CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Arden Akarakian; Armen Gharibans

Project Number
S0201

Project Title
Seismic Bearing

Abstract

Objectives/Goals
The objective of our project is to determine if putting base isolators in the foundation of buildings would decrease the displacement of the building, making it a safer environment for people during an earthquake. We hypothesize that putting base isolators in the foundation of buildings would decrease the displacement of it.

Methods/Materials
We used particleboard for the floors of the building, threaded rods for the columns, bolts to attach the floors to the columns, and springs for the base isolators. To simulate and earthquake, we taped six batteries onto a rotating wheel attached to a motor and adjusted it to hit the side of the table, which the building was on. This way, it was the same magnitude earthquake from one trial to another. We measured the displacement by taping a plain poster on the wall behind it, which had centimeter divisions. We turned on the machine and tried reading the number of divisions. We also tried putting pencils on the edges of the building to mark the poster. Both these gave the same result, so we recorded it in our notebook. We wanted to see if base isolators would work in all conditions, so we also put weight on the building and recorded the results.

Results
Our hypothesis was correct. The building with base isolators in its foundation was displaced less than a building with a conventional foundation. We also observed that the base isolators work when weight was put onto the building. When the weight was put onto the structure, the displacement of it was less both with and without base isolators.

Conclusions/Discussion
We found that base isolators decrease the amount of displacement of the building and are a good way to protect people during an earthquake. We concluded that the reason why the building with more weight was moving less was because since it was heavier, it needed more force to move it. Since the force was the same, the heavier building was moving less than the lighter building.

Summary Statement
We want to find a way to create a safer environment for people during an earthquake.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Brandon Blum; Derek Chang; Brad Gussin; Csaba Petre

Project Number

S0202

Project Title

Convection and Heat Transfer in Ferrofluid

Abstract

Objectives/Goals

The purpose of our experiment is to demonstrate the benefits of convection and heat transfer in ferrofluid, a magnetic liquid. We will show 1) a plan for a ferrofluid heat transfer experiment that we designed to fly on the space shuttle next year as an extension of our experiment. Our team won the 2002 NASA Student Involvement program competition in the Space Flight Opportunities category that allows us to fly our experiment on the space shuttle. We will also demonstrate 2) a set of ground experiments to show convection in ferrofluids without the help of gravity, 3) a computer simulation of ferrofluid heat transfer that we wrote, and 4) a completely passive, non-mechanical ferrofluid heat pump.

Methods/Materials

We tested convection and heat transfer in ferrofluid by measuring the temperature difference between two sides of a container of ferrofluid with an elecrical bridge circuit. We used plastic containers, electric heaters, and permamnent magnets in our experiment. We also wrote a computer simulation program to simulate heat transfer in ferrofluid. We used the finite element method to solve the one- and two-dimensional heat transfer differential equations. We wrote our code in C++.

Results

We developed an experiment to test ferrofluid convection in space; this experiment will be launched on the space shuttle next year. We sent our flight ready experiment to NASA this month. We also have developed and tested a ground experiment that shows that convection and convection-based heat transfer can occur in ferrofluid without the help of gravity. Classical convection does not occur without gravity, but through our experiments we proved that convection can be created using ferrofluid and used to induce heat transfer in microgravity. In addition, we have built a heat pump device that uses ferrofluid for non-mechanical, passive heat transfer. We wrote a C++ computer program to simulate heat transfer in ferrofluid. We have compared our simulation results to our measured data. They are in good agreement.

Conclusions/Discussion

From our research, we have found that it is possible to induce convection and improve heat transfer in ferrofluid without gravity. The system requires only a heat source and a permanent magnet. Ferrofluid based convection and heat transfer can also be used to build a completely passive and non-mechanical heat pump. Heat transfer in ferrofluid can be accurately simulated by computer models.

Summary Statement

We demonstrated that in ferrofluid, convection can be created without the help of gravity, and heat transfer can be improved.

