling through the slits, the interference patter of two photons at the same time appeared. Thoe photos appeared to show that two photons were where only one could possibly be.

Conclusions/Discussion
According to the data, it appeared that indeed, one photon could be in two places at the same time. By this, we can hypothesize that there is an entirely different set of physical rules at work in the quantum world.

Summary Statement
This project demonstrates that a quantum particle can be in two places at the same time.

Help Received
Borrowed equipment from UCI lab under supervision of father (Professor Apkarian)

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Benjamin E. Bartel

Project Number
J1503

Project Title
Increased Gravity

Abstract

Objectives/Goals
Three different objects of the same weight: zinc, tin, and lead were tested to see if their size influenced weight at increased gravity.

Methods/Materials
A 12" Patton Fan was used with spring scales mounted on the blades. The zinc, tin, and lead masses were alternated on the calibrated sping scales The spring scales were alternated as well. Each position was tested 3 times. There were 27 positions tested.

Results
Results show that the smallest volume produced the greatest average weight at increased gravity and the largest volumed produced the leastaverage weight at increased gravity.

Conclusions/Discussion
It is inconclusive that larger objects exert more gravitational force at increased gravity than smaller objects of the same weight. It appears from the findings that perhaps smaller objects exert more force at increased gravity than larger objects of the same weight. But these results are questionable due to the margin of error with the spring scales used with this investigation.

Summary Statement
Do larger objects exert more gravitational force at increased gravity than smaller objects of the same weight?

Help Received
Dad typed the report, parents bought the backboard and paper supplies, parents donated the 12" Patton Fan and helped with the display. Science teacher loaned the spring scales and masses and gave advice on the apparatus and methods.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Laura A. Brees

Project Number
J1504

Project Title
The Power of Colored Light

Abstract

Objectives/Goals
The objective of this experiment is to determine which color filter will make the radiometer spin the fastest.

Methods/Materials
To conduct this experiment, I will be using a radiometer, different color filters, a laser, a photo-diode, an electrical filter, and an oscilloscope. The radiometer will spin in proportion to the amount of light that reaches it. The radiometer spins because the light hitting the internal vanes is heating them up unevenly (the black side absorbs more than the white). The more the light, the faster the radiometer spins.
To conduct this experiment, all the equipment must be powered on. The filter to be tested is inserted into the filter holder. The oscilloscope measures the time between pulses which is the time of ¼ revolution. The speed of the radiometer can be calculated by the formula
Speed = 60/4 x Trace Length x time base unit /1000

Results
The experiment showed that the red filter made the radiometer spin the fastest. Each of the graphs had great variation. In some of the trials, the red filter caused the radiometer to spin the fastest. While in other trials, the red filter had the slowest spin. The blue filter was one of the slowest but it caused the least variation in spin rate.

Conclusions/Discussion
In conclusion, my hypothesis was incorrect. The Medium Red filter made the radiometer spin the fastest. The Red filter spin the fastest because it allowed more infra-red light through than ultra-violet light. The output of the radiometer had a lot of variation. The trace on the oscilloscope bounced around. The radiometer was not very sensitive. It took a 100-watt light bulb to make the radiometer turn so that the oscilloscope could show the trace.
Some uncontrolled variables are: the radiometer seems to change speed with temperature, the friction of the radiometer vanes spinning on a needle, and the light source does not have the same light output level for every color.

Summary Statement
What color of light will make the radiometer spin the fastest.

Help Received
I'd like to thank my father for helping me build the light trap box for the radiometer and showing me how to use the oscilloscope. A thanks to Edmund Scientifics, where I purchased the radiometer and colored filters. Finally, a thank you to The Optical Society of San Diego for providing a helium-neon laser.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Erik T. Brown; Brendan M. O'Connor

Project Number
J1505

Project Title
Sound Transmission through Glass

Abstract

Objectives/Goals
Our objective was to see if shape texture or tint made a differenc in the way sound was transmitted through glass.

Methods/Materials
The materials that we used to construct this project are. Plywood, Glass wool insulation, Carpet padding, Clear plastic, Bronze tint glass, Obscure glass, Gray tint glass, Reeded glass, Clear glass, Glue chip glass, Clear laminated glass, Two 12 volt power supplies, Amplipher, Microphone, Multi Meter, Oscilloscope, wood screws, 120 volt electrical outlet, Pen, Calculator, Logarithmic paper, Neoprene seal material, Electrical connectors, Staples, Wood glue, Nylon strapping, Contact cement, Electrical wire, springs, Electrical power strip, Plastic, Wood, and Elecrical tape.
The method that we used for our construction of our project is. Construct a rectangular plywood box. In the center of this box are two frames made of wood with a continuous neoprene seal on the inside of them. The next step is to cover the entire inside of the box with carpet padding and glass wool instulation including the frames. On one end of the box drill a hole to except a microphone and on the other end of the box drill a hole that will alow you to put a power cord through that will be supplying a sona alert that will be located in the center of the end of the box with the power cord.Next attach microphone cable to ampliphier and multimeter and oscilloscope,last attach power supply to ampliphier. On the other end attach the other power supply tothe sona alert. When you are ready to test turn one all of the supplies which contain a power switch to the on posithion and then conduct testing.

Results
Our test showed that Duel glazed glass was the best for keeping out sound. this is the order of the glassfrom the best for keeping out sound to the worst for keeping out sound. Duel glazed, Clear laminated, Obscure, Clear, Glue chip, Clear, Clear plastic, Gray tint, Bronze tint light, Bronze tint dark, and Reeded.

Conclusions/Discussion
Our test results showed that duel glazed glass woked the best for keeping out sound and that reeded glass was the wort for keeping out sound. We believe this because duel glazed glass is two pieces os glass with an air seal in between so we figured double the amount of sound being cut. Over all we proved that our hypothosis was correct.

Summary Statement
Does shape, texture, or tint make a difference in the way sound is transmitted through glass.

Help Received
Father helped with design and construction, friend helped with electronics and insulation, another friend helped supply parts to measure the sound, buisness helped supply glass, teacher pupplied the plastic.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Lia G. Cassanego

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

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Justine M. Chaney

Project Number
J1507

Project Title
Using Photometry to Measure Vesta's Rotation

Abstract

Objectives/Goals
The objective of this project was to see if the rotational period of Vesta can be determined by using photometry.

Methods/Materials
The method used was photometry, and the materials were:
- 14" telescope at Mt. Wilson
- CCD Soft (computer application)
- TheSky Astronomy software
- Microsoft Excel

Results
The project was successful; magnitudes were obtained and graphed, a light curve was made, and the rotational period was determined.

Conclusions/Discussion
The project was successful, but there were problems along the way, such as software problems. If I were to take this project further, I would try to obtain a full rotational period; my results only equal about half of one because of limited access to the Mt. Wilson telescope.

Summary Statement
Testing whether or not Vesta's rotational period can be determined using photometry.

Help Received
My science advisor Joe Wise showed me how to use the software, how to do photometry, and drove me to Mt. Wilson. He allowed me to access the computers at New Roads School. Barrett Duff, the science advisor to Telescopes In Education (T.I.E.), operated the

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Kevin Chiang

Project Number
J1508

Project Title
How Fast Does the Earth Rotate and How Large Is the Earth?

Abstract

Objectives/Goals
The purpose of my experiment was to determine the speed at which the earth rotates, and the size of the earth. I have two hypotheses: the earth is round, and rotates one cycle per day from East to West.

Methods/Materials
By placing two poles 13.5 and 35 miles apart at the same latitude, east and west to each other, I observed that the time the shadow of the east pole passed 0º north occurred before the west pole. From the distance between the two poles and the difference in time seeing the shadow pass 0º north, the speed at which earth rotates was calculated.

The shadow pattern of a pole was also observed for three consecutive days. The time for the earth to rotate one cycle was when the shadow of the pole crossed 0º north twice.

The size of the earth was calculated by the speed and rotation time. Since the experiment was conducted at 37.14º latitude, my results were converted to the equator so I could compare with references.

Results
At the equator, the speed at which the earth rotates is 14.02 miles per minute; and the radius of the earth is 3213.65 miles.

Conclusions/Discussion
My results are 81% of the values from the references. They also confirmed my hypothesis. My experiment can be improved by: better compasses, more precise measuring instruments, and longer distances between the two poles.

Summary Statement
I have devised a simple and low cost method that can measure the size of the earth and the speed of rotation to 81% accuracy.

Help Received
My father helped me brainstorm the idea and the method. My teacher Mr. Lee directed me through the science fair.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Kelli L. DeBellis

Project Number
J1509

Project Title
Going Up: A Study of Rising Heat through Flooring Materials

Abstract

Objectives/Goals
To determine what types of flooring on a second story house would allow heat to transfer quickly and be maintained to keep overall heating costs down. I believed that the Red Pile Carpet with rebond padding would allow the least amount of heat to transfer to the second floor and the Linoleum sample would allow the most heat to transfer.

