CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Thea Adumitroaie

Project Number

J1801

Project Title

Diamagnetic Levitation of Pyrolytic Graphite and Young Humans (Could We?)

Abstract

Objectives/Goals

My research project was aimed at finding the effect of levitating mass and external magnetic field on the levitation height of a diamagnetic sample, and estimating the magnitude of the magnetic field required to float a young human.

Methods/Materials

The main items in my experiment were 64 rare-earth alloy (Nd2Fe14B) permanent magnets, each being of 6mm sized cube and N48 grade; 3 pyrolytic graphite (a strongly diamagnetic material) sheets, 25mm x 25mm x 1mm thick, which were cut along thickness. The best identified magnet configuration (alternating poles) was scaled down to a 4x4 magnet layer and used to levitate different masses and sizes of graphite samples. The levitation height in each setup was measured on a 1mm x 1mmm printed grid. I repeated the measurements for increasing numbers of magnet layers. To explain the latter effect, I used a magnetic field computer simulation program. I also derived an expression for the magnetic field, from force equilibrium conditions. Using a simple geometric model of my body and assuming a 70% content of water (a diamagnetic substance), I estimated the magnetic field needed for me to levitate.

Results

As expected, the levitation height was found to be inverse proportional to the diamagnetic mass, given a constant surface area. Adding multiple layers of magnets produced no visible change in levitation height, which, at first, was puzzling. Using a magnet computer model, I calculated that there should be at most a 15% change in the magnetic field, which translates to a maximum 0.3 millimeters increase in levitation height. This change was unnoticeable by unaided visual observation. Finally, 85 Tesla (1.7 million times stronger than the Earth's magnetic field around my house) are required for me to float.

Conclusions/Discussion

Diamagnetic levitation can be analyzed successfully using a combination of experiments, physics modeling, and computer simulation. My hypothesis was correct, in that both sample mass and external magnetic field strength affect the diamagnetic levitation height, but I discovered that sample surface area (at constant thickness) is an independent variable as well. In the current setup, finer measurement techniques are needed to describe the effects more accurately. Levitating humans in magnetic fields seems to be a feasible activity, but not necessarily a healthy one.

Summary Statement

In this project, I was able to analyze diamagnetic levitation of graphite and young humans using a combination of experiments, physics modeling, and computer simulation.

Help Received

Father helped with cutting the graphite sheets and explaining the physics formulas.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Celeste Amaya; Ashley Galvez

Project Number

J1802

Project Title

Project Pendulum

Abstract

Objectives/Goals

Our objective was to determine what affects the period it takes a pendulum to swing and if the amplitude was the main factor.

Methods/Materials

In our first experiment we made a pendulum, adjusted its length, weight, and angle, to measure the effect the independent variables had on the period of the pendulum. This experiment demonstrated the importance of the length in determining the period of the pendulum. We then modified our experiment to isolate the variables and determine the effect of the amplitude on the period. We set a fixed length and weight to the pendulum and focused on the amplitude.

Results

Our results show that the length of the pendulum is the biggest factor in determining the period. After additional experimentation, we also discovered that the amplitude is a factor in determining the period, but the affect is smaller.

Conclusions/Discussion

We discovered that the pendulum has two factors which affect its period, the length and the amplitude. After completing our first experiment, the amplitude did not seem to affect the period, so we modified our experiment and extended the length so that we could measure and graph the effect of the amplitude.

When researching pendulums we found several formulas which graph the period from the length and/or amplitude. There were two formulas which we found most useful. The first was the simple pendulum formula that was in our text book and the other formula was a modification which included the addition of the amplitude as a variable. While the second formula was more precise and matched our results the best, it is the first formula that we believe to be the best for most applications.

After all the testing was complete, we found the averages of periods from our results matched closely with the theoretical value from the equations. This confirms the accuracy of our data, experiment, and our procedure. The amplitude does affect the period of the pendulum, but it is not the main factor.

Summary Statement

The length and the amplitude of the pendulum affect the period of the pendulum.

Help Received

Brother helped drill the hole in the board and mounted the pendulum on a ladder and on the ceiling wood beam.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Ayisha M. Aziz

Project Number
J1803

Project Title
Temperature Effect on Magnets and Electromagnets

Abstract

Objectives/Goals
The objective of my project is to provide an insight into the workings of magnets and explore the relationship between temperature changes and the workings of magnets and electromagnets.
It was hypothesized based on the research, that magnets and electromagnets would work better in cooler temperatures than in warmer temperatures.

Methods/Materials
The experiment was tested using three permanent magnets: ferrite,samarium cobalt,and neodymium.Additionally, an iron core electromagnet powered by two nine volt batteries, was used.The strength of each magnet was tested in five different temperatures, and averages were taken based on three trials in each temperature. To see the strength of magnets, the number of nails attracted in each trial were counted.

Results
The hypothesis was proven correct. Electromagnets and magnets do have a correlation. All of the magnets showed a decrease in magnetic strength at higher temperatures. The magnets strength increased in lower temperatures. In the end mathematical equations were created based on the strengths of each magnet.

Summary Statement
My project explores magnets and electromagnets in different temperatures to see if there is a correlation between the two magnetic fields.

Help Received
Mother helped with experiment; Cousin guided through research; Teacher gave alot of time

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Kate J. Ba

Project Number
J1804

Project Title
Snapping Depth

Abstract

Objectives/Goals
The objective of the experiment was to test and analyze the answer of the cause and effect question: How does changing the amount of light a 35 mm SLR camera takes in affect the clarity of the depth of a picture shot using a high shutter speed? It was expected that the trials with the additional light would have a higher overall depth of field.

Methods/Materials
The five different trial sets were 100% flash power (control), 50% flash power (variation one), 25% flash power (variation two), 12.5% flash power (variation three), and finally, 6.25% flash power (variation four). Ten different pictures were taken for each of the different trial sets- five with the Fresnel lens and five without. Each picture was shot at relatively the same time (3:45 p.m.). They were shot indoors, where the shut blinds created a dim room. The subject of the pictures was a regular measuring tape. At the end of the picture taking, the clarity was measured and inputted into data tables.

Results
The trials with the Fresnel lens had a higher depth of field than the ones without. Additionally, it was found that the 50% flash power trials were the clearest.

Conclusions/Discussion
In conclusion, the hypothesis was correct. The additional lighting did result in a higher depth of field. To go beyond photography, the Fresnel lens could be installed on a light bulb, therefore increasing its output while maintaining the same power input. This creates a method that is environmentally beneficial.