Help Received

Dr. Finlayson of University of Washington supplied ferrofluid; Mr. Gussin of Raytheon Co. helped assemble circuit board; Dr. George Valley of Aerospace Co. and Dr. Peter Petre of HRL helped with consulation

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Valarie Bochenek; Jessica Lau

Project Number
S0203

Project Title
Determing the Most Optimal Structure to Resist Specific Seismic Waves

Abstract

Objectives/Goals
The purpose was to determine which structural designs withstand secondary, primarily, and Rayleigh waves through the most applied force. Three structural designs were created and three waves were applied to each structral design; secondary, love, and Rayleigh.

Methods/Materials
We also looked into several articles and magazines featuring earthquake damage to cities located along fault lines. We then had to decide how to build a device that would simulate three earthquakes. This is referred to as a shaker table, in which we would pull or tilt the platform to simulate a specific wave. We built three different sets of buildings; Type 1 was with cross beams, Type 2 was with a base foundation, stilts, and cross beams, and Type 3 was with base foundation, stilts, diagonal cross beams, and single cross beams.

Results
The data indicates that the stronger the interior fortification and base foundation, the ability of the structure to resist a specific seismic wave was stronger than a structure with just cross beams (Type 1). In the general observation of building designs on compatibility in specified earthquake zones, Type 1 was highly responsive to complete collapse in comparison to the Type 3 building. Type 2 design was more able to withstand Raleigh waves, than primary or secondary, based on the strong foundation and stilts to balance the cross beams during the rolling motion. Type 3 responded to earthquakes the strongest as hypothesized. No complete collapse occurred in the primary, secondary, or Rayleigh wave. Type 3 buidling is the strongest in all three emitted waves, and thus is recommended to be constructed in all earthquake zones.

Conclusions/Discussion
The major issue that posed a threat to the validity of the exeriment was the use of the clay. The experiment was focused on structural design, and the dependency of clay to hold the strucures together, could have defeated the experiment's purpose by making the test results directly related to the durability of the clay. It is very difficult to work around this possible error,so the only way to resolving the situation, without abandoning the experiment's purpose would to concentrate more on historical events and statistics. We could investigate past earthquake and the seismic waves; then look into what main buildings were damaged and identify those structures.

Summary Statement
To determine the most optimal structure that can resist three specific seismic waves.

Help Received
Father helped to design the shaker table.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Esteban Castaneda

Project Number
S0204

Project Title
It's Got the Power

Abstract

Objectives/Goals
To see if solar, wind, and sound power are more efficient than gas power, as well as feasible and cost effective.

Methods/Materials
R/C cars were acquired, electric R/C car was modified with solar cell, fans, and microphone to produce energy. Test each car three times to see which is most efficient.

Results
Battery life doubled, 69% more distance from modified cars. Gas powered car is in between. Unfodified R/C car is least efficient.

Conclusions/Discussion
Modified car is more efficient and also runs longer due to modifications.

Summary Statement
Modifying an R/C car to run on alternative power sources to improve efficiency.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Jason R. Castillo

Project Number
S0205

Project Title
Backpack Straps: Does the Length Affect the Force Exerted on the Back?

Abstract

Objectives/Goals
The objective is to determine whether or not the length of the straps on a backpack has any effect in how much stress is exerted on the back as represented by my testing device.

Methods/Materials
I built a testing device to represent a back constructed from wood, PVC pipe and connectors, galvanized pipe and flange, a garage door spring and various levels. I filled the platform with bricks as counterbalance. I used a standard school-type backpack for my testing. I marked each strap at 1" intervals from 16" to 30". I tested each strap length at weights from 10pounds through 35 pounds at 1 pound intervals. I recorded the angle of the spring under each weight(at 1 pound intervals) and strap length (at 2" intervals)and measured the angle (bend) using a goniometer with an attached level.

Results
The degree of change of angle from vertical was dramatic as the strap lengths increased. Under the 35 pound weight the 16" length straps had an angle of 39 degrees. Uner the same 35 pound test weight, the 30" strap length had an angle of 91 degrees.