Methods/Materials
Drilled hole in the lid of each box. Put four small foam pads inside of the box to act as a shelf. Cut the flooring samples to fix in the box. Boiled water to 172 degrees Fahrenheit. Constantly measured water for temperature consistency
Poured water to 1# level in box.Immediately inserted flooring material and closed lid.Inserted the thermometer,then took initial temperature reading.
Recorded temperature readings at intervals of 5 and 15 minutes

Plastic Box with lid,Thermometer,Timer,Red Pile Carpet,White Compact Carpet
Red Pile Carpet with rebond padding,White Compact Carpet with rebond padding
Linoleum,Wood Flooring,Control (Box with no flooring material)

Results
Heat transfer results at the 15 minute interval:
Red Pile carpet allowed an average of 15 degrees, White Compact Carpet allowed an average of 16 degrees. With rebond padding the Red Pile carpet allowed an average of 11 degrees and the White compact carpet allowed an average of 13 degrees. Linoleum allowed an average of 22 degrees. Wood allowed an average of 25 degrees. The Control allowed an average of 39 degrees.

Conclusions/Discussion
My hypothesis was not completely accurate. The Red Pile carpet with padding did allow the least amount of heat to the top story. The wood flooring not the linoleum allowed the most heat transference. I expected the wood flooring material would not allow the heat through because the material is significantly thicker than the linoleum. I had not considered that the wood was porous and the linoleum was not. I was also surprised to discover the carpet rebond padding only changed the results by a few degrees. My research indicated that carpet padding was much more effective than my project showed. It is possible carpet company advertisements overstate the effectiveness of carpet padding.

Summary Statement
My project is about the process of heat transference through common flooring materials.

Help Received
Mom helped boil water and purchase materials; Grandfather drilled holes in box lids; Father cut wood flooring material; High School loaned thermometer; Mom submited online application.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Bowen W. Dunnahoo-Kirsch

Project Number
J1510

Project Title
How Big Around Is the Earth? The Eratosthenes Method

Abstract

Objectives/Goals
The objective of this project is to estimate the circumference of the Earth by using Eratosthenes method, a procedure that uses the angle of the Sun at solar noon in two distant geographic locations and the north-south distance between those locations to determine the circumference.

Methods/Materials
On January 20, 2002, the angle of the Sun's rays was measured at solar noon by me in Menlo Park, CA and by my uncle's family in Carlsbad, CA. Solar noon is when the Sun is at its highest point in the sky. We found solar noon at both sites from the U.S. Naval Observatory website. Vertical sticks where set up using a carpenter's level and plum-bob, and butcher paper was spread under it to mark the length of the Sun's shadow. Beginning a few minutes before solar noon, the shadow length was marked every minute, until the shortest shadow was reached (solar noon). The stick height and shadow lengths were drawn to scale on graph paper, so that the angle of the Sun's rays in each site could be determined. Using geometry, the two Sun angle's are used to determine the central angle, or pizza slice, of a circle (the Earth). Using a World Atlas and mileage key, the north-south distance between our two cities was measured with a ruler. Finally, the number of pizza slices that fit in the circle (360 divided by the central angle) was multiplied by the north-south distance between the two cities. The result is an estimate of the Earth's circumference.

Results
The Sun angle measured at solar noon in Menlo Park was 56 degrees, and 52 degrees in Carlsbad, which is 302 miles away on a north-south line. The difference in the Sun angles, 4 degrees, is our central angle and "pizza slice". 90 "slices fit in a circle. 90 multiplied by 302 miles equal 27,180 miles around the Earth. The true distance as found in our World Atlas is 25,120 miles. I was about 8% off the real distance.

Conclusions/Discussion
I thought the result was pretty good. I think I could have gotten closer to the real distance by doing the measurements on June 21, when the Sun is at its highest point of the year and the shadow of the stick would cast a sharper image on the paper, making it easier to measure. Also on June 21, I would know that the angle of the Sun's ray is zero at the Tropic of Cancer, and be able to make a very good measurement of that distance on an Atlas.

Summary Statement
My project is about estimating the circumference of the Earth by measuring Sun angle's and knowing the north-south distance at two locations on the Earth.

Help Received
My dad helped me set up the measurement of the Sun angle, and helped me prepare the project. My aunt and uncle performed the Sun angle measurements in their town.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Kelly Eaton

Project Number
J1511

Project Title
So What's the Rub? Stiction vs. Friction

Abstract

Objectives/Goals
My project explores several aspects of mechanical friction and sets out to prove two of Coulomb's laws of sliding friction: 1) friction between two surfaces is greater just before motion begins (stiction) than when the surfaces are in steady relative motion, and 2) friction is proportional to the force (weight) pressing the surfaces together.

Methods/Materials
I conducted 2 experiments. In my first experiment ("weight test"), a small test bed sled was constructed to hold seven different weights. The sled was pulled across a fixed, relatively rough surface ten times for each weight, and the average pull force required (in grams) was recorded for both static and dynamic friction. The standard deviation of the 10 trials was calculated for each of the seven weights and the results were plotted on a line graph with error bars. A repeat of this weight test was conducted on a smooth table surface to get a second set of friction coefficients. In my second experiment ("materials test"), seven different materials were attached to the bottom of the test bed sled with equal weight. The sled was pulled across the table surface ten times for each material, and the avg pull force was calculated and plotted as a bar chart.

Results
In my first experiment the friction gradually increased as I added more weight. In the repeated version, the coefficient of friction was much lower for both static and dynamic because of the polished wood table being a smoother surface. I was able to confirm both of Coulomb's Laws in my weight test, with variations only due to an imprecise spring scale, and human reading inaccuracies. In my materials test, the surface with the greatest coefficient of friction was fine sandpaper; the least was plastic and paper towel (same friction). Although generally correct in my predictions of dynamic friction, I was inaccurate in 50% of my static friction predictions.

Conclusions/Discussion
I proved Coulomb's Laws that friction is proportional to force, and that static friction is greater than dynamic friction. Some of the surprising results in my materials test were due to unexpected causes of friction such as indentation of the softer surface by the harder body (as was the case with paper towel and tissue), interlocking of minute irregularities on the rubbing surfaces (with aluminum foil and fine sandpaper), and adhesion between surfaces (with the plastic bag).

Summary Statement
My project is a study of dry static and dynamic friction, as a function of material surface types and pressing force.

Help Received
Parents bought supplies need for project; Mom drove me to libraries to get books for research and buy materials. Dad taught how to do standard dev and loaned his calculator, glue gun, postage scale, other tools. Brother taught me how to use Microsoft graph program.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Elizabeth G. Erickson

Project Number
J1512

Project Title
Sunspots

Abstract

Objectives/Goals
The goal of my project was to determine if I could accurately calculate the sun's rotational period by observing the position of sunspots over time. I predicted I could achieve an accuracy of 0.27 percent.

Methods/Materials
Using a 6 inch reflector telescope with a solar filter, I made daily observations of sunspot locations. SOHO satellite pictures were also used to supplement my obsevations. I created a longitude grid that I superimposed over the images. Using this grid, I calculated the daily movement of the sunspots with an accuracy of +/- 1 degree. I used a proportion equation to extrapolate solar period based on the degrees of sunspot movement during the observational time.

Results
Four sunspots were used to determine rotation period during one 48 hour period. I determined that sunspots A, C,and D period of rotation to be 26.7 days. Sunspot B period of rotation was 25.7 days. Comparing these values to those obtained from NASA (25.4 days)I determined my accuracy to be 5.1 percent and 1.1 percent. respectively.

Conclusions/Discussion
The hypothesis of 0.27 percent accuracy was not supported by observational data. Percent accuracies of 1.1 to 5.1 were obtained. This was a valuable project for me because required me to apply my math skills to a real life sitation. I was really excited to see how my observation diagrams matched the images of the SOHO satellite.

Summary Statement
Using daily sunspot observations, I attempted to accurately determine the sun's rotational period.

Help Received
School provided all materials needed for project. Mom helped edit. Dad reviewed mathamatical equations.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Sarah K. Flynn

Project Number
J1513

Project Title
The Effect of Air on Heat Conduction in an Insulator

Abstract

Objectives/Goals
The purpose of this project was to test if the amount of air present in an insulator has an effect on its ability to conduct heat. My hypothesis was that if gases are poor conductors of heat, then air mixed with solids in an insulator will decrease the heat conductivity of that insulator.

Methods/Materials
Two substances of a similar material, sand and pebbles, were studied. The variable in this experiment was the amount of air in each insulator. Two controls were also measured: heat conduction in wood (sawdust) and in air alone. Hot water (45 degrees Celsius) was insulated with one of these materials and placed into a refrigerator. The water temperature was measured every half hour for three hours. This procedure was repeated three times for each material.

Results
The total average conduction of heat from the water insulated with pebbles was 30.4 degrees Celsius. The total average conduction of heat from the water insulated with sand was 34 degrees Celsius.