Summary Statement
By using a Fresnel lens, I created a means of having a clear depth of field while maintaining a high shutter speed.

Help Received
Father provided the 35 mm SLR camera

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Daniela T. Castleberg

Project Number

J1806

Project Title

Testing the Habitability of Exoplanets

Abstract

Objectives/Goals

The project objective was to determine out if there are any Exo-planets that could potentially support life.

Methods/Materials

Three criteria tested the planet#s habitability. The criteria are the Habitability Zone Composition (HZC), Atmosphere (HZA) and Distance (HZD). The HZC predicts whether a planet is likely to have soil. The HZA predicts whether a planet can hold an oxygen-based atmosphere. The HZD predicts whether the planet can hold liquid water based on the planet#s temperature. Data from the Exo-planet database was analyzed with the Habitability Zone criteria from the University of Puerto Rico at Arecibo Planetary Habitability Laboratory to find planets that could potentially support life.

Results

Out of 4,210 candidate planets in the database, only 2,740 had the sufficiently complete data to test all three criteria. There were 2,021 planets meeting the HZA, 1,403 meeting the HZC, and 51 meeting the HZD. I found 10 Exo-planets meeting all of the habitability criteria simultaneously. This was only 0.4% of the 2,740 planet candidates.

Conclusions/Discussion

Based on my results, I believe that there are planets that could be habitable. Since 10 planets met all three criteria, then there is a possibility that there is life out there. If I apply my finding to the entire galaxy, then I find something really interesting. Astronomers believe there are 100 billion stars in our galaxy. If you assume that every star has at least one planet around it and 0.4% of all of those planets meet the HZ criteria, then you discover there are about 400 million opportunities for life.

Summary Statement

In this project I sought to determine if Exo-planets could support life and discovered that 0.4% of 2,740 Exo-planet candidates analyzed met all three Habitability Zone criteria.

Help Received

My father helped with the excel spreadsheet analysis. I used data from the Exo-planet database. I consulted with Dr. Abel Mendez regarding my research. Equations were adopted from the University of Puerto Rico at Arecibo Planetary Habitability Laboratory.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Tian Chen; Anna Tsai; Ore Ziskind

Project Number

J1807

Project Title

The Thermodynamic Freezing Paradox of the Mpemba Effect

Abstract

Objectives/Goals

The Mpemba Effect is a phenomenon that seems to contradict the laws of thermodynamic. This effect suggests that warm water freezes faster than cold water. The purpose of this experiment is to determine which of the many theories have the strongest argument towards the cause of the Mpemba effect. Each of the four theories would be tested with different procedures to show the credibility. The documents that supports each theory should be closely examined, to help understand the different variables in their experiment.

Methods/Materials

If the freezing of water, is determined by the temperature of the water then the sample with the room temperature water would freeze first, according to Newton law of cooling. In order to prove supercooling, 1/4 gram of charcoal dust is added to the water to spark nucleation. To prove the theory for evaporation, the experiment is conducted in a closed container to prevent water vapor from escaping. To prove dissolved gasses, boiled water will be cooled down to normal temperature, then it will be tested again. To prove thermo-conductivity and bond energy transfer in the water, we will have to set up a heat capacity equation to see if the theory have an effect on the Mpemba Effect.

The temperature and time of freezing would be recorded. After 9.7 hours take the samples out and observe their crystal formation and physical appearance. Do this test 8 times to make sure the experiment is consistent.

Results

Observations from the data graph showed that supercooling is not a crucial part of the Mpemba effect. Although not completely ruling out supercooling, there was not enough evidence to support this theory. This theory was tested using air tight beakers, and with air that can not escape, warm water still froze faster than the water kept at room temperature, thus, showing evaporation was not a important part of the Mpemba effect. Lastly, based on observation and mathematical analysis, the most likely theory is thermal conduction and bond energy transfer.

Conclusions/Discussion

The results yielded does show that the Mpemba Effect does exist and does not contradict newtons law of cooling. We found that supercooling, evaporation, and dissolved gasses noes not have an effect on the Mpemba Effect. The equations showed it is most likely that the Mpemba Effect is caused by bond-energy transfer that leads to thermo-conduction in the system leading to hot water freezing faster than cold water.

Summary Statement

Finding conclusive proof with supporting evidence to the cause of the Mpemba Effect.

Help Received

Advised by: Dr. S L Lee, Ms. C. Degregorio Edited by: Prof. Aleksandr B. Djuristic, Ms. Cameron Most, Mr. Julian Rovee Supervised by: Ms. Meiying Song

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Kassandra A. Cornejo

Project Number
J1808

Project Title
Speed of Light

Abstract

Objectives/Goals
One goal of this project was to determine if the speed of light changes in different media. Also, if it did change to see if there are any noticeable connections between light speeds and the media they traveled in.

Methods/Materials
The materials used were: one glass container, a laser, oil, gelatin, maple syrup, water, shampoo, graph paper, protractor, ruler, calculator, and a pencil. First,the glass container with the tested media in it were put on a specific place on the graph paper on one of two perpendicular lines drawn. A laser was pointed at the container and a point was marked where the light left the container on the graph paper. Then a line was made using the point and connected to the intersection of the perpendicular lines. Using the angle made between this line and the perpendicular lines, as well as the Snell's Law Equation, the refractive index was found. Using the refractive index and the speed of light in a vacuum the speed of light in the tested media was found.

Results
The results showed that water had the fastest speed, 230 843 279.6 m/s, followed by oil and gelatin, 224 604 358.1 m/s, maple syrup, 211 365 977.7 m/s, and lastly shampoo, 172 393 850.9 m/s.

Conclusions/Discussion
From this project, it is concluded that the speed of light will change. Based on the order of light speeds, the hypothesis was proven to be correct. Lastly, it is concluded that the speed of light in a vacuum will be slowed down the most in denser media.

Summary Statement
This project is about measuring the speed of light in different media.

Help Received
I received no help doing this project.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Michele L. Eggleston

Project Number

J1809

Project Title

See the Light! An Inexpensive Cellphone Spectrophotometer for the Classroom

Abstract

Objectives/Goals

We wanted to build a simple and inexpensive cellphone spectrophotometer that would allow us to measure the absorption of visible light through different colored solutions and that would be comparable enough to a commercial instrument to possibly be usable in a school science lab.