Conclusions/Discussion
The strap length has a definite effect on the stress exerted on a back (as represented by my testing device). The difference between the 16" strap length to the 30" strap length showed an average change of 701%. The range of difference between the minimum and maximum straps was from 227% to 1000% greater in comparison. My data clearly shows that the longer straps are critical in minimizing the stress on the back as the longer straps showed a much greater angle.

Summary Statement
My project is testing whether or not the strap length on a standard backpack matters to the amount of force exerted on a back.

Help Received
An employee from a hardware shop helped me find the spring and metal parts>

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Deng-Kai Chen

Project Number
S0206

Project Title
The Effect of Cross Drilling and Slotting on Rotor Temperature

Abstract

Objectives/Goals
The objective of my experiment was to determine the effect of cross drilling and slotting on brake rotor temperature as well as the effect on the temperature of the entire braking system.

Methods/Materials
An automobile was driven strenuously around a 4.8 kilometer preset course. Immediately afterwards the front brake rotor temperature was measured through a non-contact infrared thermometer and then recorded. Caliper and rim temperature were also recorded. This process was repeated five times. The car was then driven around a 9.2 kilometer preset course with the same procedure which was also repeated five times. Afterwards the stock brake rotors were removed from the car and cross drilled/slotted ones of the same dimensions were installed. With the new rotors, the car underwent the same procedure for testing and the results were recorded.

Results
On the 4.8 kilometer course, the cross drilled/slotted rotors ran on average 20% cooler than their stock counterparts. On the 9.2 kilometer course, the cross drilled/slotted rotors ran on average 35% cooler than the stock rotors. However, there was no significant difference between the caliper and rim temperatures measured when the car was equipped with the stock rotors and when the car was equipped with cross drilled/slotted rotors.

Conclusions/Discussion
In the tested application, I can conclude that cross drilling and slotting has a definite cooling effect on brake rotors. The cooling effect became more apparent as the car was driven for a longer duration. I can also conclude that for this application, cooler rotors did not translate into a general cooling of the overall brake system as there was little or no difference between the temperatures measured of the caliper and rim on the cross drilled/slotted equipped car and on the equipped stock car.

Summary Statement
The intent of my project was to determine if cross drilled and slotted rotors run cooler than non-cross drilled and sloted rotors.

Help Received
Mom helped with display board, Dad lent me the car, recieved various information and opinions from people at acura-cl.com and acura-tl.com

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Byron Cifuentes; Eric Garcia

Project Number
S0207

Project Title
Into the Deep: Ion Propulsion Systems

Abstract

Objectives/Goals
To find if it is possible to create an ion propulsion device in an aqueous medium using the principles of a capacitor. We belive it is possible to accomplish this if we use a capacitor to create a convetion current of an ionic compund within the system resulting in a concentration difference within differnt regions of the system.

Methods/Materials
Materils:
PVC piping, distiled H(2)O, 10 gallon tank, galvanized wire mesh, fountain pump, hose, Ionic Solution (FeCl(3) and ZnCl(2)), Volt meter, battery charger, and spectrometer.

Procedure: We baisically creted a capicitor using a PVC rectanguolar frame and attaching the galvanized mesh to both sides then pumping our ionic solution (initially FeCl(3)) in hopes thatr the capicitor creates a convention current. We accumulated data by measuring the concentration of differnet regions of the system using the spectrometer. If there was a significant concentration difference we knew our hypothesis was correct. We later found this method unsuccesful so we conducted the expiriment again only this time we usex a differnt ionic solution and placed a solenoid in the middle of the capacitor to achieve the desired results.

Results
Our first trial proved unconclusive showing a constant concentration difference throughout the system. After implementing a few modifications (adding a solenoid and changing the ionic solution to ZnCl(2)) we concentration difference throughout the system proving our initial hypothesis correct.

Conclusions/Discussion
We found that it is possible to create an ionic propulsion divise using a capicitor howver a devise is needed to nuetralize charges as they exit the source so that a propulsion can be achieved, in our case we used a solenoid.