Conclusions/Discussion
Both pebbles and sawdust are good heat conductors due to their closely bound molecular structure and the presence of free electrons. In these solids, heat is transferred effectively by molecules vibrating against neighboring molecules. Air is a poor conductor of heat because it has little vibrational contact between its molecules due to the increased space between them. The results show that the solid with the most air present in the insulator (pebbles) conducted heat the most poorly. With all else held constant, it was found that the variable (air) slowed heat conduction. This result supports the hypothesis.

Summary Statement
My project investigated if the presence of air in an insulator has an effect on the amount of heat conduction.

Help Received
My dad helped me check the spelling and grammar in the written part of my project. My mom helped me make my display board.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Stephen C. Foster

Project Number
J1514

Project Title
Modeling Planetary Environments in Virtual Reality

Abstract

Objectives/Goals
The purpose of this experiment is to show how air-resistance and gravity affects how a ball bounces on Earth and Mars. Also, to see if this can be molded in virtual realty environment.

Methods/Materials
1- Find data on atmospheric density, needed in the formula for air resistance, and the gravitational pull on Earth and Mars.
2- Create a virtual reality simulation of a ball bouncing on Earth, using the variables of air-resistance and gravity, in the Python programming language.
3- Run the simulation using VRUT (Virtual Reality Utility, a 3D graphics environment specially designed for building and rendering virtual environments).
4- Record coordinates of ball position for 13 seconds, recording every 1/100th of a second.
5- Use the same procedure of steps 3 and 4 with the air resistance and gravity of Mars.
6- Compare the Earth simulation

Results
In my experiment the ball on Mars bounced farther, higher, faster, and for a longer period of time, compared to a similar ball on Earth.

Conclusions/Discussion
The variables of air resistance and gravity effect the bouncing of balls. I was able to sucessfuly model this in virtual reality which enabled me to conduct my experiment in 3D.

Summary Statement
I modeled and compared the gravity and air resistance of Earth and Mars in virtual reality.

Help Received
Learned to use virtual reality software at University of California Santa Barbara under the supervision of Dr. Andy Beal during a summer internship. Borrowed university virtual reality goggles to view the final experiment.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
James V. Hunter

Project Number
J1515

Project Title
Using Experimentation, Modeling, and Observation, Is It Possible to Explain the Rise and Fall of Ocean Tides?

Abstract

Objectives/Goals
Explain why there are tides and why there are two high tides every day. Do this by using data and results from experiments, models, and observations.

Methods/Materials
Methods: 1) General Observation. At the beach, observe that there is a high tide and low tide. 2) Detailed Tide and Moon Observation. From observation and study of tidal records notice that there are two high tides in a day and that the time of day the high tides occur changes each day. Notice that the high tide cycle repeats itself and this cycle is at the same frequency as is the obit of the moon. 3) Make the connection between the tides and the moon. 4) Centripetal Force Experiment. Spin an object connected by a spring in a circular path. From this verify the centripetal force equation, F = m*V^2/r. Also, recognize that in order for the moon to be able to be in orbit about the earth, there must be a force that pulls it to earth. From research, determine that this force is due to gravity and that Fg=G*M*m/r^2. 5) Ocean Water Model. Using a physical model show how the ocean water rises under the influence of small gravitational forces. 6) Use results of the centripetal force experiment to explain why there are two high tides each day. 7) Verification. Observe location of the moon, go to the beach and record time of high tide. Compare with prediction.

Material: Centripetal Force Experiment: Drill motor, bungee cord, hocky puck, ladder, scale, weights, video camera. Ocean Water Model: Blocks and Springs

Results
From observing the cycle of tides and the moon I was able to show that the moon controls tides. From the centripetal force experiment and research about gravity I showed that the pull of gravity and centrifugal force cause high tides twice a day. From the Ocean Water Model I show why the tide rises under the influence of small gravitational and centrifugal forces.

Conclusions/Discussion
I was able to show why ocean water rises and falls twice every day by using experiment, models, and observation. This experiment is relevant because, by explaining natural phenomena of tides, we can formulate and check laws of nature. We can then use these laws of nature to predict other thing.

Summary Statement
Explains the rise and fall of ocean tides uses experiments, models, and observation.

Help Received
Dad helped with experiments and equations. Mom helped with proof reading.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Lara A. Injeyan

Project Number
J1516

Project Title
Verification of Heisenberg's Uncertainty Principle

Abstract

Objectives/Goals

The objective was to verify both forms of Heisenburg#s Uncertainty Principle given by the equations:
*x*px ~ h
and
*t*E ~ h
Where x is position, p is the momentum, t is time, E is energy of an object and h is Plank#s constant. I hypothesized that these equations will hold true and if one tries to increase the accuracy of one variable the other will become less certain or accurate.

Methods/Materials

I used beams of light to verify the Uncertainty principle. For the first equation I used diffraction to observe the spreading of the beam as the beam passed through a slit. Using a narrow slit is equivalent to reducing the uncertainty in the beam position in the direction transverse to the beam propagation. The Uncertainty Principle predicts that this will increase the uncertainty in the momentum in the transverse direction making the beam diverge. The uncertainty in the propagation vector, *k relates to the uncertainty in momentum of the beam through the relationship
*px = h *kx / 2*.
For the second equation, I used short pulses of light and looked at the pulse duration as the bandwidth of the pulses was varied using a Fabry Perot Interferometer. The bandwidth or frequency content, *n, of the beam relates to the energy uncertainty of the photons through the relationship
*E = h *n.

Results

My results indicate that my hypothesis was correct and the uncertainty principle was verified for both equations. In both cases when the accuracy of one variable was increased the uncertainty in the other variable also increased. In the case of the fist equation, results of the diffraction experiments matched the theoretical predictions within 3%. For the second equation, the product of *n*t, approached the predicted value of 0.31 as the Fabry Perot Bandwidth became significantly smaller than the laser bandwidth.

Conclusions/Discussion

Heisenberg's Uncertainty Principle was verified in both forms.

Summary Statement

My project is about the verification of Heisenberg's Uncertainty Priciples

Help Received

Father helped with identifying project, getting equipment for experiment and collecting data. Some experiments were performed at TRW Inc.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Mangala S. Iyengar

Project Number
J1517

Project Title
Rainbow Makers

Abstract

Objectives/Goals
My objective was to determine how the refractive index value of a medium affects its angular dispersion.

Methods/Materials
In the first part of my experiment, I used Snell's Law tocalculate the refractive indices of the materials that I used. To measure the angular dispersion, I began by preparing an easel paper by drawing the shape of the hemispherical dish that I used. Then I drew the three angles of incidence (30, 45, and 60 degrees) and the normal from the exact center of the dish. Then, I poured 1/2 a cup of liquid into the dish and directed a beam of light from a slit lamp through the medium, placing the beam on the desired angle of incidence. I then followed the angle of refraction until the place on the paper where the spectrum was clearest and marked the beginning and end of the spectrum. After connecting the two lines back to the origin, I connected their ends with a small line which I named L, while the spectrum line was called R. I used the formula Theta = 360(L/2 x pi x R), in which theta was the angle of difference between the red and blue ends of the spectrum. I then used Theta/Delta Lambda(change in wavelength) to calculate the angular dispersion.

Results
The media with the highest refractive index values produced the highest angular dispersion values. The mineral oil, which had the highest refractive index value, produced the highest angular dispersion. The water/gel, which had the lowest index values, produced the smallest angular dispersion values. The isopropyl alcohol, whose index value was in between the water/gel and the mineral oil, produced an angular dispersion value that was also between them.

Conclusions/Discussion
My conclusion is that my results supported most of my hypothesis. The mineral oil, isopropyl alcohol, and water produced angular dispersion values in the descending order that I had predicted. The part of my hypothesis that was not correct concerned the aloe vera gel. Although its refractive index value tested as almost equal to water, it was so viscous that I predicted that it would not even be able to refract light. However, it produced an angular dispersion equal to that of water.

Summary Statement
My project was about the effects of a medium's refractive index value on its angular dispersion.

Help Received
Professor John Kenney at Concordia University helped with the experimental design ; Mr. Ramiah Bapu helped with the mathematical formulae; Mother helped spot beam of light to minimize error

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Ben F. Kahn

Project Number
J1518

Project Title
Light Power: Energy from Color

Abstract

Objectives/Goals
The objective of my project was to test different wavelengths of light to find out which color can produce the most power when shined on a solar cell. My hypothesis was that blue would produce the most power because it has the highest frequency, so more waves per second hit the cell.

Methods/Materials
The general idea was to shine different colors of light onto a photocell that was connected to a voltmeter. At first, I built a tall cardboard box, lined with reflecting material, with a light bulb hanging over a filter. Then, I switched to a slide projector with color filters in slide mounts, and a tube on the end to contain the light. Both of these setups had a photo cell at the end of the test apparatus. Neither design worked very well.