Methods/Materials

We use a single LED bulb flashlight as source of visible light. We used food coloring, blue, yellow, red and green at different concentrations in water to create the colored solutions. These were placed in a cuvette directly in front of the LED light. A light spectrum was created by directing the light beam through a grating slide and the resulting image was captured by a cell phone camera in a dark room. The pictures were uploaded onto an image analysis software to calculate the absorbance and transmittance of each solution, using water as reference. We also measure the absorbance of milk, grape, apple and spinach juices. We also passed the same samples through a commercial spectrophotometer.

Results

We found that a solution of a specific color will absorb most of all the other colors of the spectrum but will transmit its own color. The measured wavelength of peaks of absorption for each commercial dye solution showed only a 2 to 5% difference with the values given by the manufacturer. In addition, more concentrated solutions absorbed more of the other colors. The absorbance peaks of these dye solutions as well as the natural solutions measured by the commercial spectrophotometer were in the same wavelength range, with a difference of 30 nm at most.

Conclusions/Discussion

Our spectrometer can help estimate the absorbance of commercial dyes and of colored natural solutions such as plant pigments, or juices, with results comparable to a more expensive commercial instrument. It can also be used to compare concentrations. It is portable, doesn#t require any expensive materials, and could be used in a science classroom to teach student about light and some of its properties such as absorbance and transmittance.

Summary Statement

Estimate the absorbance of colored solutions with a simple, inexpensive spectrophotometer.

Help Received

Mom gave access to lab spectrophotometer at Sanford Burnham Medical Research Institute

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Adishree Ghatare

Project Number
J1810

Project Title
What Is the Effect of Reflecting Angle and Type of Reflector on the Efficiency of a Solar Cooker?

Abstract

Objectives/Goals
The objective is to investigate the effect of reflecting angle and effect of the reflector type on the efficiency of a solar cooker.

Methods/Materials
In reflecting angle experiment I made three octagonal solar cookers. I wrapped the cookers with aluminum foil as reflecting material, and, set them on leveled surface with one flap directly facing the sun (reflecting flap). Flap angle is the angle of the flap with the horizontal surface. As the flap angle changes, the reflecting angle changes. Reflecting flap angles were different in different cookers, i.e. 79.3° for Cooker 1, 39.5° for Cooker 2, and 10.2° for Cooker 3. Then I placed glass bottles painted black, filled with water, mint and tea leaves, in the center of the octagonal cooking pit. To trap the heat, I covered the cookers with plastic wrap and allowed the tea to heat for an hour. Then, I measured the temperature of the tea. In reflector type experiment, I covered three cookers with different reflecting materials: Cooker 1 with aluminum foil, 2 with shiny golden gift-wrap, and 3 with white wallpaper and kept reflecting angles same in all three cookers. I recorded the temperature of the tea after an hour. I repeated both experiments three times.

Results
For reflecting angle experiment repeated three times, the average temperature increase for Cooker 1 (79.3°) was 34°C, for Cooker 2 (39.5°) was 21.3°C, and for Cooker 3 (10.2°), the increase was 19°C. For the reflector type experiment repeated three times, the average temperature increase for Cooker 1 (aluminum foil) was 37°C, for Cooker 2 (shiny gift wrap) was 36.5°C, and Cooker 3 (white wallpaper) was 34.3°C.

Conclusions/Discussion
My hypotheses were supported as reflecting angle affects the efficiency of solar cookers and more lustrous reflectors increased temperature attained in tea, implying that they increased the efficiency of solar cooker. I experimented in one-hour periods as sun's position in the sky moves with time. For further studies, I will investigate how to make a solar cooker that constantly reflects sunlight to food with "moving sun." As some organizations supply solar cookers to poor places, they can take this idea into account so they can make more efficient solar cookers. We can use these everyday, reducing our dependency on non-renewable sources.

Summary Statement
My project investigates the effect of reflecting angle of sunlight and reflector type on the efficiency of a solar cooker.

Help Received
Parents helped cutting the cardboard.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Jennifer A. Gomberg

Project Number

J1811

Project Title

Does the Height and Weight of an Ice Skater Affect the Speed of His/Her Spin?

Abstract

Objectives/Goals

The objective of this experiment was to see whether the height, weight, or body mass index of an ice skater affects the speed of his/her spins.

Methods/Materials

Twenty-five ice skaters who can successfully complete a one foot spin voluntary consented to participate. Before the first test, the participants were measured and weighed with measuring tape and a scale. The participants executed seven spins once a week for six weeks while being measured with a radar gun in kilometers per hour. An adult helper videotaped the participants for a future reference.

Results

There was a slight effect on the height, weight, and body mass index of an ice skater's spin, but not enough to show the hypothesis is correct. After creating the overall graphs, the trend line was the exact opposite of the hypothesis, but when separated into smaller categories, the trend line was pointing slightly downwards, showing that taller, heavier, and larger body mass indexes have slightly slower spins. The different body types, however, had similar qualities to their spin.

Conclusions/Discussion

The results of the experiment showed that the hypothesis was wrong, as the trend line in the graphs pointed only slightly downward at a small percentage when the graphs were created into smaller categories. Even though the body composition did not affect the speed of the spin, it seemed to affect the certain qualities of the spin. Professional athletes need to focus on their body composition as it may affect the qualities, not quantities, of their performance.

Summary Statement

Twenty-five ice skaters with various body compositions were selected to see if the height, weight, and body mass index had an effect on the speed of an ice skaters spin.

Help Received

Mother helped taking notes and video during trials; Father edited report; Elaine Gillum edited notebook and took photos; Jami Macleod answered questions on the physics of ice skating; Wendy Smith allowed the experiment to be done at the San Diego Ice Arena.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Marina K. Grimmett

Project Number
J1812

Project Title
Sound Penetration into Rough Water

Abstract

Objectives/Goals
The objective of this project is to determine if more sound will enter a rough water surface than a flat water surface.

Methods/Materials
A sound blocking disk and a sound directing tube were used to control sound. A pool, two laptops, a speaker, a hydrophone and a fan were used in the apparatus. For each setting, the disk was moved up gradually or the tube moved to a larger angle. This was repeated with 4 different wind speeds created by the fan, 0 knots, 17 knots, 27 knots, and 37 knots.

Results
When after 13 degrees, the angle at which no sound should penetrate the water, it was seen that the level of fan corresponded with the level of sound. The highest fan setting had the highest level of sound from the specified signal sent out by the speaker, and so on for the low and medium wind speeds.

Conclusions/Discussion
In both methods, evidence was found that supported the hypothesis, that sound would penetrate at approximately 27 degrees. In each setting, most of the data stayed generally the same with few outliers, although there was variation due to the possibility of sound diffraction. Sound levels with the fan, were higher than without the fan.