Summary Statement
Using the principles of a capacitor and electron negativity principles we were able to contruct an ion propulsion devise in an aqeous medium.

Help Received
Used lab equipment from Centennial High School under supervision of Mr. Phil Beach

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Aaron M. Cox

Project Number
S0208

Project Title
If the Air Chamber Is Increased in Volume at a Constant Pressure in the Air Cannon, Then the Projectile Travels Farther

Abstract

Objectives/Goals
The objective was to determine if the volume of compressed air in a compressed air cannon would affect the distance a projectile will travel.

Methods/Materials
An air cannon and three compressed air chambers were constructed out of PVC pipe. The three chambers range in size from 30# x 2#, 45# x 2#, and 60# x 2#. Each compressed air chamber was individually attached, filled to a pressure of 100 p.s.i , and used to launch a projectile five times. Each projectile was measured and then cut to a uniform size. The travel distances of the five projectiles from each of the chambers were measured from muzzle (front) of the barrel to the rear of projectile. Data was analyzed and compared.

Results
The projectiles fired from the largest (60#) compressed air chamber consistently outdistanced the projectiles fired from the two smaller compressed air chambers. The averaged data showed that each additional cubic inch of air chamber propelled the projectile 9.49 inches.

Conclusions/Discussion
My conclusion is that the projectiles fired from the largest of the compressed air chambers flew farther because the projectiles had an increased force from the compressed air to propel them further out of the cannon.

Summary Statement
Showing that larger volumes of compressed air at a constant pressure propel projectiles further.

Help Received
Father helped record projectile distance and helped transport equipment to test site.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Logan J. Creighton

Project Number
S0209

Project Title
Can a Thermosyphon be Used Effectively as a Passive Heating and Cooling System?

Abstract

Objectives/Goals
To test a thermosyphon to see if it will effectively heat and cool a house without using any form of energy other than the heat of the sun which is preexistent. It is intended to be simple to build so as to meet the need of heating and cooling a house without using energy created by burning nonrenewable resources.

Methods/Materials
Two 12x18 inch shed style houses were built. A tank and a copper coil, consisting of 11 vertical 1/4 inch pipes, were installed on one of the houses. Three thermometers with remote sensors were attached to the houses to record the interior temperature of both houses as well as the ambient air temperature and the coil's temperature. The temperatures were recorded every hour from 9:00 A.M. to 8:00 P.M. for one test. Ten tests were made with the tank full of water and another ten with the tank full of ammonia (I ended up with a total of over 1,500 individual recordings).

Results
The thermosyphons had a total average temperature variation of 36.27 degrees Fahrenheit compared to the control's 46.81 degrees Fahrenheit variation and the ambient air's 38.25 degrees Fahrenheit variation.

Conclusions/Discussion
Based on my results I can conclude that my hypothesis was correct. A thermosyphon can be used effectively as a passive cooling system. It can heat although it is not as effective. Through both experiments the thermosyphons had smaller temperature changes than both the control and ambient air.

Summary Statement
This project proves that solar power, through the use of a thermosyphon, can indeed be used effectively to cool a house, reducing or eliminating the need for active cooling which depends on energy made by burning nonrenewable resources.

Help Received
Mother and sister proofread and father supervised.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Alexander L. Early

Project Number
S0210

Project Title
Comparing 4 and 6 Legged Motion

Abstract

Objectives/Goals
The Goal of my project was to see the differences between walking with 4 and 6 legs. I compared the results i got to what real animals with 4 and 6 legs are like. This experiment has a lot of controls to it, such as the footsize, total energy of the motors, and robot size

Methods/Materials
I made a 4 and a 6 legged walker out of legos. Then i got 3 terrain samples and ran the robots across each 2 times. I used a grass mat, a sand pit, and a smooth board. I recorded the times it took for the robots to cross each sample and made notes on what the robots acted like as they crossed.

