CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Justin J. An

Project Number

J1701

Project Title

All About That Bass: The Effect of Different Frequencies against Isopropyl Alcohol Fires

Abstract

Objectives/Goals

The purpose of the experiment was to locate the frequency the frequency that controlled and extinguished the fire the best. It was hypothesized that if low frequencies were played towards a fire, then the fire would be extinguished because the low frequencies create bigger areas of high and low pressure, which would affect the fire by altering the atmosphere around the fire, separating heat from fire, and eventually, taking it out. This project expands our knowledge on the nature of sounds and how we can apply them to our daily lives.

Methods/Materials

Rubens Tube experiment: Construct a Rubens Tube/ speaker, computer w/ tone generating software, lighter. Two frequency ranges were used; 30Hz # 60Hz and 200Hz # 500Hz. Frequencies were played and areas of high/low pressure and wavelengths were created, observed, and measured. Extinguishing Fire experiment: speaker, 4 aluminum cookie pans, isopropyl alcohol 70%, lighter, timer/phone, and computer with a tone generator. Low frequencies attempted to extinguish a fire. The alcohol in the pan was lit using the lighter and fire was given 5 seconds to develop. Then a frequency was played towards the fire and a timer started. Once fire was out, from burning fuel or being extinguished, the frequency, time, and observations were recorded. Process was repeated from 30Hz # 60Hz in increments of 5Hz each trial.

Results

Rubens Tube experiment: low frequency range had longer wavelengths/larger areas of high and low pressure. High frequency range had shorter wavelengths/smaller areas of high and low pressure. Sound Extinguishing Fire experiment: low frequencies played towards a fire. 50 Hz: frequency quickly extinguished the fire by pushing it towards the corner, making flames small, and disturbing the surface of the fuel, which affected the burn rate. Flames almost immediately blue when frequency was played toward the fire.

Conclusions/Discussion

Frequencies were visually displayed through the Rubens Tube and the low frequencies were put to the test in the Sound Extinguishing Fire experiment. high frequency: short wavelengths and small/close areas of high and low pressure. low frequency: long wavelengths and large/far areas of high and low pressure. Data showed that while the low frequencies had larger areas of high/low pressure and longer wavelengths, there was an apex point in the range. The hypothesis was both supported and rejected through these two experiments.

Summary Statement

I showed that certain frequencies had different effects on isopropyl alcohol fires, their areas of high and low pressure, and how there was an apex point to which the fire was effected by sound waves efficiently.

Help Received

My father helped me construct the Rubens Tube and supervised the Sound Extinguishing Fire Experiment. My science teacher supervised testing of the Rubens Tube and gave me access to a gas supply in the school sic lab.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Zachary W. Behn

Project Number
J1702

Project Title
Hockey Puck Speed Test

Abstract

Objectives/Goals
The objective of this study is to determine effects on the speed of a hockey puck made of different materials on an ice surface.

Methods/Materials
Hockey pucks fabricated of ice, wax, fiberglass, plastic, and standard hockey puck. Launching apparatus made from a bow, wood and hockey stick, stopwatch, video camera, cones, ice rink. Pucks were launched at a constant speed. Time measured for a distance of 10-feet to find speed data.

Results
10 trials completed per puck. Results indicated that fiberglass pucks traveled the fastest and the standard hockey puck travel the slowest on ice.

Conclusions/Discussion
The fiberglass puck went the fastest out of all of the trials. I found the friction is less when both materials are the same. Errors that I made were that the pucks were not all the same weight. Having the same weight could have made the pucks go faster and the speed results may not have been due to the effects of friction. I could improve this experiment by adding pennies to even out the weights. Another mistake that I made was that the pucks were not perfectly the same shape. I could improve the shape by making a mold and covering the top with a piece of wood to flat surface.

Summary Statement
Speed of different material pucks were tested on the ice to see which material would travel the fastest.

Help Received
My dad helped me make the pucks and launcher, my hockey coach supplied the ice rink, my friend's father made the hockey molds, Mrs. Shimshock helped me improve my experiment

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Hunter Bren

Project Number
J1703

Project Title
Math in Ballistics

Abstract

Objectives/Goals
The object of my experiment is to gather acceleration, and ballistic data by using a car and track so that I may derive a probabilistic curve. This data helps scientists, engineers, and military accomplish their respective goals.

Methods/Materials
I nailed support beams, in which the height and distance from the center of the beam follow a parabolic curve, into a wooden 2 by 4. Next, I nailed quarter-inch PVC to the origin of the parabolic shaped support beams, so that the PVC only touched the base of the wood at the origin. Then, I attached the Hot Wheels track on top of the PVC. Following this I placed a wooden beam with paper target board, at the opposite side of the 2 by 4. The width of the car used is 30 mm, the height 15 mm, the frontal area of the car needed to calculate the air drag is 0.00045 m2 and the mass 31.5 g.

Results
1.The higher the release height of the car on the parabolic track, the farther the car will jump horizontally from the ramp.
2.Friction Force and drag force will reduce the horizontal jump distance when compared to the maximum ideal jump distance.
3.A constant friction coefficient and drag coefficient exist that describe jump distance and car motion on high speed videos.
4.The car landing locations form an elliptical region, with this elliptical region containing almost all landing locations. Using this data, and the right formula, I can derive a basic, or more accurately, general probabilistic curve.

Conclusions/Discussion
The results support my hypothesis. The data from this project is essential to rocket launches, airplane takeoffs, space craft orbiting and docking and military projectiles (missiles, howitzers). It will help in the design and construction of everything from skis for ski jumping to bullets for rifles or even applications for Mars landings.

Summary Statement
I used a ramp and a hot wheel car to illustrate the ballistic probabilistic curve, and this probabilistic curve helps you determine in a variety of situations how many of the propelled objects to launch at the target and where to aim them.

Help Received
My mother helped me purchase the materials. A friend used the high speed camera. I thank my teacher for his guidance.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Brandon L. Cabatu

Project Number

J1704

Project Title

Thermoelectricity: The Direct Conversion of Heat into Electricity Utilizing the Seebeck Effect

Abstract

Objectives/Goals

Based on my research on thermoelectricity, I believed that I would be able to convert heat into electricity by utilizing the process called the Seebeck Effect. The Seebeck Effect was discovered by a physicist known as, Johann Seebeck, and is based upon the production of electricity by using two different conductors, or semiconductors, at two varying temperatures in order to create an electromotive force to drive the charged particles through the materials. I also want to prove that the fundamental equation: V= (SB-SA) (T2-T1) explains how the temperature differences and Seebeck coefficients of the material affect the voltage produced from the basic thermoelectric circuit.