Summary Statement
My project is about sound penetration into rough water, and if sound will penetrate rough water more than calm water due to physical laws of sound.

Help Received
My dad brought my attention to this topic, assisted in constuction of apparatus and in the programming of the system through which I took the data, and taught me Snell's Law; Teacher helped edit the research paper and notebook; mom helped in design and construction of the backboard

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Sophia L. Hodson

Project Number
J1813

Project Title
Physics and Figure Skating

Abstract

Objectives/Goals
Figure Skating and Physics

My objective was to find out if one goes faster in an axle jump with their arms above their head or with their arms tucked into their chest and why the speed varies, if it does.

Methods/Materials
I had two skaters of the same International Skating Institute (ISI) skating level each perform several of each kind of axle. I video taped them and then timed all the jumps from takeoff to landing. They both had the same size toe picks and they both had Harlick skates.

Results
Skater 2 was generally faster than skater 1 and both skaters landed the jump with their arms tucked in faster than with their arms above their heads.

Conclusions/Discussion
My conclusion is that when a skater is rotating with their arms above their head, the arms are slightly farther away from their body and they rotate slower. This is because the average radius of the rotating body is slightly higher and there is nearly no friction in the jump. Therefore the angular momentum stays the same so speed varies inversely with the average radius of the spinning body.

Summary Statement
Because I am personally learning to do an axle jump, I wanted to find out if a skater spins faster in an axle with their arms tucked into their body or with their arms above their head.

Help Received
I refused to let me mother help. I had no help at all with this project except for the skaters that let me video tape their axle jumps.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Alexander K. Ida

Project Number
J1814

Project Title
Can the Forces of Firearm Recoil Cause Brain Injury?

Abstract

Objectives/Goals
The objective of my project was to determine if the recoil forces of different firearms could generate enough acceleration of the head to cause subconcussive brain injury.

Methods/Materials
A head accelerometer, ten firearms, eight different ammunitions, safety glasses, ear plugs, laptop computer and a weight scale were used. Recoil energy was calculated for each of the firearm combinations using the equation:
Recoil Energy = [mgun/64.348] X [(mshot x vshot + powder x vshot x xf)/7000* mgun]squared . Peak head acceleration was measured using the head accelerometer for each of the firearm combinations tested. One hundred and ninety data points were collected. Calculated recoil energy and head acceleration were compared.

Results
Average recoil acceleration of the head increased as the calculated recoil energy increased. The recoil forces generated to the head were dependent on the velocity of the bullet, weight of the bullet, weight of the firearm, weight of the powder charge, type of firearm and the mass of the shooter. Firearms with recoil energies above 35 ft-lbs created enough head acceleration to potentially cause subconcussive brain injury. Firearms with lower recoil energies, as high as 24.5ft-lbs do not create enough head acceleration to cause subconcussive brain injury. Mismounting the firearms created forces to the head that could cause subconcussive brain injury. Recoil reducers in the stock of the firearm lessened the recoil forces to the head.

Conclusions/Discussion
Firearms with high recoil energies created enough head acceleration to potentially cause subconcussive brain injury. This should be a wake up call for people who shoot large recoil energy firearms frequently like peace officers, marksmen and soldiers. They should be aware that frequent use of large caliber firearms could cause excessive forces to the head.

Summary Statement
Firearms with high recoil energies created enough head acceleration to cause brain injury.

Help Received
Mr. Hobbs helped with development. Father helped with testing. Mother pasted together board.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Thomas M. Karpishin

Project Number
J1815

Project Title
Laser Vibes: Design of a Laser-Based Vibration Sensor

Abstract

Objectives/Goals
1. Build a vibration sensor using the reflection of a laser off of a liquid surface.
2. Test seven different liquids (acetone, methanol, ethanol, hexane, pentane, glycerol, and water) and determine which is most sensitive for detecting vibrations in my sensor.
3. Determine what properties of the liquids make them more sensitive to vibrations.

Methods/Materials
A vibration sensor was designed and built by using a 650nm 5mW laser and a homemade laser-light sensor. The laser was reflected off of the surface of a liquid and the reflected light was aligned close to the light sensor so that vibrations of the liquid would cause it to move over the sensor.

Seven different liquids were investigated to see which one was the most sensitive in detecting vibrations. For each measurement, a "pulse" vibration was initiated and the sensitivity of the liquid was determined by measuring the time that the reflected laser light continued to move after the vibration.

Results
A highly sensitive vibration sensor was constructed using laser reflection off of a liquid. Of the liquids tested, the results show that acetone was the most sensitive liquid for measuring vibrations. My results show that the most sensitive liquids were acetone, pentane, and hexane, which have have the lowest boiling points, lowest viscosity, and lowest density. The least sensitive liquid was glycerol, which has the highest boiling point, viscosity, and density.

Conclusions/Discussion
A new type of vibration sensor was made using laser light reflection off of the surface of a liquid. Acetone proved to be the most sensitive liquid tested in this device. By graphing the relationship between the sensitivities of the liquids and their properties, I showed that the sensitivity of the liquid was correlated closely to density and boiling point and less correlated to viscosity. These findings will be useful in the design of future more sensitive vibration sensors based on the principle of reflected laser light.

Summary Statement
I designed and investigated a new type of vibration sensor by monitoring the reflection of laser light off of a liquid surface.

Help Received
Father helped solder electronic circuits.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Gabriel Keith

Project Number
J1816

Project Title
Eddy Current

Abstract

Objectives/Goals
The purpose of my experiment is to demonstrate the properties of eddy currents, explore the power of eddy currents, and discover things for myself.

Methods/Materials
The materials I used when I created this mechanism were:

* clear acrylic
* screws
* washers
* vice
* clamps
* camera
* timer
* hard drive bearing
* hard drive magnets
* clear tape

I did four experiments for each conductor, each experiment had 10 trials I did each trial and each experiment exactly the same except for the conductor. if the pendulum hit the side I re-ran the experiment. For the distance tests I also moved the magnets closer or farther away.

Results
I got accurate results that followed my hypothesis. Since I did ten trials for each experiment my data is too large to show in this abstract so see my results below.

Conclusions/Discussion
My data has definitely shown that the conductors that are solid conduct the best. I see a pattern in my data which is that the fastest trial is the solid conductor then the cut or silted conductor then the trials with no magnets. I also see a pattern in my time distance graph. this pattern looks like exponential growth meaning eddy current increases exponentially as the distance between magnets decreases.