Results
I found that my results were very close to the attributes of 4 and 6 animals. The 6 legged had much better balance and turning, and the 4 legged walker was able to move faster since it had less legs to coordinate.

Conclusions/Discussion
From my results, i now know why animals have as many legs as they do. It also helps me understand how a strange animal will probably behave based on the number of legs it has. This project is idea for further research; it would be interesting to make 2 and 8 legged walkers and to try different changes between the robots, like body size and foot shape.

Summary Statement
Comparing the differences in 4 and 6 legged walking.

Help Received
Internet gave me idea for what robot would look like.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Britta L. Jewell

Project Number
S0211

Project Title
Response of Smoke Detectors to Different Types of Fire Conditions

Abstract

Objectives/Goals
Smoke detectors are effective in saving thousands of lives every year from fires in residential homes. Two technologies of smoke detectors, ionization and photoelectric, are widely available. Because these two detectors have different designs, their reaction times vary depending on the nature and amount of smoke present. Understanding reaction time properties to common smoke conditions that might arise in residences provides valuable information to guide the appropriate location of detectors. The objective of this experiment is to compare the reaction times of an ionization detector to a photoelectric detector under a variety of fire conditions.

Methods/Materials
An ionization detector and a photoelectric detector were tested under wood smoke, cooking smoke, and cloth smoke conditions. A paired design, in which both detectors, attached to a wooden rod, were exposed simultaneously to a series of fires, was used to control variables such as the amount of smoke and distance of the smoke detectors from the fire source. For each fire, the detector response times were measured with two electric timers. Thirty-five replicates of the experiment were performed for the three types of fires. Mean response times were compared using graphs and the paired t-test.

Results
The ionization detector had a lower mean response time to both the wood and the cooking smoke, and both tests yielded statistically significant results. The photoelectric detector had a lower mean response time to the cloth smoke, but the results were not definitive enough to be statistically significant.

Conclusions/Discussion
The location of detectors and minimization of false alarms are both important considerations for their effective use. The results suggest the use of an ionization detector in places subject to flaming fires, such as a living room. Alternatively, a photoelectric detector may be preferable in basements, or other places where smoldering fires might occur. Dual detectors, which use both ionization and photoelectric technologies simultaneously, are optimal.

Summary Statement
This project compared the mean response times of ionization and photoelectric smoke detectors under three different fire conditions.

Help Received
Father helped operate the timers.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Michael A. Johnson

Project Number
S0212

Project Title
Lubrication: Performance under Pressure

Abstract

Objectives/Goals
Through my project I wanted to find the lubricantthat would withstand the most amount of pressure and produce the least amount wear on a rod and pipe assembly.

Methods/Materials
Six steel rods of the same length were fitted into six steel pipes of the corresponding diameter. Each of these rods was with one of the test lubricants. The rod with the lubricant was rotated within the pipe at extreme speeds with a drill. After the lubricant wore off and the drill locked up, the trial was over. Increasing amounts of pressure were then added to each rod and pipe assembly.

Results
The rod and pipe assembly that was applied with the graphite lubricant was able to be rotated for the longest amount of time without locking up the drill. It also was one of the lubricants that produced the least amount of wear.

Conclusions/Discussion
Graphite is the best lubricant to use when in a rod and pipe assembly rotating at high speeds and in extreme pressure conditions.

Summary Statement
This project is testing various lubricants under different amounts of pressure.

Help Received
My father helped me obtain the rod and pipe assembly and he operated the drill.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Matt R. Larabee

Project Number
S0213

Project Title
The Heat Extractor 2002

Abstract

Objectives/Goals
By using thermal dynamics and a concentrated consolidated heat devise, I planned on increasing the efficiency of the common household fireplace.

Methods/Materials
By placing the heat extractor into a fireplace and adding certain alloys, I timed and recorded how long it takes to heat a room up and what temperature the extractor can heat the room up to. Copper tubing was inserted into certain positions and various alterations and deterimined the thermal dynamic output.

Results
Between the heat extractor, the heat extractor w/metal sheet, and the heat extractor w/consolidated appratus, the apparatus worked the best. Also this devise is very cost effective.