Methods/Materials

I first created a basic frame for the circuit and attached Junctions 1 and 2 together. Then, I continuously changed the temperature of Junction 1 to cold, medium, etc., while keeping Junction 2 under constant room temperature. I did this a total of 5 times per difference in temperature, for each metal combination, and found both the average temperature and voltage associated with the metal combination. Lastly, I used a K-type thermocouple, which I connected to the multimeter, in order to record the flame voltage and convert it into a temperature gradient.

Results

My science experiment on the Seebeck Effect was successful since I was able to produce a voltage from the differences in temperature and the difference in the conductors Seebeck coefficients. The Seebeck coefficients, for the metals, determined the best possible thermocouple, which turned out to be Nickel, -19.5 mV/K, and Zinc, 2.4 mV/K, because of the large difference in each metals Seebeck coefficient.

Conclusions/Discussion

My hypothesis turned out to be correct since I was able to find the best metal combination that produced the greatest voltage, which turned out to be zinc and nickel. The equation: V= (SB-SA) (T2-T1) proved that the larger the difference in the Seebeck coefficient and temperature between the metal combination, the larger the voltage would be. The large difference in the Seebeck coefficient of zinc and nickel verified the voltage equation and proved that the larger the difference in the Seebeck coefficient, the higher the voltage. Ultimately, I was also able to prove that you could convert heat into electricity using the metals: copper, zinc, aluminum, nickel, and utilizing the process of Seebecks Effect.

Summary Statement

My project is about the conversion of heat into electricity by utilizing a physical phenomenon known as the Seebeck Effect.

Help Received

None. I conducted this experiment by myself.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Angela E. Czintos

Project Number
J1705

Project Title
Boiling Cold: Lowering the Boiling Point of Water

Abstract

Objectives/Goals
I wanted to explore the phenomena of lowering the boiling point of water through decreasing air pressure or adding solutes into the water.

Methods/Materials
Using a vacuum pump to decrease the air pressure in a glass containing the tested solution I watched for the solution to begin to boil. I then measured the pressure within the glass and the temperature of the solution. I did this procedure for several different temperatures and plotted a curve.

Results
The lower I decreased the pressure, the lower the boiling temperature of the solution became. By adding salt I increased the boiling temperature of water for a given pressure.

Conclusions/Discussion
I was able to lower the boiling temperature of water easily to room temperature. This may suggest an easy way to purify or desalinate water with less energy than current methods. To add on to this point, adding salt to water seemed to increase the boiling temperature of water for a given pressure. These results prove that water's contaminants contribute to its boiling point, and further studies could examine why such things happen.

Summary Statement
By decreasing the air pressure within a glass containing water I was able to lower the boiling point to room temperature.

Help Received
I received ample help from my dad who explained the pressure temperature curve, and method of using the vacuum pump with gauges.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
William P. Edwards

Project Number
J1706

Project Title
The Impact of Weight and Surface Area on Static Friction

Abstract

Objectives/Goals
The objective is to determine whether weight or surface area has more of an impact on static friction.

Methods/Materials
I determined the static friction force between an object and a surface using an adjustable inclined plane setup. I used 4 object surface areas of the same material, 5 weights per object, and 2 surface materials for a total of 40 test cases. Each test case was repeated for 5 trials.

Results
Objects with different surface areas and weights were tested on an adjustable inclined plane to find their static friction force. The static friction force between the object and the surface is impacted by weight but not surface area.

Conclusions/Discussion
My 40 test cases showed that weight did effect friction force, but surface area had no significant impact. From this I concluded that weight impacts static friction force, but surface area does not.

Summary Statement
My data showed that the static friction force between 2 materials is dependent on weight, but not on surface area.

Help Received
I did all of the research, testing, analysis, and documentation. My dad helped me obtain the materials and build the inclined plane setup.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Bella M. Gath

Project Number
J1707

Project Title
Camera Obscura: The Physics of Optics

Abstract

Objectives/Goals
The Camera Obscura, also known as the pinhole camera, uses a simple hole which mimics the iris of an eye. The goal was to build a Camera Obscura that successfully captured the incoming light, demonstrating the physics of optics and light as it enters an eye.

Methods/Materials
The camera obscura was built using a paint can which provided a light-protected place to hold the light-sensitive photographic paper. Both positive and negative photographic paper was tested. The photo paper was developed in a homemade darkroom.

Results
By developing the photo paper after each exposure, trials and results were immediate and improvements and adjustments were made accordingly. The final result was a consistent, clear reversed image.

Conclusions/Discussion
This design confirms how a simple pinhole reverses light as it passes through, simulating how the iris of a human eye works.

Summary Statement
My project demonstrates how light is reversed passing through an aperture, simulating the optical physics of light through the iris of an eye.

Help Received
I found out how to build a darkroom online and only received help from my dad who had to use a power tool to cut a hole in the metal paint can. I performed the experiment and developed the photos myself.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Adam A. Guggenheim

Project Number
J1708

Project Title
Rolling Resistance: Effects of Natural vs. Artificial Turf and High vs. Low Inflation on Rolling Soccer Balls

Abstract

Objectives/Goals
Soccer balls appear to move faster and further on artificial turf surfaces than on natural grass fields. Inflation seems to affect how far and fast balls go. This experiment is designed to test the effects of different playing surfaces and air pressures on ball movement.

Methods/Materials
Soccer balls with different pressures were rolled off of an incline plane onto natural grass and artificial turf surfaces to determine the effect of surface type and ball pressure on the distance the ball travels. Balls with different inflation pressures also were struck by a device to apply equal "kick" force to determine the effect on rolling distance.
Materials included: 2 soccer balls (zero and high inflation); Ramp (wood and stand); Striking Device (wood and stand); Measuring Tape; Notebook; 2 grass and 2 artificial turf fields.

Results
The highly inflated ball consistently rolled further than the deflated ball on both artificial and natural turf surfaces. It ranged from 7% to 14% further on each different surface, and 11% on average across all surfaces combined. The balls released from the ramp consistently rolled further on artificial surfaces than on the natural grass surfaces. On average, the balls went 25% further on artificial surfaces. When struck (rather than being released on the ramp), the inflated ball went 52% further than the deflated ball. Comparing the "kick" to the non-impact force of gravity, the inflated ball went virtually the same distance. The deflated ball went 33% further with the ramp release than when struck. The distance rolled is a way to compare how much energy is transferred to the ball to make it move and the rolling resistance to the ball's forward motion.