Summary Statement
My project demonstrates properties of eddy currents, showing the effect of conductor shape and magnet distance on eddy current strength.

Help Received
My Father helped with the construction of the experamental equiptment.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Yuval Lifshitz

Project Number
J1817

Project Title
What Affects the Motion of a Pendulum?

Abstract

Objectives/Goals
In my project my goal was to see for myself if Galileo's claims about the dependence of a pendulums period on mass, length and amplitude were correct.

Methods/Materials
10 weights (40 gr each), screw-eye pivot, string for the pendulum, Measuring tape (cm), protractor, and stopwatch for measurement.

Results
I discovered that Galileo was only partially correct. He was wrong about the amplitude, even though I actually read that he noticed the changes in the period but he disregarded them.

Conclusions/Discussion
I confirmed two of Galileo's observations regarding the period of a pendulum.I also measured the gravitational acceleration constant g and got a pretty good approximate value of 9.87 meters per seconds squared (about a 0.6% error from the known value of 9.81 meters per seconds squared). Also, I found that my hypothesis regarding the dependence on amplitude was correct, the period increases with the increase of the amplitude. It seems that Galileo was wrong, although according to some books, Galileo himself measured that there was a dependence on amplitude but did not believe it. Scientists today know that this dependence exists.

Summary Statement
Measuring the dependence of a pendulum's period on it's mass, length and amplitude.

Help Received
my parents helped me construct the pendulum and perform the measurements, and they proof-read my paper: My sister allowed me to use her eleventh grade physics book.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Shobhan Mangla

Project Number
J1818

Project Title
Stealthy Shapes

Abstract

Objectives/Goals
The objective is to determine which 3-D geometric shape (cylinder, crumpled cylinder, W, or V), reflects the least light and hence is the stealthiest, and test the effect of different colored paper (white, green and gold), for each shape on the reflectivity of light and stealthiness.

Methods/Materials
I used a flashlight, a lux meter, and white, green, and gold paper to determine how much light is reflected back by each shape and how stealthy it is.
First, I made 4 shapes (cylinder, crumpled cylinder, W and V) out of all of the different colors of paper. Then I put them in the box at three different distances and turned on the flashlight for each different shape, color, and distance and recorded the data found from the lux meter and analyzed it.

Results
In all the distances and colors of paper that I tested, the cylinder and the white paper reflected the most light and therefore was the least stealthy, and the V-shape and the green paper reflected the least light and therefore was the stealthiest.

Conclusions/Discussion
My conclusion is that the cylinder and the white colored paper was least stealthy, and the V-shape and the green colored paper was most stealthy.

This occurred because the V-shape scattered the light behind itself and away from the lux meter, and therefore reflected the least amount of light and was most stealthy. Also, the green color paper absorbed the most light, reflected the least light and was the stealthiest.

Summary Statement
In my project , I tested the reflectivity of light with different shapes made out of different colored paper and its correlation with stealth technology being used in military aircrafts.

Help Received
Dad helped buy the materials and construct the test box. Dad helped glue the flashlight and luxmeter.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Laura H. McGann

Project Number
J1819

Project Title
Good Vibrations

Abstract

Objectives/Goals
The purpose of this project was to determine whether or not the amplitude of a sound changed over distance and between different media. The hypotheses stated that the amplitude would be greater in water than in air, and that it would also be greater over distance.

Methods/Materials
A pipe apparatus was made to contain the medium (water or air) and for the sound wave to travel through. A swinger contraption was made to create the sound as it hit a metal end cap on one end of the pipe. A foam sleeve was put into the pipe to reduce reflection and resonance. A microphone waterproofed with balloon and attached to a computer was placed in the opposite end of the pipe. The computer used a program to record the sound waves the microphone picked up, and Python programming was used to then analyze, compute, and plot the data.

Results
The amplitudes in water were greater than that of those in air, as predicted by the hypothesis. The data regarding the other hypothesis proved to be less cooperative. The amplitude of the sound waves in the 6ft pipe-length for both media was bigger than that of the amplitude in the 4ft pipe-length. This could be because of some error. The rest of the data, however, proved the hypothesis to be true.

Conclusions/Discussion
In conclusion, the first hypothesis was proved, and the second one was not, although it provides a point of further study and interest. Overall, much was learned and much can still be looked into.

Summary Statement
The purpose of this project was to determine whether or not the amplitude of a sound changed over distance and between different media.

Help Received
Dad and other knowledgable mentors helped explain big science ideas; Dad taught how to use Python programming; Mom reviewed typed report; Brother hit 'record' button on computer

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Brian M. Ng

Project Number
J1820

Project Title
The Effect of Temperature on the Strength of Nitinol Spring

Abstract

Objectives/Goals
To determine if nitinol spring contracts and exerts different amount of force with the change in temperature

Methods/Materials
In order to determine if nitinol spring exerts different amount of force with the change in temperature, I conducted a series of experiment where I added different weights, 2 to 18 grams, to the nitinol spring and heated the nitinol to 45 degrees C. I then let the nitinol cooled and measured its length every 5 degrees C until it reaches 15 degrees C. I repeated the experiment three times for each weight and took the average. Then I graphed the results in length versus weight and length versus temperature. For the control group, I conducted an additional experiment on the nitinol without weights. It was used to compare the difference in length when the nitinol was not loaded. The independent variable was the nitinol temperature and the dependent variables were the length and force exerted by the nitinol.

Results
The results showed that the nitinol spring became stronger at higher temperature. In fact, when nitinol was heated from 15 degrees C to 45 degrees C, it became about 3 times stronger. I also discovered that at around 30 degrees C, the nitinol contracted the most. This is the transition temperature where the nitinol changes from martensite to austenite phase.

Conclusions/Discussion
In my research, I discovered that the transition temperature for the nitinol spring is around 30 degrees C and the nitinol becomes 3 times stronger above the transition temperature. This property makes nitinol very useful for many applications where heat is a natural energy source. One example is in medical devices such as a stent made of nitinol which will exert higher force when it is inserted into the blood vessel. Another example is to replace motors to save energy. One of my ideas is to use nitinol in an automatic shading system that is powered by the sun#s heat. When the room gets hot, the nitinol will contract and therefore closing the blinds

Summary Statement
Nitinol spring was found to exert 3 times more force at higher temperature and the transition temperature is around 30 degrees C

Help Received
My mother helped me to buy the materials and handle hot water which was used to heat the Nitinol

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Kyle A. Rosecrans

Project Number
J1821

Project Title
Secrets of Shooting Success

Abstract

Objectives/Goals
What shooting angle gives you the greatest chance of making a basketball shot.