In my final design, I mounted two small cardboard boxes, about 35 CM apart, on a board. On one side of the first box, I mounted colored LEDs, which provided pure sources of different wavelengths of light. On the other side this box, I cut a hole and taped a magnifying lens to focus the light beams. In the front side of the box at the other end of the board, I cut a small hole for the light to enter. On the back wall of this box, I mounted a calculator photocell, which was more sensitive than the photo cell I used in my first experiments. I put a lid on this box to keep outside light from hitting the cell. On the board, just in front of the second box, I placed two more lenses to focus the light beam even more. Finally, I cut a hole in the side of the second box, for inserting an optometer probe to measure the power output of each LED. I used this apparatus to test eight different wavelengths of light, including infrared and white.

Results
The Yellow LED caused the photocell to output the highest power, followed by green, orange, turquoise, blue, red, and finally, infrared. The photocell output almost no power from the infrared LED, and the output from the white LED was a little less than the output from the red LED..

Conclusions/Discussion
My hypothesis was incorrect. Yellow produced the highest output of all of the wavelengths. This may be because the photo cell from the calculator was meant for use under indoor lighting (usually in the green-yellow range) instead of outdoor light (which peaks at blue).

Summary Statement
My project is about which wavelength of light can produce the most power when shined on a photocell.

Help Received
My dad drove me around to various places and helped me assemble parts of the project. He provided certain materials and gave me some suggestions on how to analyze my data. Dr. Gross gave me suggestions about how the project could be improved and provided

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Dominic A. Kane

Project Number
J1519

Project Title
How Colors Absorb Heat

Abstract

Objectives/Goals
The objective of the project is to find out how objects of different colors absorb heat from sunlight differently. I believe that darker colors will absorb heat from sunlight faster than lighter colors. This will be demonstrated by exposing samples of different colored water to sunlight and measuring their temperature over time.

Methods/Materials
Seven identical clear plastic bowls were filled with an identical amount of cold water. Six of the bowls of water were then colored with food coloring, to create bowls of red, orange, yellow, green, blue, and purple water. One bowl of water remained clear. A thermometer was placed in each bowl of water. The bowls of water were placed in direct sunlight from late morning until mid afternoon for three straight days, and the temperature of each bowl of water was recorded over that time.

Results
Based on the recorded temperatures, the clear water absorbed the least amount of heat from the sunlight, while the blue water absorbed the most heat. The specific order from least to greatest amount of heat absorption is: clear, orange, yellow, red, green, purple, and blue.

Conclusions/Discussion
In conclusion, darker colors will warm up more quickly and absorb more heat in sunlight than lighter colors. This knowledge can be useful in everyday life. For example, on a cold yet sunny day, it would be better to wear a dark colored jacket than a light colored jacket. The darker colored jacket will absorb more heat from the sunlight, and help keep the person wearing the darker jacket warmer.

Summary Statement
My project is about determining how various colors absorb heat from sunlight differently.

Help Received
My mom helped me get materials. My dad helped me with the report and graphing the results.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Stephanie T. Kokka

Project Number
J1520

Project Title
Sculpting with Light: Applying Photonics to Create a Three Dimensional Image

Abstract

Objectives/Goals
The ability to utilize lasers to produce a three dimensional image often requires high power sources and thousands of dollars, but by utilizing a common inexpensive diode laser ("laser pointer"), and constructing my own experimental components, I will be able to successfully produce a three dimensional image in a safe, cost effective, manner.

Methods/Materials
Using mostly common materials found in local hardware stores, a vibration isolation platform was constructed. In order to ensure a consistent power source, I modified a standard "D" cell battery holder to supply power to an inexpensive diode laser ("laser pointer"). Using silver halide gel emulsion plates, and photography darkroom materials, I experimented with different subject matter, subject orientations, exposure times, and developing times in an effort to produce a three dimensional image.

Results
Through repeated trial and error experimentation, it was discovered that a common diode laser does indeed supply sufficient coherent light to record and reconstruct a three dimensional image in the form of a hologram. The "contact copy" method of object orientation (bringing the subject in direct physical contact with the emulsion in order to nullify vibrational distortion), in conjunction with an exposure time of eight seconds, proved to be effective in producing a consistently successful hologram.

Conclusions/Discussion
I have concluded that photonics principles can be successfully applied in the use of a common laser pointer to create a three dimensional image. My experimental results validates the use of diode lasers for the purpose of recording objects as holograms, as opposed to coventional, flat, two dimensional photographs. This finding opens up the possibility that in the near future, we will be able to cost effectively produce holograms for a variety of applications, including: archiving, security identification, artistic, commercial advertising, medical imaging, etc.

Summary Statement
I will prove that a common laser pointer produces sufficient coherent light to create a three dimensional image.

Help Received
Dr. Tung Jeong, set-up and supplies; Dr. Rich Chin, darkroom equipment; Frank DeFreitas, experimental design; Darren Boyajian, electronics advice; Dan Brown, presentation; parents, overall support

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Janelle M. LaFontaine

Project Number
J1521

Project Title
The Effect of X-Ray Beam Energy on Image Quality of Objects

Abstract

Objectives/Goals
The objective is to determine whether x-ray image contrast is improved using lower energies.

Methods/Materials
X-ray images of an anthropormorphic head were obtained using a diagnostic x-ray machine with varying energies. The department film processor was used to develop the x-rays. A densitometer was then used to measure the multiple radiograph backgrounds and optical densities. Image contrast was calculated as the relationship of the Background Density (B) minus the Optical Density (OD), divided by the Background Density (B).

Results
The resultant x-ray images taken at lower energies produced better contrast and more detailed bone structure than those taken at higher energies. Radiographs taken at higher energies proved to have less contrast, therefore penetrating through the skeletal detail, creating darker and sometimes overpenetrated images.

Conclusions/Discussion
Image contrast is improved on radiographs by utilizing the lower kVp energy, producing better detailed bone description.

Summary Statement
By using a lower kVp, x-ray image contrast is improved.

Help Received
I worked in the Radiation Oncology Department at the Naval Medical Center of San Diego under the supervision of Richard LaFontaine, Ph.D., Medical Physicist.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Joshua C. Leighton

Project Number
J1522

Project Title
Radiation

Abstract

Objectives/Goals
The goal of this project was to determine if I could identify an unknown source of radiation (Coleman lantern mantles) as emitting alpha, beta, or gamma radiation. In addition to this I performed experiments on what blocks radiation, whether thickness matters when blocking radiation, how magnets affect radiation, and to validate the inverse square law.

Methods/Materials
I constructed a Geiger Counter that I enhanced with a digital counter. I obtained alpha, beta, and gamma radiation disk sources that I used in my experiments. Using a variety of different materials placed between the radioactive source and the Geiger tube, I performed experiments to discover what materials block radiation. I then used this information to determine what type of radiation Coleman lantern mantles emit.

Results
Any material almost completely blocked alpha radiation. Beta radiation was blocked better by thick or metallic materials. Almost nothing blocked gamma radiation.

Conclusions/Discussion
Using the information recorded when blocking radiaiton I was able to estimate that the Coleman lantern mantle gave off about 18% alpha, 70% beta, and 12% gamma radiaiton.

Summary Statement
My project is about the properties of radiation.

Help Received
Dad helped troubleshoot Geiger counter, reviewed my report, and asked leading questions occasionally; Larry Web of Spectrum Techniques lent me the radiation sources.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Courtney J. Mazzei

Project Number
J1523

Project Title
What Is the Source to Complete the Force? A Study of Centripetal Force

Abstract

Objectives/Goals
The objective is to find out why an object, such as a roller coaster or Hot Wheels car, is able to travel upside down around a loop without falling off of the track. My hypothesis is that the height of the track is more important than the weight of the car in gaining enough speed for the car to successfully travel around the loop.

Methods/Materials
One Hot Wheels car was filled with varying amounts of fishing weights of the same size and sent down a track to travel around a loop. Speed was changed by placing the initial starting point of the track at different heights. The weight of the car was changed several different times by adding fishing weights.

Results
The car traveled around the loop more often with a high track starting point, rather than with more weight and a lower starting point.

Conclusions/Discussion
The weight of the vehicle does not matter as much as the height of the starting point of the track in achieving enough speed for the car to successfully travel around the loop. When the right combination of initial track height and weight of the vehicle occurs, centripetal force is achieved.

Summary Statement
My project is a study of centripetal force using a Hot Wheels car and track.

Help Received
Mother helped buy materials. Parents and science teacher explained the concepts of centripetal force and Newton's Laws of Motion.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Katie Merrill; Laura Schwartz

Project Number

J1524

Project Title

It's Our Fault! Exploring the Relationship between Friction in Fault Zones and Pressure Required to Cause an Earthquake

Abstract

Objectives/Goals

The object of our experiment is to explore the relationship between the friction existing between earth segments in a fault zone, and the amount of force necessary to generate movement in the fault.