Conclusions/Discussion
The data confirmed the hypothesis: balls roll further on artificial turf than on natural turf surfaces, and balls with high inflation roll further than un-inflated balls. The difference in distance was less than expected for balls from the ramp. The difference in rolling distance between inflated and un-inflated balls was greater for the kicked balls. This is because rolling resistance is greater on the natural surface, and energy went into deforming the kicked ball instead of into rolling momentum.

Summary Statement
This project is about some of the physical forces (rolling resistance, air pressure and elastic/inelastic collisions, conservation of energy) that affect the motion of a soccer ball.

Help Received
My dad helped me build (power tools) and move the equipment, and we talked about physics. One of us released the ball on the ramp and the other one measured the distance it rolled.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Audrey G. Hanna

Project Number
J1709

Project Title
Size Really Does Matter: A Study in Stovetop Efficiency

Abstract

Objectives/Goals
The objective of my project was to determine the effect of pot size on the efficiency of natural gas conversion into heat energy on a stove.

Methods/Materials
Four aluminum pots of differing sizes, gas stove, gas meter, thermocouple thermometer, water, timer, graduated beaker, computer for graphs, ruler, and calculator. Measured the efficiency of energy conversion in four different sized pots.

Results
By heating water for a fixed time in different sized pots and measuring the temperature change, I determined through a series of calculations that the energy conversion in the largest pot was 229% more efficient than that of the smallest pot.

Conclusions/Discussion
I estimate the U.S. consumption of natural gas for cooking to be 236,624,307,003 cubic feet annually. If even half of the U.S. population began to use larger pots for cooking, we could save 66,000,000,000 cubic feet of natural gas per year. Since each therm is the equivalent of 2.268 pounds of CO_2, this would amount to saving over 150,000,000,000 pounds of CO_2 emissions each year.

Summary Statement
By measuring the efficiency of natural gas conversion into heat energy in various size pots, I demonstrated that substantial carbon dioxide emissions reduction is possible.

Help Received
I designed and performed the experiments by myself. My father helped me research the equations and further my understanding of the calculations.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Xiaoyue Jin

Project Number
J1710

Project Title
Waves

Abstract

Objectives/Goals
To investigate the behavior of transverse waves.

Methods/Materials
An oscillator is connected to a wave function generator on one end. A weight is attached to the string on the other end. The function generator registers the frequency. Using a ruler, I measured the wavelength and the amplitude. I calculated the speed, period, and equation of the wave. I also set different frequencies to get different number of the nodes of on the string.

Results
After I tested several groups in different situations in my experiment, I calculated the velocity of the wave using two different equations and comparing them. Then, I compared the placement of the y value of the wave I calculated using the equation and the one I measured with the ruler. Also, I graphed several standing waves.

Conclusions/Discussion
I listed several reasons that might have caused the error and I also calculated the error percentage. Then, I figured out the relation between the frequency and some factors. For example, as the number of nodes grows, the frequency grows as well. I also found the trend of how the frequency of a string increases as the number of nodes on the string grows.

Summary Statement
Speed and equations of transverse waves.

Help Received
Work at Seebach Family Physics & Chemistry Lab at Ribet Academy.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Tavleen Kaur

Project Number
J1711

Project Title
Does the Surface Tension of Water Change When You Mix Different Substances in It?

Abstract

Objectives/Goals
My project is to find out if different solutions have different surface tensions. The purpose of this project is to see if affecting the surface tension of an ecosystem can affect the wildlife that lives there. For example, creatures such as water striders rely on surface tension to keep them afloat on the water. If someone or something alters the surface tension, the water striders may potentially not be able to survive. Another purpose was to find a cost effective and environmentally friendly substance that can be used to alter the surface tension of water so that it prevents mosquitos from laying eggs on still water.

Methods/Materials
To conduct my experiment, I built a simple scale out of Knex. On one side, I attached a string with a slide taped to it. On the other side, I built a small paper basket to keep counterweights in. I used this scale to measure the surface tension of my solution. I measured the surface tension of my solution by placing the slide on the surface of the solution and putting counterweights in the basket to balance out the scale. I took the number of weights and divided it by the two lengths of the slide which totaled up to be fifteen. This measurement is the mg wt/cm.
-mg is a measure of mass
-mg wt refers to force

Results
My results showed that after I had tested all my prototypes (distilled water; salt water; oil, and bubble liquid water), distilled water had the highest surface tension. Bubble liquid water had the lowest surface tension.
Bubble liquid can initially be used as a low cost solution to control the population of mosquitos, but it is not environmentally friendly and may harm other species.

Conclusions/Discussion
I did my analysis on all of the prototypes and found out that distilled water had the highest surface tension because of the imbalance of intermolecular attraction. The distilled water did not have any other substance interfering with the attraction between its molecules whereas the other solutions had foreign substances altering the attraction between molecules therefore reducing the surface tension. The bubble liquid solution affected the surface tension the most. Since most household waste is derived from soap (detergents), we can potentially harm the environment when we dispose of materials in streams and waterways.

Summary Statement
I built a simple device to measure how much the surface tension of water change when you mix different substances in it.

Help Received
The people who guided me during my project were my father, Saravjeet Singh, and my science teacher, Mr. Jenkinson. My father helped me understand what polarity was and my science teacher taught me about significant figures.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Ish Khandelwal

Project Number
J1712

Project Title
Does the Strength of a Magnet Vary with Temperature?

Abstract

Objectives/Goals
In what ways does the temperature affect a magnet?
How could you measure the strength of a magnet?

Methods/Materials
One large ceramic magnet(size should be 4 ½)
Plastic tongs
Thick heat-resistant glove or oven mitts (not potholders)
Digital scale with 0.1 g increments
Flat surface or plate at least 2 inches wider than the diameter of your magnet
Small bowl or container
Thermometer
Freezer
Ice cubes (about 3 trays worth)
Large plastic bowl (your magnet needs to fit in the bowl)
Water
Stove or hot plate for heating water
Pot

Results
Based on my trials, I observed that the weight of the paperclips the magnet picked up decreased with increasing temperature and the weight of the paperclips the magnet picked up increased with decreasing temperature.
The weight of the paperclip represents the strength of the magnet. I interpreted that the strength of a magnet increases as the temperature decreases and the strength of a magnet decreases as the temperature increases.