Methods/Materials
28.5 Basketball
Camera
Tripod
Subjects
10 foot Basketball Hoop
Basketball Court
Notebook for data
Pencil

Results
What I found is that the correct shooting angle was in the range of 58-62 degrees. At first I thought it would be 48 degrees but after I got my data I realized it was not.

Conclusions/Discussion
I originally was looking for the angle to be at 48 degrees. I got scared when I found it was something other than 48 degrees. I thought I had done the whole project wrong. After I continued my project I realized that the consistent angle was in the range of 58-62 degrees. That is when I realized I was on the right path to finding the correct angle. The correct angle is in the range 58-62 degrees.

Summary Statement
This project determines the best angle to make a basketball shot

Help Received
I received help with display board layout.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Edward Ross

Project Number

J1822

Project Title

Balloon Acoustics: Why Do Balloons Make a Loud Noise When They Pop?

Abstract

Objectives/Goals

My objective was to find out why balloons make a loud noise when they pop. I wanted to get enough data to choose between two main conflicting ideas for what creates the noise: gas expanding rapidly after a balloon pop, or latex ripping or snapping faster than the speed of sound. My hypothesis was that gas expanding and forming a pressure wave after a balloon is popped makes the sound.

Methods/Materials

Each balloon type (round, cylindrical, or long-skinny) was filled with either Helium (He), Air or Tetrafluoroethane (TFE), to a certain inflation level, then popped, at a distance of 1 m or 3.2 m. I measured loudness with a sound level meter and waveform with Audacity software, 10 measurements per combination. I showed my final data to NASA acoustician Dr. J. Panda to help interpret. I took high-speed Schlieren videos to see balloon pops in detail.

Results

TFE was loudest for all cases except less-inflated cylindrical balloons, for which all gases were about the same loudness. Air was usually 2nd loudest but relatively close to He. Long-skinny He balloons were quietest. All cylindrical balloons had relatively small loudness differences between gases. All balloons were louder when inflated more. Balloon popping sounds are rapid oscillations that ramp up then down, not simple impulses like a gunshot. All spectra for all balloons had peak frequency at ~3000-3250 Hz, with a pretty straight decreasing slope past the peak. Spectra for TFE balloons above 3000Hz were almost always higher than for the other gases. Below 3000 Hz, He was loudest for 3 of 8 cases. Balloon pressure was low, less than ~8500 Pa for all cases. Schlieren video showed when a balloon pops, at first a hydrodynamic (noiseless) pressure wave emerges, then the latex on the surface and at the ripped edges begins to ripple, and at the peak of each ripple a pressure wave is released. The latex rips at ~100 m/s and the expanding gas moves even slower.

Conclusions/Discussion

My data disproved common explanations for why popped balloons make a loud noise, including my hypothesis, and led to a new theory. The new theory complied best with my results although some aspects need more research. For characterizing room acoustics, fully-inflated round TFE balloons are loudest and contain the most even frequency spectrum.

Summary Statement

The goal of my project was to take acoustical data to see which explanation of why balloons make a loud noise when they pop is correct.

Help Received

Help from NASA: Dr. Jayanta Panda helped interpret my data, Laura Kirschner and JT Heineck took Schlieren video. Lisa Marcacci and Dr. Kent Gee at BYU gave advice. Dad was my lab assistant; he popped balloons while I took data. Mom helped type and edit my abstract and organize/glue my poster.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Ilana S. Shapiro

Project Number

J1823

Project Title

Gravity and the Torsion Balance

Abstract

Objectives/Goals

The objective was to recreate an age-old experiment (Cavendish's gravitational torsion balance) in an original way to show gravitational interaction between two small masses. I asked: How does mass affect gravitational attraction between objects? I hypothesized: If the masses of two objects are increased, then the gravitational attraction between them will increase, and the torsion bar will move a greater distance toward the affecting mass.

Methods/Materials

An original gravitational torsion balance was constructed using nylon fiber to suspend a titanium rod with a steel sphere at each end. The system was constructed in a covered trundle bed frame and the windows in the testing room were covered with aluminum foil for maximum stability. Two receptacles were constructed to allow placement of affecting test masses adjacent to the each of the bar's masses but on opposite sides. A laser was reflected off a mirror centered on the torsion bar and onto a ruler to measure bar movement. A programmed webcam recorded the laser's position on the ruler every minute. A control setting with no affecting masses, and four different mass settings (14.52 kg, 7.29 kg, 0.40 kg, and 0.20 kg), were tested.

Results

The laser's position on the ruler for two of the four mass settings (14.52 kg, 7.29 kg) averaged 9.4 cm and 3.4 cm away from the control's average in the direction my hypothesis predicted. A third mass setting (0.20 kg) returned data averaging -37.7 cm away from the control, opposite the hypothesized direction. The error margin was +/- 1 mm. A fourth mass setting returned inaccessible data (the laser beam rarely appeared in the webcam's view).

Conclusions/Discussion

My hypothesis was supported with data from the greatest two of the four mass settings (14.52 kg and 7.29 kg), but not with data from the lowest mass setting (0.20 kg). A possible explanation for the unpredicted data is that this smallest mass tested was so small, external factors overwhelmed the slight gravitational force. Though I can support my hypothesis with the majority of the data, I cannot conclusively prove or disprove it due to conflicting data. To improve this experiment, a more isolated environment than my house would be used. In the future, using its subtle sensitivity, the torsion balance could measure the Casmir Effect, an attraction between two plates in a vacuum due to decreasing energy between them compared to the surrounding vacuum.

Summary Statement

A gravitational torsion balance was constructed to experimentally measure the gravitational attraction between very small masses.

Help Received

Mentor (Dr. Philip Lubin) helped with theoretical and mathematical concepts behind the project, Mother helped with gluing and pasting on the display board, Father helped me with some of the drilling and lifting during construction.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Gurveer Singh

Project Number
J1824

Project Title
The Analysis of Pollution Using Underwater Acoustic Networks

Abstract

Objectives/Goals
The primary objective of this project is to determine whether underwater acoustic networks, or UAN's, can be used as a system to monitor pollution in relatively large bodies of water. Also, its purpose was to expand upon initial studies by various companies and develop a system which uses acoustic technology to identify the amounts of contaminants in a solution. This system's capabilities to analyze pollution were tested through the addition of sodium chloride and refined oil.