Methods/Materials

MATERIALS: - a 1lb 2" by 4" wood block about 8" long; - a 4' by 6" wood plank; - tinkertoy set; - 5 lbs clay (4 lbs needed for test); - 4 sheets 8 1/2 by 11" sandpaper(50 grade); - 5 lb scale; - stapler; - packing tape

Test Board: - 2 sheets 50 grade sandpaper cut in half ; - Staple each piece rough side up to connect across length of board; - Sand 1 side of wood block ; - Drill ceiling hook into middle of wood block so open part is facing up; - Place tinkertoy crank on end of board; tape down legs; - Tape one end of string to spring scale and the other to crank; - Connect other end of spring scale to block

Testing Procedure: - Use wood block with no clay for 1st test. Turn crank; observe Newtons required to move block ; - Record observation; - Repeat test nine times, recording observations ; - Repeat test sequence with 1lb, 2lbs, 3lbs, 4lbs, and 5lbs, ; - Average data for each set of tests

Results

Test Averages: 1lb-4.65; 2lbs-9.45; 3lbs-14.1; 4lbs-16.1; 5lbs-18.85

Originally we assumed that as we increased mass on the block, the Newtons would increase at the same rate because the results of the 1lb and 2lb test began looking like a direct variation. But as we continued our testing, we were disappointed to find out that the Newtons increase no longer maintained the same pattern. These results are apparent in our data. We were surprised when the difference of Newtons between each lb decreased. If this data were to relate directly to earthquakes, it would prove on a small scale that more friction results in a more forceful earthquake. A large amount of friction within a fault would keep the fault from shifting until a large enough amount of force could be generated to move it.

Conclusions/Discussion

We now know how potential and kinetic energy work in relation to earthquakes. In the simulation we created, we found that mass increases friction. The mass (clay weights)and the number of Newtons required to move it, increased in a relationship of 1 to 5. After that, the number of Newtons began to increase at a more gradual rate, and the pulls became more sporadic.

Summary Statement

The purpose of our experiment is to explore the effect of friction on seismic movement.

Help Received

Special Thanks to our science teacher, George Merilatt for helping us formulate our project idea. To our parents for helping us gather supplies and for their support.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Sara Newton; Alex Wolf

Project Number
J1526

Project Title
Science Friction

Abstract

Objectives/Goals
To determine if static and sliding friction is affected by surface texture and the weight of an object.

Methods/Materials
Method
Glue three different sandpaper textures onto painted wood, leave space for painted wood texture. Drill three holes in wood block for weight placement. Attach Newton scale to 1.5N wood block. Pull the scale across the four different textures to measure the static friction and the sliding friction at a speed that is moving at a constant rate which means it stays at the same speed every time. Record the static and sliding friction onto a data table. Repeat steps 1-3 with 2.0N and 2.5N wood blocks.

Materials
Painted wood; Fine sandpaper; Medium sandpaper; Rough sandpaper; Wood block; 3 .5N weights; Two Newton scales; Glue.

Results
2.5 Newton sliding body weight had the greatest friction, 2.0 Newton body sliding body weight had the secnd greatest friction, and 1.5 Newton sliding body weight had the least amount of friction.
Rough sand paper had the greatest friction, medium sandpaper had the second greatest friction, fine sandpaper had the third greatest friction, and painted wood had the least amount of friction.

Conclusions/Discussion
We came to the conclusion that our the surface texture the object slides across and the weight of the object that is sliding across the surface affects sliding and static friction. We also discovered that there was a more drastic change between the friction on the painted wood and the fine sandpaper more than any other texture change. This could be because the fine sandpaper is a lot rougher than the painted wood and the medium sandpaper was not as rough when compared to the fine sandpaper. Thus, surface texture and weight of an object does affect static and sliding friction.

Summary Statement
It's about finding if surface texture and the weight of an object affects static and sliding friction.

Help Received
Parent helped assemble lab set up.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Christine E. Nielsen

Project Number
J1527

Project Title
Sound Through Pipes

Abstract

Objectives/Goals
The objective is to determine how transmission of sound through a pipe is affected at different frequencies. I believe that the only result that will vary is the volume, with higher frequencies keeping the same volume and lower ones becoming quieter.

Methods/Materials
Sound waves were created by a laptop PC with a program for producing pure tones. These traveled through a pipe that was 27" long and had a 3" diameter, surrounded by a foam wall 4" thick. On the other end, 20" away from the end of the pipe, a microphone picked up the sound waves and transmitted them to another PC to a program that analyzed the sound, showing both frequency and decibel rating (volume). Data was collected with a wall in between sound generator and microphone, and without either a wall or pipe as a control.

Results
For all frequencies except 400 hz the volume after going through the pipe was lower. When the microphone was placed at a straight angle from the pipe, higher frequencies (1200 hz and above) were significantly louder than lower frequencies (1130 hz and below) although not as loud as the control. At 90 degree and 45 degree angles, the higher frequencies were not as loud as the straight angle, but lower frequencies were often as loud or louder than the straight angle test. The wall used was more effective at blocking out sound at higher frequencies, but was still effective at lower frequencies. At 400 hz the wall did not help at all in blocking sound, as the control (without pipe or wall) was the same volume as when I tested with the wall. Also, the tone at 400 hz was louder after it went through the pipe, at all angles, than the control.

Conclusions/Discussion
My conclusion is that after going through a pipe, most frequencies are quieter than they would be without a pipe. When testing with the pipe, sound distribution and volume differs from frequency to frequency. Higher frequencies tend to produce a 'sound beam', with sound concentrated at a straight angle, while at other angles, such as 45 degrees and 90 degrees, the sound is significantly quieter. 1130 hz has a wavelength of 12", or four times longer than the 3" width of the pipe. Lower frequencies appear to be much less predictable. Reflected sound may be responsible for less reliable control measurments.

Summary Statement
This project is about how transmission of sound through a pipe affects sound volume at different frequencies.

Help Received
My mentor was Eric Nielsen.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Rebecca J. Olson

Project Number
J1528

Project Title
Properties of the Pendulum

Abstract

Objectives/Goals
My objective was to find which variable - weight, length, or amplitude - would have the greatest effect on the period of a pendulum. I believed that weight, length, and amplitude would each have an equal effect on the period.

Methods/Materials
I constructed a pendulum to test different weights, lengths, and amplitudes to see which would have the greatest effect on the period of the pendulum. I then tested three different lengths, 30 cm, 60 cm, and 90 cm; three different amplitudes, 20?, 45?, and 70?; and three different weights, 1-1/4 oz, 2-1/2 oz, and 3-3/4 oz. I timed each of these variables 10 times for one period of motion.

Results
I found that length made the most significant difference in time. Weight and amplitude made little or no difference.

Conclusions/Discussion
My hypothesis was not supported. I found that length made the most significant difference in time.

Summary Statement
To determine what affects the period of a pendulum -- weight, length, or amplitude.

Help Received
Father used power tools to cut pendulum materials to size and helped with the assembly of pendulum.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Katrina A. Pare'

Project Number
J1529

Project Title
Turning the Tortoise into the Hare

Abstract

Objectives/Goals
This experiment was done to discover if hitting the ketchup that has been refrigerated for 24 hours or at room temperature for 24 hours, would fill your need to feed faster.

Methods/Materials
Frame (made of wood), 10 bottles of restaurant style ketchup (5 bottles have been placed in a refrigerator for 24 hours,and the other 5 bottles have been placed in room temperature for 24 hours), 2 stopwatches, pencil or pen, paper, calculator, and a packet of 6in. (15 cm.) plates cut in half.

Results
The results of this experiment showed that the ketchup that had been in the refrigerator for 24 hours came out 2 min. and 14 sec. faster, than the ketchup bottle that had been at room temperature for 24 hours. The results also show that it takes over 100 hits to even see viscosity changing.

Conclusions/Discussion
After all data was completed and averaged I came to the conclusion that after refrigerating the restaurant style ketchup bottle for 24 hours and smacking the bottom of the bottle will cause a 2 min. and 14 sec. decrease from smacking the bottom of the ketchup bottle at room temperature. The ketchup will take forever to come out on its own if not acted upon by some sort of variable. So when put in the refrigerator for 24 hours, the viscosity changed making the ketchup flow faster than at room temperature. Then when we hit the bottom of the ketchup bottle, it caused the viscosity to shift to a different position so it didn't take as long. In further conclusion, my hypothesis was proven wrong.

Summary Statement
By hitting the restaurant style ketchup bottle on the bottom, which temperature of ketchup comes out faster, room temperature or refrigerated?

Help Received
Dad helped build frame and place ketchup bottles in handles during experiment.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Ashley R. Paulus

Project Number
J1530

Project Title
Magnets

Abstract

Objectives/Goals
The objective is to determine if decreased temperature increases magnetic strength.

Methods/Materials
Five groups with five magnets in each group were tested at varying temperatures (-161 degrees C, -9 degrees C, 4 degrees C, 16 degrees C and 161 degrees C) to determine if decreased temperature increases magnetic strength. Each magnet was set to its specific and placed on the anvil. The spring scale was attached to the magnet and was pulled until the magnet was released from the anvil. The number read on the spring scale when the magnet was released from the anvil was recorded as the magnetic strength in grams.