Conclusions/Discussion
I concluded that the more alterations added to the heat extractor, the more efficient the system was.

Summary Statement
Increasing the efficiency of the common fireplace.

Help Received
Grandfather helped design the extractor.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Noel L. Lopez

Project Number
S0214

Project Title
Motors, Motors & More Motors -- Original Electric Motor Designs

Abstract

Objectives/Goals
Electric motors are being used more due to increased demand for cleaner vehicles, energy and technology. Standard electric motors are only about 30% efficient, leaving significant room for improvement. Highly efficient electric motors need to be designed. In response to this problem, I created and built some innovative designs. I predicted my original motors would be more efficient than the standard design, and Motor 4 most efficient.

Methods/Materials
I tested the models of my designs by comparing them to a model I also built of a basic electric motor with magnets around electromagnets, a commutator and brushes (Motor 1). Motor 2 has brushes and a commutator, but I placed magnets at both sides of the electromagnets. Motor 3 is a new brushless design with circuitry and a magnet switch. Motor 4, a simpler brushless design, has perpendicular magnets and a magnet switch. My main test method involved measuring speed, power in and power out as each model lifted weights with string and a smart pulley.

Results
Motors 2 and 3 proved more efficient than the standard electric motor, represented by Motor 1. Motor 4 tested least efficient. The first part of my hypothesis was correct. The second part regarding Motor 4 could not be verified.

Conclusions/Discussion
At least two of my designs will improve the efficiency of the electric motor when manufactured and refined using top quality industrial materials. Motor 4 requires a different type of magnet (rectangular bar-shaped instead of circular disk) to operate efficiently since its magnets are perpendicular to the electromagnets. My design innovations are effective for many current and future applications, including electric-powered vehicles and conversion of gas-powered vehicles to electric.

Summary Statement
I designed, built and tested models of three new electric motors, compared with a similar standard control model, to improve efficiency of the modern motor.

Help Received
Mother helped type report; Parents helped connect board; Used lab equipment at Mount Everest Academy under the supervision of Mr. Jim Edwards.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Alana S. Maiello

Project Number
S0215

Project Title
I Hit a Good Putt. Why Didn't It Go In? Did the Hole Move?

Abstract

Objectives/Goals
I have always wondered while playing golf if the construction of a golf ball and the material it is made out oever has an impact of whether the ball goes in the hole or not. Can the structure of a ball ahve a great effect on the result? The purpose of my experiment was to find out how much the constuction and cover material of a golf ball affects the distance of a consistent putt.

Methods/Materials
Obtain all the golf balls that will be tested and used during the experiment. Find the construction and cover material of each. Give each ball a number. Obtain all materials needed to perform the putting of the balls. Construct "Puttsy," the structure that will putt the ball consistently each time. Go to the 1st green of Las Posas Country Club,a green of medium speed, and pick a level area with a level. Set up Puttsy and adjust all of its settings so that it is ready to putt each abll. Putt each ball three(3) times with the indicator-gauge on Puttsy measuring 3 feet for the three feet testing and 5 feet for the five feet testing. Record the distances of each ball.

Results
During the 3 feet test, the balls consistenlty rolled past 3 feet. The highest average for the covers was balata and the lowest was the urethane covered balls. The highest out of the construction types was the 2-piece balls and the losest was the 3-piece balls. During the 5 feet test the balls consistently rolled past 5 feet. The urethane covered balls once again had the lowest average and the trithane balls had the highest.

Conclusions/Discussion
My hypothesis proved to be correct. Different types of cover material and constructions showed to differ in the average distances, sometimes averaging almost a foot more than another cover material or cosntruction! The 2-piece balls had the highest averages for the construction types in both tests and the urethane covered balls had the lowest averages for the covers in both tests. This shows consistency in my results, despite the distance tested. Although no ball rooled exactly 3 or 5 feet in both test, the balls seemed to roll further past 5 feet than they did 3 feet, because of the extra speed relayed onto the ball when hit after being taken back. A notable observation is that each ball rolled a little differently when putted. When a ball was hit 3 times, it rarely landed in the same spot.