Methods/Materials
An underwater acoustic network was created by initially designing the signal generator and signal receiver of the apparatus. The signal generator was created by purchasing an oscilloscope (72 MHz analog bandwidth) and modifying it so that it could produce the signal using a smartphone's transducers. I connected this to a clear PVC pipe (5 cm x 5 m), while creating the signal receiver by modifying a decibel meter so that it is waterproof. Once the apparatus was finished, sodium chloride was added to distilled water to create a solution which would be placed in the PVC pipe. Also, oil is added to distilled water to create the second part of the experiment. It is mixed by a magnetic mixture to ensure that it is homogeneous.

Results
After the experiment was completed, the addition of sodium chloride increased the decibel level by 2 dB with an increase of 5 g, incrementally. With the addition of 20 g of sodium chloride in 100 ml, the decibel level increase to 98.1 dB from 90 dB. When I added 25-100 ml of oil to 1 L of distilled water, the decibel levels decreased by an average of 4.3 dB.

Conclusions/Discussion
The addition of sodium chloride increased the decibel levels, while the addition of oil decreased the decibel levels. The first experiment agreed with my hypothesis, however the second experiment dealing with oil did not. Interesting observations were made during the testing of sodium chloride. An interesting observation is that the addition of salt could have allowed for the creation of density-based thermoclines. These observations may act as the key understanding for the phenomena that occur with underwater acoustic networks.

Summary Statement
A small-scale underwater acoustic network was built to test and record its capabilities of analysis for contaminants in a water supply.

Help Received
I would like to thank my instructor, Mr. Briner, for helping me purchase much of the scientific equipment.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Nicole M.L. Stokowski

Project Number
J1825

Project Title
Flute Physics

Abstract

Objectives/Goals
The objective of this project was to see if keyhole (finger hole) size, on a flute, would affect its pitch, (I was curious how a flute worked). I believed that as the keyhole size got bigger the pitch would go up.

Methods/Materials
First I did some research on flutes and sound waves, then, me and my dad built a two-foot PVC flute with an embouchure hole and a cork in one end and a keyhole in the other end. I used different size drill bits from 1/16-3/4 and a drill to bore different size keyholes in the same flute (one at a time). I then played the flute, with the keyhole open, and used a tuning app on my dad¡#s phone to see the note being played and the hertz. For each hole I played the lowest note, an octave above it, two octaves above it, and a note in between the second and third octaves.

Results
As the keyhole size got bigger the pitch went up, but it barely went up between some keyhole sizes where it went up drastically for others.

Conclusions/Discussion
Although the keyhole size did affect the pitch, I also realized that there were many other factors affecting the flute¡#s pitch as well. I thought this because the tuner was showing me many of the notes I was playing as much higher notes due to overtones.

Summary Statement
My project is about how different keyhole sizes affect what note a flute plays.

Help Received
Father helped with idea, drilling, cutting, and recording; Mother helped with presentation.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Megan T. Tang

Project Number
J1826

Project Title
Effects of String Properties on the Likelihood of Knotting

Abstract

Objectives/Goals
The purpose of this project is to investigate how the length of string affects its likelihood to be knotted. It was hypothesized that strings with longer length had higher knot probability and had more crossings than the strings with shorter length. Also, the likelihood of knotting may be different for different types of strings.

Methods/Materials
An experiment was designed to study the likelihood of knotting by counting the number of crossings (overlaps of string) after the string is dropped into a closed container and tumbled 10 times. This experiment was repeated for four string types of different material and thickness with varying string lengths. A picture was taken of the knotted string. This was repeated with every length of every type of string ten times to account for variability of the results. The pictures of the knots were analyzed and the crossings were counted and recorded into a scientific journal. After the analysis of the first set of data, it was found that the number of crossings did not change with the thin thread when the length was above 90cm. To test if this was true, a longer length of the thin thread of 150cm was added. In addition, the thin string experiments were repeated using the same box whose rough wooden surface was covered by paper.

Results
The experiment resulted in clear results that proved the original hypothesis to be correct. For all four of the string types, the number of crossings increased as the string length increased. However, this relationship is not in a simple linear form. The thin thread had the most number of crossings compared to the other string types, while the elastic string has the least number of crossings. As the string length of the thin thread increased from 120cm to 150cm, there was a significant increase in the number of crossings compared to the shorter string length. It was also found that the crossings of the thin thread with the paper box were less variable and the string did not stick to the sides of the container as much as in the experiment with the rough, wooden box.

Conclusions/Discussion
As the number of crossings increases, there is more variability in the results when the number of crossings is larger. The strings with narrow curves and higher flexibility yielded a higher likelihood to knot than the strings with wider curves.

Summary Statement
This experiment will investigate how the length of a string will affect its knotting ability.

Help Received
Mother helped count crossings

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Kyle E. Worcester-Moore

Project Number
J1827

Project Title
Is Magnetism Conserved?

Abstract

Objectives/Goals
For my project, I wanted to see if magnets are able to magnetize certain other objects without any effect on their own strength. I wanted to test this because I thought this might mean magnets do not follow the law of conservation of energy. I hypothesized that magnets are able to magnetize other objects without depleting their own strength.

Methods/Materials
My test used a magnetometer, several screws and several neodymium magnets. By measuring the magnetic strength of the objects before and after magnetizing the screw with the neodymium magnets, I was able to determine change in strength of the magnet, and the strength of the newly made magnet (screw).

Results
My results showed no noticeable change in the magnetic strength of the neodymium magnets, and a noticeable but varying change in the magnetic strength of the screws.

Conclusions/Discussion
The major issue with my experiment was the limited accuracy of the magnetometer used. My results show that my hypothesis was correct, magnets are able to magnetize other objects without depleting their own magnetic force. Although these results seem to violate the law of conservation of energy, given that magnetism is not a type of energy, this experiment does not break the law of conservation of energy.

Summary Statement
Do magnets retain their magnetic strength after they are used to magnetize another object?

Help Received
Father helped record data while I performed the experiment; Used magnetometer at CSUMB physics classroom.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Belal Zahran

Project Number
J1828

Project Title
Energy Levels in Different Light Colors

Abstract

Objectives/Goals
The objective of this project is to find out if different light colors contains different amounts of energy. My hypothesis was Red will contain the highest level of energy.

Methods/Materials
Four different colors of filters (red, blue, green and yellow) were placed on a solar panel one after the other. The solar panel was connected to a digital meter. and directed toward the sun in the middle of the day.