Results
Results show that magnetic strength decreases as temperature increases. This is shown in the overall decline of the magnetic strength in grams as temperature increases.

Conclusions/Discussion
Decreased temperature increases magnetic strength. According to the chi-squared statistic, there was no difference in magnetic strength between the room temperature and the decreased temperature of the magnet. However, the chi-square statistic shows that there was a difference in magnetic strength between the room temperature and the increased temperature of the magnets. This shows that increased temperature reduces magnetic strength but the decreased temperature barely affected the magnetic strength, according to the statistical analysis. A predetermined probability of 5% or smaller was said to be reasonable before computing the chi-squared statistic.

Summary Statement
The project was designed to determine the strength of magnets at varying temperatures

Help Received
Richard Bartel perfected the methods, provided spring scale and 100g weight; Jennifer Rusco provided oven thermometer; my parents bought magnets and helped with the board; dad taught me chi-squared statistical analysis; Dominic Buzzelli provided anvil; the Erbstoessers provided the liquid nitrogen

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Caitlin J. Payne

Project Number
J1531

Project Title
Jupiter and Its Moons

Abstract

Objectives/Goals
My objective is to determine why Jupiter's moons have different orbits. I predict that the moon farthest from Jupiter will have the longest orbital period and the closest moon will have the shortest orbital period.

Methods/Materials
Using a Meade LX200 12-inch reflector telescope located in my driveway between the hours of 6:00PM to 11:00PM from January 5th through January 8th, 2002, I observed Jupiter and the continously changing positions of it's four Galilean moons. With a pencil and paper, I drew Jupiter and it's moons exactly as I saw them. After the drawing was completed, I used the January 2002 edition of "Sky and Telescope" magazine to identify the name of each moon. I repeated this same procedure for four consecutive nights. I then measured the distance between Jupiter and it's moons in my drawings and plotted the changing positions of the moons. With this data, I calculated the relative distances of Europa, Ganymede and Callisto to Jupiter compared to the distance from Io to Jupiter. This was done by taking the average drawn distance of each moon to Jupiter. I then created a graph that showed the positions of the moons with time. I connected the points on the graph similar to the orbital pattern seen on the Jupiter Satellite Position chart on page 114 of "Sky and Telescope", January 2002 edition. Then, I estimated the orbital period of each moon. I compared the relative distance of each moon from Jupiter to the orbital period of each moon.

Results
The observed relative distances of each moon to Jupiter compared to Io's distance to Jupiter was determined. The observed relative distance of Europa was 1.49X, Ganymede was 1.94X, and Callisto was 2.56X. Actual relative distances are 1.59X, 2.52X, and 4.58X respectively. The observed orbital period of Io was 2.0 days, Europa was 3.8 days, Ganymede was 7.4 days and Callisto was 12 days. Actual orbital periods are 1.8 days, 3.6 days, 7.2 days, and 16.7 days respectively.

Conclusions/Discussion
After analyzing the data, I conclude that Jupiter's four Galilean moons have different orbits because thay are different distances from Jupiter. My hypothesis is correct in stating that the farther the moon is from Jupiter, the longer it takes to orbit Jupiter. These results support the findings of Johannes Kepler's third law of planetary motion.

Summary Statement
This is an observational study of Jupiter's moons distances from the planet and their orbital period

Help Received
I would like to thank my father for teaching me how to use the telescope. He spent many late nights in the cold extending my knowledge of the solar system.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Marcelle N. Phene

Project Number
J1532

Project Title
Good Vibrations

Abstract

Objectives/Goals
My goal in doing this project was to study how the length of a resonator affects the amplitude of sound that a vibraphone bar gives off.

Methods/Materials
A decibel meter was used to measure the amount of resonance an A4 bar of a *Musser vibraphone gives off with the resonators A^3-A^5 underneath it. Room temperature was measured and recorded throughout this experiment to quantify any possible air temperature changes. On any vibraphone, each resonator is aligned with its tuned bar. Thus, the experiment began with the A^4 resonator underneath the A^4 bar. A hard plastic mallet, wrapped in yarn was used to strike the bar; the mallet was mounted to a stand throughout the experiment to provide exact replication of force and angle to each strike. The resonators were rotated so a different resonator was underneath the A^4 bar for each #treatment# of the experiment. Then the striking of the bars was repeated three times each.

*Brand names are used for the sole purpose of identification and are not meant as endorsements by the author.

Results
The length of the resonators did affect how much of the sound was amplified; with the correct resonator the sound was amplified the most.

Conclusions/Discussion
The length of the resonator does affect how much of the bar#s sound it amplifies. The resonators need to be the length that matches the tuning of the bar it is underneath. Concert halls, for example, have to be specifically tuned so that they do not have higher resonance frequencies for one certain pitch. If this were to happen then when that pitch is played it will be over emphasized. This applies to my experiment because if the resonators were all the same length then they might have a higher resonance frequency to one pitch and when someone strikes that bar it will be over emphasized.

Summary Statement
My project is about how much resonance is occuring with different length resonators under vibraphone bars.

Help Received
Used vibraphone from Alta Sierra Band; Percussion Instructor helped move resonators & supervise during experiment.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Nick A. Rael

Project Number
J1533

Project Title
Impact Craters and Ejecta

Abstract

Objectives/Goals
The purpose of this experiment is to determine how the size of the incoming object, the energy of the incoming object, and the type of target surface material effect the size of the impact crater and how far the ejecta will fly.

Methods/Materials
Each object to be dropped was weighed. Each surface material was weighed and it's density was calculated. I then performed three drops for each combination of surface material, object, and drop height. The crater diameters and ejecta distances were measured and the mean crater diameters and mean ejecta distances were computed. For each of the objects and drop heights; the energy of impact was calculated.

Results
The results of the experiment clearly show that a larger mass makes a bigger crater and throws the ejecta farther. The results also show that a higher energy object makes a bigger crater and throws the ejecta farther. Finally, it can be clearly seen that crater diameter and ejecta distance are larger when the surface material density is higher.

Conclusions/Discussion
The first part of the hypothesis, that the object with the greatest mass and energy will make the biggest impact crater and throw the ejecta the farthest, was supported by the data. The second part of the hypothesis, that the surface material that is the least dense will have the largest impact crater and farthest ejecta range, was disproved by the data. The third part of the hypothesis, that the energy of the object will affect the crater size and ejecta range the most, was neither proved or disproved. More data points are necessary to reach a conclusion.

Summary Statement
Droping different sized objects into different surface materials to make impact craters.

Help Received
Mother helped me create graphs on my computer. Mrs. Kumar provided a triple beam balance scale.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Patrick G. Ruden

Project Number
J1534

Project Title
Buoyancy in the Bermuda Triangle

Abstract

Objectives/Goals
The objective of my project is to find out whether the release of methane gas from vents on the ocean floor will have an effect on a ship's buoyancy. Does this loss of buoyancy cause ships to sink? My hypothesis is that underwater gases will affect the buoyancy of boats or a ship because a mixture of gases and seawater will not support weight as well as seawater normally does.

Methods/Materials
My procedure was to build a test tank using a fish tank, a small propane cylinder, tubing, a 10 CFH flow meter, a manifold to simulate the sea floor vents, and fittings. I then injected propane gas at 2, 4, 6, 8, and 10 CFH (cubic feet per hour) from the bottom of the tank of salt water. The buoyancy of several model ships and boats were measured with and without injection of propane gas. The height of the model ships was measured to determine the height relative to the surface of the water at the different flow rates. The data was collected and recorded and used to prove my hypothesis correct or incorrect.

Results
The test results show that the buoyancy of the test models was affected. Test number one was for a model tugboat. The maximum buoyancy drop from release of gas at 10 CFH was .125 inches. Test number two was for the model Titanic, which dropped at a maximum of .375 inches at 10 CFH. This translates to a 26.47 feet drop in the ocean at full scale. In addition, when the gas valve was initially opened, the flow exceeded the meter scale, which resulted in drops as much as .750 inches or 52.94 feet at full scale.

Conclusions/Discussion
In conclusion, I have proved that my hypothesis is correct because the propane gas had an effect on the buoyancy of multiple model ships within the experimental tank. I think that the propane gas displaced some of the water around the ship, which reduced the volume of the water that was under each model ship. By reducing the volume of the water, it lowered the ships position in the seawater. Therefore, the ships positive buoyancy was reduced making it sink lower into the water.

Summary Statement
Multiple experiments to learn if the release of underwater gases effects the buoyancy of ships or boats in sea water.

Help Received
Father helped type my information into a report, supervised the handling of flamable gases, and helped identify correct materials for tests.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Amy R. Shipley

Project Number
J1535

Project Title
The Visible Wavelengths of Light

Abstract

Objectives/Goals
All light sources produce a wavelength or wavelengths of some kind. I performed many experiments to try to study the wavelengths of certain light sources. I thought that the color of the outside of the light source determined what wavelength or wavelengths were produced.