Summary Statement
My project tests wheher golf ball construction types and cover materials ahve an affect on the distance they roll in a consistent putt.

Help Received
Dad helped carry materials and drived me to golf course, Randy Poorboy helped construct Puttsy

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Paul K. Mithun

Project Number
S0216

Project Title
The Effectiveness of Different Concentrations of Protective Gel to Prevent Head Trauma

Abstract

Objectives/Goals
The objective was to find if highly concentrated gelatin wrapped around an object inside a solid containter would prevent damage during an impact.

Methods/Materials
Six concentrations of gelatin were formulated at 15, 30, 45, 60 and 90 grams/liter. The control was at 0 g/l. Twenty milliliters of each batch were poured into 30 identical Dixie cups (5 cups per level) and were placed together to consolidate. An egg was placed rightsideup in every cup, was stabilized with cardboard and was dropped at exactly meter. I then recorded the damage done to the egg.

Results
I recorded a few different measurements. I found that as the the concentrations became higher, there were a fewer total number of cracks on the egg. Also, as the concentrations increased the depression left in the gel was lesser. Overall, the qualitative status of the eggs were that the lower concentrated eggs suffered much more damage than the higher concentrated ones.

Conclusions/Discussion
From my results, it seems that a highly concentrated gelatin layer would be beneficial and would ameliorate the protective qualities of helmets. This could be applied to modern sports and bicylce helmets and could help save lives.

Summary Statement
My project is focusing on a way to make sports helmets safer and more protective

Help Received
I accomplished this project independent from outside help

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Allison L. Orum

Project Number
S0218

Project Title
The World of Polymers

Abstract

Objectives/Goals
My objective was to conclude in which direction you can stretch a strip of plastic grocery bag further.

Methods/Materials
I obtained a plastic grocery bag and cut it into strips. I stretched the strips that were cut out of the bag horizantally and vertically. Then with a apparatus that I built I stretched the strips and measured them. I compared the results and came to my conclusion which is backed up by my research.

Results
The horizantal strips stretched further than the vertical strips. My data showed that the averages of horizantal lengths were longer. And my averages of vertical averages of lengths were shorter.

Conclusions/Discussion
My conclusion was that horizantal strips stretch further than vertical strips stretch. This is because of the way the structure of the polymer chains assemble of the machines that manufacture large sheets of plastic grocery bag material.

Summary Statement
My project is about stretching strips of plastic grocery bags orientated in differrent directions, and then comparing which one stretched further.

Help Received
Mr. Bodily helped me think of project and edit my board; My mom and dad helped me assenble and transport board; Mr. Brown & Mr. Downs that also edited and revised my board; My friends' parents that came to our school's science fair and interviewed us.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Chrysanta Patio; Nonafaye Williams

Project Number
S0219

Project Title
Harnessing the Sun: Determining Economical but Optimal Solar Reflectivity through Design and Material

Abstract

Objectives/Goals
Find a low-cost material combined with cost-effective design that produces the most reflective sunlight to a given focal area.

Methods/Materials
Research began in December, and by late January we visited three Solar Electric Generating System Plants in the High Desert region of Southern California. We set up two 500-watt halogen lamps, and arranged each type of material in a 30.5 cm x 30.5 cm array around the lamps to reflect light onto four solar cells each measuring 15.25 cm x 15.25 cm. We took note of array angles, distance from light source, and corresponding voltage produced by solar cells for each array setup. Tests were conducted at night to limit light energy, specifically to the output of the lamps.

Results
Of the five materials tested, the reflective film gave off the most light as evident by the DC voltage output of the solar cells, while the compact discs gave off the least. Angling the material did have a significant impact on voltage variation because at 180 degrees, each material gave off its maximum amount of light.