Conclusions/Discussion
My conclusion is that when the temperature is lower the strength of the magnet is greater and when the temperature is higher the strength of a magnet is less. This happens because when the atoms of something is cold it make the atoms slower and when the atoms of something warmer the atoms move a lot faster.

Summary Statement
My project is about how the temperature can effect the strength of a magnet.

Help Received
My parents supervised me while I was handling a magnet at hot and cold temperatures.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Joey D. Krauskopf

Project Number
J1713

Project Title
Slanted or Straight: Which Will Save Your Life?

Abstract

Objectives/Goals
My project explained how best to protect armored vehicles, the problem is making the armor strong but keeping the vehicle maneuverable. Spaced armor (pairs of parallel armor plates) is a solution.

Methods/Materials
I used balsa wood armor plates and a BB gun to test this question. I tested five different angles and shot ten BB pellets for each angle to determine the average penetration of the BB pellet into a Styrofoam.

Results
My results supported my hypothesis, when the plates were set at 60° , the lowest average penetration was achieved. These results confirmed the importance of the obliquity effect. However, plates at 0° and 15° did match my hypothesis. I noticed that I failed to control a key variable: wood grain.

Conclusions/Discussion
Because of this I decided to run another data set and control for this. My data then did match my hypothesis. This means that when asking the question, Slanted or straight: which will save your life? The answer is slanted!

Summary Statement
My experiment tested which angle of spaced armor (pair of parallel plates) was the most effective and showed that projectile penetration was the least at 60 degrees due to obliquity.

Help Received
My mother helped me design the project and my dad let me use his workshop to design the rig and let me conduct experiments in the garage. I also consulted with Dr. Matt Richter about the forces involved with this project.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

William A. Labrador

Project Number

J1714

Project Title

An Inexpensive Radiation Detector and Its Application to Cosmic Rays and Environmental Radiation

Abstract

Objectives/Goals

The goal of this project was build a scintillation counter using inexpensive, easily available materials and to demonstrate the applications of the scintillation counter in the fields of radiation and secondary atmospheric muon detection.

Methods/Materials

While researching radiation detector technologies to see if I could build a DIY detector, I learned that Japanese scientists had published a paper in 2011 demonstrating polyethylene naphthalate (PEN) plastic works as well as more expensive scintillator materials. PEN is widely available in consumer products. I also found a low-light detector circuit online that I might be able to use to detect the scintillation from the PEN plastic when detecting radiation. I constructed the detector, using an Arduino board to record the data and IDL to analyze the data. I tested my detector with Potassium Chloride (Morton Salt Substitute, which emits beta particles) and atmospheric muons produced by cosmic rays.

Results

My signal histograms showed signals detected from salt substitute at levels statistically significantly higher than background. Muon signals are still being analyzed.

Conclusions/Discussion

I was able to construct a radiation detector using inexpensive and widely available scintillation material and do-it-yourself electronics. Unlike cloud chambers, which have been used in science fair projects, this detector's only consumable is battery power. It is also easy to use, with data stored immediately on SD cards.

Summary Statement

My project was to create a cheap particle detector to use in radiation testing or in particle detection.

Help Received

My father, Dr. Allan Labrador, helped me with this project by teaching me electronics, programming, soldering, and how to interpret the data.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Callie M. McCaffery

Project Number

J1715

Project Title

Centrifugal Force or Fiction?

Abstract

Objectives/Goals

I want to understand how changing the distance at which an object spins around a center point affects the centrifugal force experienced.

Methods/Materials

I used a box fan motor, tinker toy hubs and arms, springs and metal balls. The balls were attached to the springs which were attached to the arms connected to the hub on the fan shaft. I changed the length of the arm then measured the spring stretch for each arm length. I then found the force associated with this spring stretch which is used to represent the centrifugal force.

Results

I found that the shorter the spinning arm, the more force is exerted on the spinning object. My experiment helped me understand the strength of centrifugal force, how it relates to Newton's first law of motion, and velocity.

Conclusions/Discussion

I found that my hypothesis was correct, the smaller the spinning radius the larger the centrifugal force. I wanted to verify my measured forces with calculations, so I used mathematical formulas (F = ma) to calculate the force. These calculations helped me see that by changing the arm length, I was also changing the velocity of the spinning object. This change in velocity also changed the amount of force, even more than the arm length.

In addition to the physics, I learned how we've adapted to the effects of centrifugal force in the real world by banking curves on roads and train tracks.

Summary Statement

How will changing the distance at which an object spins around a center point affect the measured centrifugal "force" or inertia.

Help Received

I designed the prototypes and planned the experimental set up. My father helped me with construction of the set up and verified the calculations. My mother helped me with data collection.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Danial Pirooz

Project Number

J1716

Project Title

Are Cool Magnets More Attractive?

Abstract

Objectives/Goals

The objective of my project was to determine how different temperatures would affect the magnetic pull of a magnet. I believe that if the magnet is heated it will have a weaker magnetic force and if a magnet is cooled, then it will have a stronger magnetic force.

Methods/Materials

The materials I have used were, 3 ceramic blocks with identical shapes and sizes, one plate, 62 grams of iron filings, a freezer at 0° F., 10 oz. of boiling water at 186.8° F., One American Weigh Scale, A glass container, and 3 Ziploc bags. My methods were, put a magnet in the boiling 10 oz. of water, then begin your experiment with your room-temperature magnet. First, you must put the magnet a Ziploc bag, then you must drop the bag into the iron filings which have been poured on the plate, then you hold the bag in the iron filings for 5 seconds, and then lift the bag off the iron filings. Then you weigh the iron filings inside the bag and record. Repeat this 5 times. After this, take your heated magnet out of the boiling water, put your last magnet in the freezer for 2 hours, then repeat all the steps listed above. Repeat this 5 times (You do not reboil the magnet). Once you are done with that, do the same with the freezer magnet as you did with the room-temperature magnet. Repeat this 5 times (You do not refreeze the magnet)

Results

In my project, the cooled magnet had an average of 47.8 grams of iron filings after the 5 trials, whilst the room-temperature magnet had an average of 46.2 grams of iron filings after the 5 trials. Finally, the heated magnet had an average of 32.6 grams of iron filings after the 5 trials. The results supported my theory that cooler magnets have a stronger magnetic force than heated and room-temperature magnets.