Methods/Materials
To examine the wavelengths and measure them, I built a spectrometer with a diffraction grating (A device with many grooves that splits the light.) To measure the wavelength I calculated and made a scale using the equation
m*lamda=d*sin(theta). The materials used to build the spectrometer were a piece of cardboard 11 inches long by 4 # inches wide, a yardstick, 2 razors, and a diffraction grating, 19,050 grooves per inch. I pointed the slit I had made in my set up and at a lit fluorescent cool white bulb, incandescent light bulb (Frosted White), aquarium light bulb (Clear Glass), black light bulb, and colored bulbs and L.E.Ds (Both yellow and red.)

Results
My results were that both the incandescent and aquarium bulb had the smoothest spectrum called continuous spectra. The cool white fluorescent light had a continuous spectrum and within the continuous spectrum were two brighter bands, blue and green, called line spectra. The fluorescent full spectrum had line spectra of all the colors. The black light had purple, blue and a dim green line spectrum. With the L.E.D.#s and colored bulbs, I saw a continuous spectrum with the yellow colored bulbs and L.E.D.#s and a small red spectrum with the red colored bulbs and L.E.D.#s.

Conclusions/Discussion
This concluded that my hypothesis was right when it comes to colored bulbs. However, when it comes to cleared glass aquarium bulbs and frosted white incandescent bulbs, the color of the outside of the bulb did not have any effect on the spectrum and wavelengths produced.

Summary Statement
I measured the visible wavelengths of different light sources using a diffraction grating.

Help Received
My Father helped with explaning some of the math and building my spectrometer.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Hayley Smith (Wade)

Project Number
J1536

Project Title
Light Refraction

Abstract

Objectives/Goals
Can the refraction of light be used to identify materials?

Methods/Materials
Using a laser and polar projection paper, I shot the light beam through the medium and calculated the refraction index of the material to identify them.

Results
It is possible to identify materials using Snell's Law and light refraction. Each material has a different index of refraction. For instance, in ethyl alcohol the refraction index for 45 degrees is 1.305, and for crown glass it's 1.52. It does not make a difference whether the medium in solid or liquid, as long as the substnace is thin enough for light to travel through.

Conclusions/Discussion
My hypothesis was correct, because it is possible to isentify materials using refraction. This process will help for many different areas and problems. For instance, identifying unknown substances in labs, and in geology to idenify what minerals are in a peice of rock.

Summary Statement
Identifying liquid and solid substances by their index refraction

Help Received
Mr. Bob Lewy - was my mentor throughout the experiment and let me use the materials in his lab where he worked.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Adam Sowlati

Project Number
J1537

Project Title
Superconductivity

Abstract

Objectives/Goals
This project is an attempt to understand and learn how superconductors behave. Do magnetic fields affect the electrical resistivity of Type 2 superconductors? This was the question, which was the focus of this project. A second question was later introduced: does the current flowing through the superconductor determine how the magnetic field affects the superconductor's resistivitiy?

Methods/Materials
An electro-magnet was used to expose the superconductor to a magnetic field. Wrapping a roll of magnetic-wire around an iron-bar created the electro-magnet. A four-point electrical probe with a Bi(2)Sr(2)Ca(n-1)Cu(n)O(9)(BSCCO) superconductor was attached to a thermocouple, power supply, ammeter, and a voltmeter. The four-point probe was submerged into liquid nitrogen and retrieved only to expose it to the magnetic fields. The resistance was calculating using Ohms law, which states that resistance, is voltage divided by current. The second part of the project was determined by performing the previous experiment with varying currents flowing through the superconductor.

Results
As the magnetic field increases the resistivity greatens. Also, as the current increases the magnetic field affects the superconductor's resistivity more.

Conclusions/Discussion
The findings of this project are truly fascinating. It has been discovered that magnetic fields do affect superconductors, and that the current flowing through the superconductor determines how the magnetic field affects the superconductor's resistivity. This shows that different types of energies affect superconductors.

Summary Statement
This project toiled with the question of how superconductors are affected by magnetic fields.

Help Received
Used Viewpoint School's lab and equipment under teacher's supervision; Technical questions answered by mentor; Teacher gave advice.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Katherine C. Stephens-Doll

Project Number
J1538

Project Title
The Effect of Differentiating Droplet Size on Rainbow Brilliance

Abstract

Objectives/Goals
The reason that this project was chosen above others was because my dad and I were sorting through books to look for a project, and we came upon an entry on Prisms and Light. The diagrams of the reflective patterns of light interested me. I had lots of questions about Rainbows, so I decided that that would be a perfect area of investigation. The overall purpose of this project was to find if a certain characteristic of water (drop size) would effect the rainbow, and if so, how. I believed that the bigger the droplets, the more water would be available to reflect in and that would make more diverse and detailed patterns.

Methods/Materials
I could take the size of a solid object that you could measure, and compare it then I would be able to infer the size of the water droplet. One characteristic that both objects shared was their shadows. If I could magnify the shadows from the objects, I could measure them more accurately. I built an instrument that measured everything I needed to know, and therefore cross-multiplied and found the size of the drop. Then I had to take several different sized drops measured on my instruments and saw how far they spread out on filter paper. Now that I know an accurate measurement of my droplets, To figure out an accurate measurement of the droplet#s brightness, I decided to use the computer program #Photo Impact# to find individual pixel intensity.

Results
I found that my control drops were: Control Drop #1 was 49.02,Control Drop #3 was 36.58, and Control Drop #4 was 25.65. For my shower wand i got 3.89mm, and for the mist nozzle i got 2.01mm. For four different spots in the rainbow, red, blue, and green#s (primary colors of light) levels of intensity were found. By adding up the average of each color, and then finding the average of the three colors, we get a total average of intensity for each rainbow. The intensity for the Shower wand was 181.6 and the intensity for the mist nozzle was 159.0 (255 = full sun).

Conclusions/Discussion
My final results supported my hypothesis. It seemed that the best results (181.6) were found in the shower wand, which had many droplets, and the brightest rainbow. The fog (lower mark, 159) was the smallest nozzle, and the dimmer light, supporting my hypotheses. I found that all of my variable work (see original abstract) made my project much more accurate. I then did more research to attempt to further support the hypothesis.

Summary Statement
If larger or smaller droplets create a more vivid array of colors in a rainbow.

Help Received
Father helped with math; Mother helped get information on fair guidelines.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Jameson A. Stout

Project Number
J1539

Project Title
Tuning an Instrument Using Beats

Abstract

Objectives/Goals
I wanted to learn how to tune my instrument withouth the use of an electric tuner. If two frequencies overlap, they will produce loud bursts of sound where two peaks match. I used these to see if the frequencies were closer to being in tune when the beats were closer together or farther appart.

Methods/Materials
I used a stringed instrument called a fretted dulcimer to find the answer to my question. On the dulcimer I used, there were two strings that were exactly the same. These, I tuned to the same note. I used an electric tuner to tune one of the strings slightly down, while leaving the other the same. This produces the off frequency. I measured the amount of beats that occured in five seconds. I continued down until I reached the next note

Results
I have found that the two strings are closer to being in tune if the beats are farther appart. Also when the frequencies are going away from each other, they go higher rapidly, but when they begin to go down, they go down very slowly.

Summary Statement
My project is about using sound frequencies to tune an instrument.

Help Received
Dad helped make charts and graphs; Ms. Rasmussen got board; Mom provided instruments and tuner

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Caroline M. Swinehart

Project Number
J1540

Project Title
What Is the Effect of Magnetism on the Ionization of Gas Plasma?

Abstract

Objectives/Goals
My goal was to learn if the presence of a magnetic field at the anode or the cathode of a tube containing a rarefied noble gas would affect the voltage at which the gas would ionize. If this ionization potential were to be lowered by a magnetic field, it would allow for a more efficient or easier to initiate form of electric lighting.

Methods/Materials
Direct current, high voltage electricity was passed through low pressure neon gas in an enclosed Pyrex glass tube. The initiation voltage of ionization was recorded using a voltmeter with a high voltage probe. Readings were taken each of three ways: with no magnet present for a baseline value or control, with a magnet at the cathode, and with a magnet at the anode.

Results
I discovered that a magnet placed at the cathode increased the voltage needed to initiate ionization relative to the baseline voltage. The magnet placed at the anode had a minimal effect.

Conclusions/Discussion
It was hoped that placing a magnet at the electrodes would decrease the ionization potential needed to initiate ionization. Most modern forms of electric lighting,including fluorescent lighting, street lighting, and sign lighting, are made from gas plasmas. If I could lower the ionization potential of gas plasmas, it would make it easier to initiate these forms of lighting and make them easier and more economical to produce. However, the opposite effect was found, as the anode magnet had only a very small effect and the cathode magnet made ionization much more dificult to achieve.