Results
Red recorded the highest energy level while green was the least.

Conclusions/Discussion
Different colors of light do have different levels of energy

Summary Statement
Different colors of light contain different levels of energy

Help Received
My dad helped with connecting solar panel to digital meter

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Zoe Zawol

Project Number
J1829

Project Title
Is the Cosmic Ray Flux Greater at Higher Altitudes Than at Lower Altitudes?

Abstract

Objectives/Goals
My objective was to to determine if the cosmic ray flux is greater at higher altitudes than at lower altitudes. My hypothesis was yes; I reasoned that at higher altitudes cosmic ray particles have a smaller chance of interacting with atmospheric molecules than they do at the increasingly denser atmosphere at lower altitudes. Therefore, the cosmic ray flux should be greater at higher altitudes than at lower altitudes.

Methods/Materials
To perform my experiment, I built a cloud chamber to detect cosmic rays. I lined a small aquarium (chamber) with felt strips soaked in 99% pure isopropyl alcohol. I sealed the chamber with a metal plate, inverted it, and placed it metal plate down on top of crushed dry ice. A supercooled alcohol vapor cloud developed within the chamber. Ionized cosmic rays passing through the vapor caused visible condensation trails.

I tested my cloud chamber at different altitudes, video recording the trails. As a control, I placed the cloud chamber in an aluminum foil wrapped box, which I thought might block the cosmic rays. The videos revealed too many cosmic ray trails to accurately count, so I masked all but a small portion of the video screen proportional to a section of the cloud chamber. I counted the trails in that portion and calculated the cosmic ray flux per cubic centimeter per minute for each altitude.

Results
My results showed that at higher altitudes, the cosmic ray flux is greater than at lower altitudes. I reasoned that this is because the increasing density of the atmosphere provides more opportunities for cosmic rays to interact with other particles as they descend, resulting in fewer cosmic rays reaching the lower altitudes. I also found evidence that variations in the solar wind may affect the cosmic ray flux.

Conclusions/Discussion
My conclusion is that the cosmic ray flux is indeed greater at higher altitudes than at lower altitudes.

Summary Statement
The central focus of my project was to determine whether the cosmic ray flux is greater at less dense higher altitudes above earth than at increasingly denser lower altitudes.

Help Received
Dad helped me buy materials, drove me to the various altitudes to conduct my experiments, and talked with me about my ideas.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Bronson C. Zell

Project Number
J1830

Project Title
True Perpetual Motion Machines: Lessons Not Learned from The Laws of Physics

Abstract

Objectives/Goals
If a perpetual motion machine can be made then it could be used to create electricity for free? The purpose of this project is to find out if a perpetual motion machine is possible and if it could produce free electricity.

The independent variable in this experiment was the design of the machines. The dependent variable was success rate of the machines. The control of this experiment is gravity, magnet strength, chain, bearings, spring, sprockets and wheels.

Methods/Materials
Four perpetual motion machines were made; the Overbalanced Chain, the Overbalanced Lever Wheel, the Overbalanced Magnet Wheel and the Spring Engine.
Materials Needed: Overbalanced Chain: 4 inch x 18 inch plywood, (5) Screws, (5) Idler Sprocket, and a 40 inch Chain
Overbalanced Lever Wheel: (8) 3 inch Strap hinges, (8) Weighted knobs, Screws, Bicycle wheel, and Wheel fork
Overbalanced Magnet Wheel: Cubic inch high powered rare earth magnet, 1inch Steel Bearing Ball, 8½ inch Diameter Aluminum wheel, Aluminum stand, 1 inch wide Aluminum strap 8 ½ inch long, Stainless steel screws, (8) Brass tubes ½ inch long, Brass nuts, and Steel bolt
Spring Engine: 4 inch Compression Spring, Telescoping cylinder to hold spring, Skateboard wheel, Aluminum stand, 6 inch Plastic wheel, Steel bolt and Wheel fork

Results
The purpose of this experiment was to determine if these specific perpetual motion machines are possible. The results collected from the experiment show that the perpetual motion machines involved in this experiment are not possible, so they couldn#t produce energy. Research indicates the perpetual motion machines are impossible because they violate the first or second law of thermodynamics or both.

Conclusions/Discussion
According to the data collected, the hypothesis, if a perpetual motion machine can be made then it could be used to create electricity for free, appears to be not supported.

None of the perpetual motion machines in the experiment were successful, not even one rotation was achieved. Since these experiments didn#t work is not to say that can#t work better, there could have been

Summary Statement
If a perpetual motion machine can be made then could it be used to create electricity for free.

Help Received
My mother and father help motivate me with my research and building the devices.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Ananya V. Madabushi

Project Number

J1899

Project Title

IM Free: Do the Fastest Freestyle Swimmers Have the Fastest Individual Medley Time?

Abstract

Objectives/Goals

The objective was to see if the fastest freestyle swimmer in an IM race would have the fastest time. The experimenter hypothesized that 85% of the fastest freestyle swimmers in an IM race would have the fastest IM time.

Methods/Materials

Swimmers ages 11-12 and 13-14 both girls and boys were used. The swimmers were recorded doing a 200 IM race with a video camera and the times were recorded with a stopwatch. The raw data was entered into a table. The raw data was then sorted from fastest to slowest IM times and fastest freestyle time fastest to the slowest time. The data from these tables were analyzed statistically.

Results

The first four experiments had 87.5% of the fastest IM swimmers be the fastest freestyle swimmers. In the next four experiments, 47% of the fastest IM swimmers were freestyle swimmers. For all eight experiments 68% of the fastest IM swimmers were the fastest freestyle swimmers.

Conclusions/Discussion

In the Individual Medley race, 68% of the fastest IM swimmers were the fastest freestyle swimmers. This shows that the three other stroke also have a big impact on the race. Most people have a specialty of the three other strokes. This means, they have better than average times in their specialty stroke. This proves that to be good at IM all the strokes need to be good not just one. Freestyle does have an impact on IM, though if you are good at freestyle and all the other strokes, you have a high probability of getting the fastest time.

Summary Statement

To determine the correlation between the freestyle split time and the overall Individual Medley time, to see the effect of freestyle on Individual Medley and to check if the fastest freestyle swimmers truly are the fastest IM swimmers.

Help Received

Parents helped by reading papers, giving advice and supporting the project. Mentoring was by Shaun Whitaker, the Quantum Flash swim team coach. Mrs. Gillum, science teacher, helped, gave advice and showed us how to work on the project.