Conclusions/Discussion

My original hypotheses was #If magnets are heated up, then their magnetic force will be weaker.# And #If magnets are cooled, then their magnetic force will be stronger.# These hypotheses were proven correct based upon the data and observations shown in the previous slide. My data confirms this because the average of my cooled magnet was the highest at 47.8 grams of iron filings while the lowest average was my heated magnet at 32.6 grams of iron filings. In the middle was my room-temperature magnet at 46.2 grams of iron filings. In my experiment, there were no signs of error besides the one variable that I could not control which may be a magnet manufacturing error.

Summary Statement

My project is about how different temperatures affect the magnetic force of a magnet.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Philip M. Ramsdell

Project Number
J1717

Project Title
Spatter Proof: How Height and Angle Affect Blood Spatter Patterns

Abstract

Objectives/Goals
The purpose of this project was to analyze two possible blood spatter pattern variables. Specifically, it was to determine if:
a) the greater the height from which the blood is dropped the bigger the size of the spatter will be and
b) the steeper the angle from which the blood is dropped the more of an ellipse shape spatter will result.

Methods/Materials
Materials: Fake Blood, Dropper (the kind with a bulb at the end), Meter Stick, Cardboard, White Paper, Protractor (or other means to measure angles) and Tacks or Pins.
1. Place five labeled pieces of paper on flat cardboard.
2. Measure the height you are dropping the fake blood from for the first set of trials (25cm).
3. Drop one drop onto each sheet of paper.
4. Repeat steps 1-3 for 50cm, 100cm and 150 cm heights.
5. Adjust cardboard at a 15-degree angle and prop securely in place.
6. Repeat steps 2-5 for 45-degree angle. The paper may have to be pinned into place.

Results
In the experiment there were 20 trials for each angle tested, and 15 trials for each height tested for a total of 60 trials. For the zero degree trials at all four heights the results showed nearly perfect spheres. What was most noticeable was the increase in size of the spatter#s diameter as the height from which the blood was dropped increased. In the 15-degree trials, the spatter began to take on an elliptical shape as hypothesized although only slightly. Similar to the zero degree trials, as the height from which the blood was dropped increased, the diameter of the blood spatter also increased. In the 45-degree trials the main spatters were much more elongated. Full analysis includes discussion of secondary spatter and blood trails.

Conclusions/Discussion
The first hypothesis that the higher the blood is dropped from, the bigger the spatter it will create is correct. Since there is more time due to the greater height there is more impact from gravity pulling the drop down which makes the drop gather more speed so it hits the surface with more force. The second hypothesis that the steeper the angle, the more of an ellipse type of shape it will create is also correct. This is sort of like a landslide. The steeper the hill it is running on, the longer it will run.

Summary Statement
This project is about how height and angle affect the shape and size of blood spatter patterns which are used for criminal and other investigations.

Help Received
Mr. Buss, the Science Fair Coordinator at my school as well as my parents provided general guidance. CVS Pharmacy donated some supplies. I performed the experiments on my own with some support from my mom.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Leif P. Rudling

Project Number
J1718

Project Title
Which 3-D Geometric Shape and Surface Color of Stealth Aircraft Makes It Most Invisible or Undetectable to Radar?

Abstract

Objectives/Goals
My project was to test different 3-D geometric shapes and surface colors to see which ones were most invisible or undetectable to radar, by testing which ones deflect the most light. I predicted that the #black v# would do the best in the stealth tests.

Methods/Materials
After I constructed a test box, I determined the place where the test shape is supposed to be, by placing a cylinder in the box and moving it so that the lux meter reads 50 lx+. I placed the test shapes (#black v#, #white v#, and #foil v# - then inverted the shapes) into the box, turned on the flashlight and lux meter, then recorded the results.

Results
The #black v# and the #black v inverted# proved the stealthiest. Then the #foil v#, #white v#, #foil v inverted#, and finally the #white v inverted.#

My experiment supports that a black surface #V-shape# is very important in stealth aircraft, as evidenced by existing aircraft, such as the B-2 Spirit, F-117 Nighthawk, and the SR-71 Blackbird.

Conclusions/Discussion
My hypothesis was proven correct that the #black v# was the stealthiest, along with the #black v inverted.# A surprise was that the #foil v# got third because it is a reflective material. It is evident that black is the stealthiest color and that #v#s# are the stealthiest shape.

The practical lesson I learned from this experiment is that stealth technology is very critical in ensuring safety in the world against enemy attacks. Our country must continue to invent, develop, test, and build stealth armament to always be the leaders in keeping the peace.

Summary Statement
My project was to test different 3-D geometric shapes and surface colors to see which ones were most invisible or undetectable to radar, by testing which ones deflect the most light.

Help Received
My parents bought the lux meter (light meter) and the project board. They also helped me create the graphs.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Andrew J. Salentine

Project Number

J1719

Project Title

Harnessing the Power of the Sun Using Solar Ovens

Abstract

Objectives/Goals

The objective of my project was to determine if dimension/volume of a solar oven has an effect on its ability to achieve higher temperatures.

Methods/Materials

I built two solar ovens with identical construction, but different dimensions. One oven was 1 cu. ft. in volume with a 1 sq. ft. glass lid. The other was 8 cu. ft. in volume with a 2 sq. ft. glass lid. A third oven was created by placing a shelf in the second oven reducing its volume to 4 cu. ft. while retaining the 2 sq. ft. glass lid. The ovens were placed outdoors side-by-side on concrete with average ambient temperature of 71.9 degrees F. A thermometer with three thermocouples was used to measure temperature. Two testing configurations occurred: ovens sitting flat with sun at an angle and ovens tilted so glass lids pointed directly at the sun.

Results

The oven with 1 cu. ft. in volume and 1 sq. ft. glass lid area heated up to the highest temperature followed by the oven with 4 cu. ft. in volume and 2 sq. ft. glass lid area having the second highest temperature. Oven with 8 cu. ft. in volume and 2 sq. ft. glass lid area was not able to heat up to as high a temperature, therefore, having the lowest temperature.

Conclusions/Discussion

My conclusion is that bigger is not necessarily better when it comes to solar ovens. The surface area of the glass lid in relation to the volume of the oven is the important factor. Solar ovens with a volume equal to or less than the surface area of the glass lid can achieve higher temperatures.

Summary Statement

Determine if dimension/volume of a solar oven makes a difference in ability to heat up to the highest temperature.

Help Received

My Dad, John Salentine, and Ken Collin advised me on the design, construction and testing of my solar ovens and I built them. Michelle Schaefer helped me on design and operational methods.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Bryan A. Shott

Project Number
J1720

Project Title
The Effect of Color on Heat Absorption

Abstract

Objectives/Goals
The objective of this experiment was to determine how different colors affect the absorption of heat in a material. I hypothesized that black would absorb the most heat, followed by red, green, blue, and white.