Summary Statement
In searching for an easier and more economical way of producing plasma lighting, I studied the effects of magnetism on the initiation voltage of the ionization of neon.

Help Received
Used equipment in father's laboratory and received his supervision on safe use of high voltage and vacuum equipment; Father gave guidance on measurement of voltage.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Brian E. Terrell

Project Number
J1541

Project Title
Utilizing Sunspots to Analyze Solar Rotation

Abstract

Objectives/Goals
To analyze the movement of sunspots to determine whether or not the sun rotates and if so, at what rate.

Methods/Materials
I utilized two Schmidt-Cassegrain telescopes (5 inch and 8 inch) with approved sun filters to observe and photograph the movement of the sunspots. I photographed the sunspot movements with a 35mm single lenses reflex camera. I used a Minolta X 700 camera with 400 ASA Kodak film. An atomic clock was also utilized to insure the accuracy of time measurements.

Results
The sunspots were noted to move in groups and in a relatively uniform and consistant manner. The approximate rate of rotation was once every thirty days.

Conclusions/Discussion
Sunspots are a relatively stable phenomenon in the sun's photosphere. They typically last a matter of days to weeks. As such, they can be used to track the movement of the sun and determine its' rate of rotation. According to my findings and calculations, the sun rotates approximately once every thirty days, in a left to right manner as observed from the earth.

Summary Statement
Tracking the movement of sunspots to determine if the sun rotates.

Help Received
My mother taught me how to use the telescopes with sun filters in a safe manner. My mother helped with the board layout and design.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Parker O. Wood

Project Number
J1542

Project Title
Does Elevation Affect the Force of Gravity?

Abstract

Objectives/Goals
The Purpose of science project was to see if the force of gravity could be tested and see a measure able difference in the force of gravity.

Methods/Materials
I traveled to 3 elevations 275,3990,7000. I timed and counted my pendulums occilations. Iused a Pendulum stopwach data sheet and thermomater

Results
There was about a 25 second difference in the force of gravity.Gravity decreased at higher elevations.

Conclusions/Discussion
My hypothesis was correct the force of gravity decreaces at higher elevations.
Now, being finished with my project I have a better understanding of physics,gravity,and it's founders.

Summary Statement
My project is about gravity.

Help Received
mom typed,grampa made board and pendulum with my help.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Kyle T. Yamamoto

Project Number
J1543

Project Title
Insulating Clothing Material vs. Cold Weather: Which Insulating Clothing Material is Most Effective?

Abstract

Objectives/Goals
My objective is to determine which insulating clothing material is the most effective at preventing heat loss against cold weather.

Methods/Materials
Ten different insulating clothing materials of identical size with different insulating/air trapping capabilities were tested against a control. The controls was an uninsulated one liter glass jar of hot water with a starting temperature of 86.6 degrees C. that was placed in a refrigerator with a temperature of 5 degrees C. Temperature readings were taken at 15 minute intervals for one hour on ten trials. Another one liter glass jar of hot water was wrapped in the insulating material to be tested, placed in a cardboard box then put into the refrigerator with temperature readings taken as with the control for ten trials. All materials were tested in a similar fashion.

Results
Polartec consistently had the lowest heat loss rate with an average of 9.17 degrees C. lost in one hour. I also noticed that the natural insulating materials, i.e. wool, cotton, and down did not insulate as well as the synthetic materials, especially polyester. Plus, condensation of moisture affected the insulating properties.

Conclusions/Discussion
The insulating clothing material versus heat loss over time tests supported my hypothesis that the Polartec material was the most affective at preventing heat loss against cold weather. Also, polyester was the major component in the most effective insulating materials, so the way these three materials are fabricated in order to trap air is extremely important in insulating efficiency.

Summary Statement
My project is about finding which insulating clothing material is most effective at preventing heat loss against the cold weather when compared to other insulating clothing materials.

Help Received
My parents offered financial support and transportation. My aunt let me use her digital thermometer. My sister let me use her color printer and she took pictures of me while I posed. My mother assisted with mounting my board.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Haley A. Yolken

Project Number
J1544

Project Title
How Does Acceleration Affect Force?

Abstract

Objectives/Goals
My objective is to learn about Newtons second law of physics and how acceleration affects force. I belive that the more acceleration the object requires, the more force it will preduce.

Methods/Materials
I used the indentations of my 2 hands in clay, which was in a 14" x 14" box, and compared the depth of my indentations of 6 differant moves to the depths of my control group. The moves where seperated into 3 grops, Slow, Medium and fast acceleration, which i then used to find the approximate force and aceleration on my hands during the move, so i could draw some conclutions as to how acceleration affects force.

Results
I found that the more acceleration the object requires, the more force it will produce by comparing the depths of the clay and the approximate amounts of force. The slow moves only produced a little bit of force, only added about 2-10 lbs. to the weight on my hands while the fast moves had more force, added about 40-60lbs. to my hands while doing my moves. By studying these results, i drew the conclution that the more acceleration you have the more force.

Conclusions/Discussion
I was correct on thinking that the more acceleration you have the more force you have, in my hypothesis. Doing this science fair project taught me a lot about Physics,. since i have never explored the concept of physics before, and i learned about how newtons second law of physics really can be applied to reall life.

Summary Statement
I am testing Newtons second law of physics to find how acceleraion affects force.

Help Received
Parents helped with supplys, physics teacher at the high school and gymnastics coach helped with ideas.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Eric J. Zagala

Project Number
J1545

Project Title
Heat Conductivity

Abstract

Objectives/Goals
The object of this experiment is to determine which type of metal will conduct heat the fastest: Aluminum, copper, bronze, silver nickel and steel.

Methods/Materials
I used five different types of metals, 1/8 inch thick. A thermometer was attached to each piece of metal. Using a propane torch as my heat source, I began to heat each piece one inch from the thermometer. Using a stop watch, I timed how long it took to register on the thermometer. I repeated this process three times with each type of metal. I recorded all results for accuracy; additionally I computed the average of the three tests.

Results
The aluminum conducted heat the fastest at an average of 14 seconds. The bronze was the second fastest at 16 seconds. The silver nickel averaged 19 seconds to conduct heat and appeared to be the strongest metal used in the experiment, as it did not melt or bend. The copper conducted heat, on an average of 26 seconds, however, quickly melted into a liquid like form. The piece of steel averaged 50 seconds.

Conclusions/Discussion
My hypothesis was correct. Aluminum did conduct heat the fastest; steel appeared to be the slowest. I predicted aluminum would conduct heat the fastest as it was the lightest. However, after my experiment and research, I learned that the weight of the metal did not determine how quickly it would conduct heat. I concluded that knowledge of metals and heat conductivity is crucial in science in the course of the development and research of technology.

Summary Statement
Determining which types of metals conduct heat the fastest.

Help Received
Dad helped with use of torch; mom helped with typing and graphing of information

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Michael H. Chan

Project Number
J1599

Project Title
In Search of a New Bridge Material

Abstract

Objectives/Goals
My project is to research and discover whether there exists another bridge material that is stronger and makes better sound than the wood bridge that is currently used on the violin. My goal is to come up with a bridge that is more durable and has better sound quality.

Methods/Materials
I chose new materials, plastic and aluminum that have higher density than wood. In my test, I used wood as my control material. I used four bridges: one wood, one plastic and two aluminum bridges. The two aluminum bridges were of two different thicknesses. After I installed each bridge on the violin, I played the D major scale and recorded the sound into the computer. Using the CoolEdit 2000 program, I analyzed the frequency and loudness characteristics of each note and then I made comparisons among the four bridges. In addition to the sound analysis, I also played and recorded the A major scale at two different speeds and several measures of a song that used all the string with all four bridges. I then played back the tapes to professionals to survey if they could hear the differences and to rank the sound quality of each bridge. The equipments used were condenser microphone, Nakamichi tape deck, 8 mm cassette tapes, PC laptop with computer microphone, a violin and the four bridges.

Results
I found that the frequency of the notes produced by the wooden bridge is about 30 Hz lower than the others. The loudness is about the same for all four bridges. I discovered that the aluminum bridge that is half the thickness of the wooden bridge does not work because it was not stable and warped. The professionals who did the survey preferred the sound qualities of the plastic and the aluminum bridges.

Conclusions/Discussion
I concluded that aluminum and plastic bridges will produce consistent sound qualities because they are homogenous materials, where as wood is non-homogenous with the grain and is brittle. Wooden bridges can warp over time, both aluminum and plastic are stronger than wood. My experiment showed that aluminum or plastic can replace the wooden bridge on the violin and these materials will in fact be stronger and produces good sound qualities.

Summary Statement
A scientific investigation on the effect of bridge material on the sound of the violin

Help Received
Mr. Robert Borate helped make the aluminum bridges. Dad helped to download the CoolEdit 2000 software from the Internet. Dad helped with the recording equipment. Mom helped with the glueing of the pictures on the display board.