Methods/Materials
Colored substrates were placed in direct sunlight and the temperature of each substrate was measured with an infrared camera every 30 seconds for 15 minutes in °C. The key materials used in this experiment were metal, wood, and plastic substrates, spray paint (black, red, green, blue, and white), FLIR C2 infrared camera, substrate holder, and stopwatch.

Results
The results of 15 trials showed that black absorbed the most heat, followed by green, blue, red, and white.

Conclusions/Discussion
My results demonstrated that heat absorption was very much affected by the color of the substrate. My hypothesis was only partially supported because red absorbed less heat than green and blue, which was not what I had predicted. This knowledge can be directly applied to saving energy and money because of less need for heating and cooling appliances.

Summary Statement
Color affects the amount of heat absorbed by a material, and results show that black absorbs the most heat, and white absorbs the least.

Help Received
FLIR Systems provided use of an infrared camera and a spectrophotometer. Dr. Richard Bornfreund helped run the spectrophotometer and answered various questions. My science teacher, Laura Ulvaeus, taught about the scientific process and gave practice for the science fair through many lab activities.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Riley H. Smith

Project Number

J1721

Project Title

The Effects of Magnets on the Rate of the Flow of Water

Abstract

Objectives/Goals

The objective of this study is to determine how different types of water are affected by magnets.

Methods/Materials

Burette, two magnets, cup, gram measurement tool, rubber band, stopwatch, ring stand, clamp, water, salt water and sugar water. Filled burette with water, opened burette and measured time it took for water to completely flow through burette.

Results

The regular tap water was the least affected by magnets, as it flowed the slowest through the burette. The salt water was the most affected by magnets, as its flow rate was the fastest.

Conclusions/Discussion

The data in my project did not support the hypothesis in that under the affects of magnets, the salt water flowed the fastest and the regular tap water the slowest. The hypothesis stated the opposite of the results concluded.

Summary Statement

This project is about how magnets affect the rate of the flow of water through a narrow passage.

Help Received

None. I designed and performed this experiment on my own.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Schuyler A. Smith

Project Number
J1722

Project Title
Can an Amateur Astronomer Measure Double Stars Accurately?

Abstract

Objectives/Goals
The purpose of this project was to determine if an amateur astronomer can contribute to science by measuring double stars accurately using amateur methods and equipment. Measuring changes in the separation and position angle of double stars is the most accurate way of calculating their orbit and masses. This project tested to see if separation angles (rho) can be measured within +-5% and position angles (theta) can be measured within +-1 degrees when compared to the most recent values listed in the U.S. Naval Observatory's Washington Double Star Catalog (WDS).

Methods/Materials
In this project, two methods available to amateurs were used to measure 11 double stars. First, 7 double stars were measured visually using a manually-guided 8" reflector with an astrometric eyepiece. For the second method, 4 double stars were CCD (charge-coupled device) imaged by a Planewave Imaging Platform telescope in Spain through the website iTelescope.net. The imaged double stars were measured using Aladin Astrometry Software.

Results
All measurements were compared to the most recent values in the WDS and differences were calculated. For all 75 visually measured rhos, the mean difference was 0.61 arcseconds, the standard deviation was 1.85 arcseconds, and the mean percentage difference was 2.7%. For all 60 visually measured thetas, the mean difference was -0.8 degrees and the standard deviation was 6.72 degrees. For all 20 CCD imaged rhos, the mean difference was -0.12 arcseconds, the standard deviation was 0.12 arcseconds, and the mean percent difference was -0.47%. For all 20 CCD imaged thetas, the mean difference was -0.12 degrees and the standard deviation was 0.33 degrees.

Conclusions/Discussion
The results were very accurate. CCD imaged measurements were consistently more accurate than visual measurements. Most individual visual double star measurements confirmed the hypothesis. All CCD imaged double star measurements confirmed the hypothesis. The recently published measurements of 06224+2640 STF 897 were confirmed and 06579+1430BPM 342 was measured for the first time in fifteen years. I plan to submit my measurements to the Journal of Double Star Observations. The results show that amateur astronomers can measure double stars accurately and make a scientific contribution.

Summary Statement
Using two methods, visual and CCD imaging, 155 measurements of 11 double stars were taken and found to be accurate when compared to recent listed values, confirming that amateur astronomers can make a contribution to science.

Help Received
This project was inspired by a seminar given by boyce-astro.org. Norman Negus, my advisor at Mount Everest Academy, gave me advice about statistics and my paper. My dad drove me to the San Diego Astronomy Association's observing site and helped me install astrometric software on my laptop.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Kristin S. Sullaway

Project Number
J1723

Project Title
Solar Survival: Dyed Water in a Solar Still

Abstract

Objectives/Goals
Solar stills are systems in which contaminated water is evaporated and condensed to produce clean water. I created four cups of water (one containing regular water and the rest becoming more concentrated with black food dye)to add to four of the same solar stills. The still that produced the most clean water revealed which solution absorbed the most heat. Three of five trials proved that the evaporation rate of water increases as concentration of black dye increases. All five trials showed that the most concentrated black water produced significantly more clean water than the regular water, proving that black dyed water evaporates much more efficiently than plain water. I hope that one day, emergency solar still kits can come with black dye to provide those in need access to clean water.

Methods/Materials
(4)2 liter plastic bottles,(8)9oz. plastic cups, Lorac solid black food dye, scissors and hot glue. I made four solar stills and put 100mL of water in each, and in the last three stills I added black powder food dye, gradually adding more to each cup. I put all four stills outside for 24 hours. The most clean water produced in a still shows which water evaporated fastest.

Results
3 out of 5 trials of this experiment show that as more black dye is added to the water, evaporation rate increases. One of the trials showed that the second most concentrated water evaporated the fastest, and the other trial showed that the third most concentrated water evaporated fastest. In all of the trials, the water with no black dye produced less than or equal to the third most concentrated water. The average of results for the regular water was 2.33mL of clean water a day, while the average of the most concentrated was 8mL of clean water a day.

Conclusions/Discussion
Although a lot of the results were irregular, the data showed a clear pattern that adding black food dye to water increases its evaporation rate. The most evaporated water was produced by the water with the highest concentration of black dye(11.8mL). The solar still design I used was cheap, effective, and reusable. The importance of this project is to collect clean water faster. Many individuals that lack clean water can get access to emergency solar stills, and my project showed the importance of black dye while using a solar still. Black dyed water clearly evaporated faster than regular water, which would be important to those who need it fast.

Summary Statement
I used black food dye to increase the evaporation rate of water in solar stills.

Help Received
I designed and built the solar stills I used. My parents helped improve details in my project, and so did high school mentors.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Charlie K. Thrift

Project Number
J1724

Project Title
Using Sound Waves to Extinguish Flames

Abstract

Objectives/Goals
The purpose of this experiment is to test if it is possible to use sound frequencies to put out a fire.

Methods/Materials
Subwoofer, lighter, computer, timer, video camera, tone generator, camera stand and decibel reader.

Tested to determine if it is possible to extinguish fire using sound waves. Timed in seconds the how long it took to extinguish fire at various frequencies and volumes to determine the most effective sound waves.

Results
In this experiment low frequencies between 30-65 Hz easily put the flame out. Interestingly, frequencies outside that range did not extinguish the flame. 45-60 Hz were the most effective frequencies. The lower and upper ends within the working frequency rage had inconsistent results where the trials for the frequencies between 40-60 Hz had nearly identical results.

Conclusions/Discussion
This experiment showed that exposing flame in the direct path of frequency waves at 30-65 Hz can put out a flame. This could lead to a more effective, safer and cleaner way to put out fires. The physics of sound tell us that frequency is determined by the number of sound waves per second. In the range of 30-65 Hz the waves are just the right density to efficiently extinguish the flame. Fire requires three element to burn: heat, fuel and oxygen. There are two theories as to why sound waves put out a fire. One is based on the Ideal Gas Theory that the drop in pressure caused by the sound waves lowers the heat extinguishing the flame. The second theory is that the sound waves thin the oxygen causing the fire to extinguish.

Summary Statement
My data showed that in the frequency range of 30-65 Hz a standard lighter flame can be extinguished.

Help Received
I devised this experiment on my own and conducted my own research.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Quang-Dan T. Tran

Project Number

J1725

Project Title

What Effect Does the Size of a Magnet Have on its Ability to Serve as a Frictionless Bearing?

Abstract

Objectives/Goals

In this project, the effect of the size of magnets on their ability to serve as frictionless floating bearing was investigated.

Methods/Materials

Magnets (passive type, Neodymium material) of different sizes and shapes were tested for push/pull forces and distances. Magnets having same thickness but different diameters were compared. Magnets having same diameter and different thicknesses were also compared. In addition, identical magnets were stacked up to compare the performance between a multiple magnets grouped together against a single magnet. Using the same number of magnets, many different stacks of different ratios were also assembled to compare their effects on push/pull distance. Also, the same number of identical magnets was tested in different pattern arrangements to see the influence of spacing between magnets (in same group) on push/pull distance. Finally, several different bearing design concepts were built and tested to validate the knowledge obtained.

Results

It was found: for the same magnet thickness, the bigger the diameter, the stronger the push/pull force and larger push/pull distance; and for the same diameter, the thicker the magnets, the stronger the push/pull force and larger push/pull distance. However, this was just a matter of better or poor performance. The most important factor was the arrangement of magnets in the design. If the magnets were placed closed to each other, the combined magnetic force was more focus in one direction. If the magnets were placed far apart, the combined force direction was changing back and forth in opposite directions which could not be utilized in a floating bearing design. . The built floating magnet bearings were also compared with a common type ball bearing and it was observed that the floating bearing could turn longer or faster due to much less friction. The concept was examined in several orientations/configurations to show they all worked. It was also found that the evenness of magnet locations and the uniformity of their magnetic strength are very important. If the magnets have uneven magnetic fields or placed unevenly, it could lead to unbalanced loading and tilting of the parts.

Conclusions/Discussion

Therefore, having bigger and thicker magnets is a good start to have stronger performance, but it is required to have proper magnet location arrangement and stack up to make these magnets serve as a frictionless bearing.

Summary Statement

I showed the size of magnets influenced the performance of a frictionless floating bearing, but the must requirement for the floating bearing to work is not the magnet size but the location arrangement and stack up of these magnets.

Help Received

I designed , built and tested the concepts myself. My teacher reviewed my project.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Greta M. van den Bergh

Project Number
J1726

Project Title
Testing the Chirality of Glucose Using a Homemade Polarimeter

Abstract

Objectives/Goals
My objective is to come up with a way to test the Chirality of Glucose. Knowing the Chirality of a molecule is important when developing substances that will go into the body since the body is a chiral environment. Can a homemade polarimeter be used as a first step in measuring the chirality of Glucose, a known Chiral molecule? Also, will the angle of rotation of plane polarized light increase with a greater concentration of Glucose or a longer path length through the solution?

Methods/Materials
Polarizer, Analyzer, Light Corn Syrup (Glucose) in four concentrations (0%,25%, 50%, 100%), Water, Four PVC tubes glued to a pane of glass to put the solutions in, iPad as a light source, camera, Analyzer stand, Lazy Susan, 16'x16' butcher block paper, Ruler, Protractor. In this experiment I use an iPad for a constant light source, two polarizers, one to polarize the light before entering the sugar solutions, and the other to analyze the outgoing light. The polarizer is rotated relative to the analyzer in order to get the minimum light through the system. This is where the polarizer and analyzer are at 90deg to each other. This technique was used for each solution concentration to see the angle differences where the minimum light occurred. This will give us the degree of polarization rotation. The 0% solution is our reference point, because water is non-chiral.
The second experiment is done using a 25% concentration solution in all four cylinders with just changing the path length, or depth, of the solution. The four path lengths are 1cm, 2.4cm, 3.6cm, and 5.1cm. The angle of rotation is found using the same procedure as the previous experiment.

Results
When increasing the ratio of the Glucose solution to water we measured a greater angle of rotation. For the three concentrations of 25%, 50% and 100% we measured angles (in degrees) of 9.5, 17.5 and 31, respectively.
When increasing the path length of the Glucose solution we also measured an increase in angle of rotation. For the path lengths of 1cm, 2.4cm, 3.6cm and 5.1cm, we measured angles (in degrees) of 10, 16, 21 and 27, respectively.

Conclusions/Discussion
A homemade polarimeter can measure the degree of polarization rotation of a Chiral molecule. The polarimeter showed that having a greater concentration of the sugar solution and a longer path length through the solution causes greater rotation of the polarization.

Summary Statement
I made a homemade polarimeter to measure the difference in angle of rotation of plane polarized light for four different concentrations of the Chiral molecule Glucose

Help Received
I had assistance from my mom to design and understand my Polarimeter and the subject of polarization.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Vivek Vijayakumar

Project Number

J1727

Project Title

Spectral Type and Frequency Correlation in Stars

Abstract

Objectives/Goals

The main objective of this project is to determine whether there is a clear correlation between the spectral type of a star, and the frequencies of light it emits (color).

Methods/Materials

An astrophotography setup consisting of a 130mm aperture reflector telescope, a motorized mount and a DSLR camera was used. Images of many different stars of many different spectral types were taken. They were analyzed with a freeware software program known as Registax using specific wavelet tools that relate to the color distribution of an image.

Results

In data set 2, when the 20 imaged stars are put into sequential order based on their spectral type, they form a concise pattern. In the O-B range, they start with a deep blue color. In the B-A range, they have a bluish-white hue. F stars have a white color with a hint of pale blue. Ignoring Aldebaran, K type stars have a pure white color. G type stars have a white color with a tinge of orange, and M type stars range from reddish-orange to completely red. Aldebaran, which is present in both data sets, has an orange color that is an outlier. Data set 1 confers with these results.

Conclusions/Discussion

Using the compiled results, the correlation laid out by the hypothesis was confirmed. A color change from blue to white to red was found between different spectral types. The ground the hypothesis was based on, such as the charts and tables commonly found in textbooks and resources, were correct with the slight variation between stars.

Summary Statement

I used an astrophotography setup to demonstrate a correlation between the spectral type of a star and the frequencies it emits.

Help Received

None. I worked out the telescope configuration for each data collection myself, researched the stars to be imaged, and analyzed them myself.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
Ben R. Walker-Edwards

Project Number
J1728

Project Title
Measuring the Speed of Sound

Abstract

Objectives/Goals
The objective of this study is to measure the speed of sound in air at different temperatures.

Methods/Materials
Microphones, computer software, cables, amplifier, mixer, 2 blocks of wood.

Used wood blocks to generate sound. Used 2 separated microphones and computer program to record sound. Analyzed sound records to obtain time taken for sound to travel between microphones.

Results
Sound moves faster in higher temperatures. The experiment was able to measure the speed of sound to within about one percent of the accepted value.

Conclusions/Discussion
It is possible with quite available materials to obtain a highly accurate estimate of the speed of sound. The largest source of uncertainty was in the separation distance of the two microphones. Such uncertainty could be reduced through the use of longer cables connecting the microphones.

Summary Statement
I measured the speed of sound in air using simple materials and found that it increases with higher temperatures.

Help Received
I designed the experiment, carried out the measurements and analyzed the results.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Grant E. Weiner

Project Number

J1729

Project Title

The Evaluation of Latent Fingerprints on Objects of Varying Temperatures

Abstract

Objectives/Goals

The objective of this study was to determine how the temperature of an object would affect the ability to evaluate latent fingerprints on it, by measuring the size of the print, the number of ridge lines seen, the clarity of the print, and the pattern of the print.

Methods/Materials

2 sets of 4 glasses each of varying temperatures, noncontact infrared thermometer, mm ruler, magnifying glass, cocoa powder, soft brush, transparent tape, black marker, latex gloves, fingerprint pattern diagram, ink pad, index card

Results

The arch pattern of the fingerprint was the same on all samples and at all temperatures. The 2 sample sets had different results in other areas. There were 25 ridge lines seen at the lowest 3 temperatures (-11C, +5C, +21C) and 30 at +37.2C. The second set differed with the 2 lowest temperatures at 25 lines and the hottest at 23. Fingerprint length in set #1 had matching 25mm on the 3 lowest temperatures and the longest print (30mm) at +37.2. On sample #2, the 2 coldest were 30mm.long. The hottest was shortest (25mm). Clarity on both sets had the hottest matching the coldest at 4.5 or 4 out of 5. Middle temperatures were 2 or 3 or 3.5 out of 5.

Conclusions/Discussion

I expected the number of ridge lines to be the greatest, the fingerprint size to be the longest and the fingerprint to be clearest with the colder temperatures of the object, since more sweat or water would have evaporated from the print in warmer temperatures, making them harder to evaluate. My results did not support my hypothesis. Perhaps I had my finger on the glass for inconsistent times while creating the print, the glass had warmed up while I was making the print so the actual temperature was higher, or I may have used too much pressure on the brush while dusting it, creating a smeared print. Since crimes are committed at different times of the day and year, a possible link between temperatures and the quality of latent fingerprints could be helpful in future investigations.

Summary Statement

I found that temperature of an object did not reliably affect the ablility to evaluate latent fingerprints left on it.

Help Received

My science teacher guided me through the intitial process. I designed and performed the experiments by myself.

CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

Natalie C. White

Project Number

J1730

Project Title

Cosmic Rays: Determination of the Relative Contributions from the Sun and the Universe

Abstract

Objectives/Goals

I wanted to find out how much of the cosmic rays are coming from the Sun and how much are coming from outside of the solar system. My hypothesis is that the cosmic ray count should decrease at night compared to daytime because at night the Earth will act to shield the contribution coming from the Sun leaving only the contribution coming from the rest of the Universe.

Methods/Materials

First, I measured the cosmic ray count during both the day and night at ground level using a Geiger counter. Next, I flew my Geiger counter on a weather balloon on both day and night flights.

Results

At ground level the cosmic ray count did not vary appreciably over a 24 hour period. Furthermore, the cosmic ray counts measured as a function of altitude were the same during day and night time weather balloon flights.

Conclusions/Discussion

The hypothesis was not confirmed since the daytime and nighttime cosmic ray counts were the same. This result was found both at ground level and at altitudes up to about 30 kilometers. I think that this result means that my Geiger counter is only picking up a signal coming from outside the solar system regardless of whether it is day or night. Since the day and night signals were the same, I was not able to determine how much of the cosmic rays are coming from the Sun and how much is originating from outside the solar system. However, I did learn that my Geiger counter is detecting a cosmic ray count coming from outside the solar system. Also, after five balloon flights I have been able to greatly improve the reliability of my equipment and improve my flight path prediction and tracking techniques.

Summary Statement

Although, my goal to measure the relative contributions to the cosmic ray count coming from the Sun and from outside the solar system was not met, I did learn that my Geiger counter must be detecting a signal from outside the solar system.

Help Received

My father taught me how to solder so that I could build a Geiger counter and a GPS radio. He also helped me study so that I could pass the amateur radio exam and get my technician license.