Conclusions/Discussion
At the end of the experiment our hypothesis proved inaccurate. The mirrors ranked second in reflectivity levels, while the reflective film was superior in light reflectivity. The foil would be the most economical, but not as effective. Finally, the mirrors ranked relatively high on the amount of light given off, but proved most expensive.

Summary Statement
A project that determines the type of material that has the best light reflectivity, and at the same time is inexpensive.

Help Received
Father helped with use of wood working tools and construction; Partner's father helped with supplies; SEGS Plant gave us information and background on solar electricity.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Alison R.M. Richins

Project Number
S0220

Project Title
The Self-Sipper

Abstract

Objectives/Goals
The goal of my invention was to create a cup for people who have difficulty drinking liquids due to permanent or temporary disabilities.

Methods/Materials
After visiting a hospital I saw patients who required assistance drinking and some who had liquids tea-spooned into their mouths. At my school, there are students who need assistance drinking. I wanted to think of a way to foster independence of patients and students with limited abilities and allow them to drink on their own. Also I noticed that some patients could not suck liquids through a straw due to surgery or stroke. I had to think of a way to get liquid into the mouth without sucking and without spilling.

Results
My finished product, "The Self-Sipper," is a device that allows a patient to drink with one hand and push a button to syphon liquids into their mouth. With the use of one hand, a person can syphon liquid into their mouth without on their own.

Conclusions/Discussion
The "Self-Sipper" can be used for home or hospital use. It fosters independence in patients and is

Summary Statement
A one-handed, self syphoning cup for people with limited abilities.

Help Received
Interviewed neighbor about cups used at the Stanford Stroke Center. Mother helped get supplies.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Kenneth A. Ross

Project Number
S0221

Project Title
Optimizing Fluidynes

Abstract

Objectives/Goals
The objectives for this project are to develop a stable Fluidyne Stirling Engine that can be created based on simple jet-feedback designs using glass tubing, from school and parts available at hardware stores. The design will be large and simple, allowing the engine to run as long as it has power and will be easy to adjust variables and find the most efficient configuration

Methods/Materials
Using a variaty of parts donated by my school, found in my garage and purchased at local hardware stores, A stirling fluidyne engine was built based on previous research. A hallogen light bulb was used to power the engine. A transformer was used to test the engine test its affectiveness at different power levels for each variable to determine the ideal configuration for the fallowing variable: The amount of water in the power column, the type of working gas, the placement of the heat source, and the use of a regenerator.

Results
The optimal configuration was found to be: Helium gas as the working air, a regenerator on the hot side of the displacer(where the teperature gradient is greatest), Minimal water in the power column, and when the heat source is placed at least 4 cm beneath the meniscus. The engine has runs as long as it has power. An unstable operating mode was discovered when too much heat was applied to the engine.

Conclusions/Discussion
1) An engine that can run as long as heat is supplied has been created using commonly available parts, proving my hypothesis correct
 a. It has run for over 9 hours straight without any performance drop
2) The engine has been adjusted to run for optimum performance
 a. Helium-filled displacer
 b. Regenerator on the hot side of the displacer
 c. Minimal water in the power column
 d. The heat source placed at least 4 cm beneath the meniscus
3) Because this Fluidyne only runs when the water is vaporized it can no longer be classified as a Stirling engine but rather a hybrid steam-Stirling engine.
4) I was wrong in following areas of my hypothesis:
 a. The engine will run better with more liquid in the power column
 b. The engine will run better when the heat is placed at the meniscus

Summary Statement
Designing and builiding a Stirling Fluidyne enigne, isolating variables that affect its performance and adjusting them to optimise the engine's performance.

Help Received
My father provided me with books and other recources about Stirling Engines. My father also helped me use Quatro Pro to create a graph based on data I collected. My science teacher, Mrs. Khalili, gave me advice for how to organize my display board.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Adrian Santos; Luis Silva

Project Number
S0222

Project Title
The Effect of Gear Size on a Spring-Powered Vehicle

Abstract

Objectives/Goals
The purpose of this project was to find the optimum gear ratio for a spring-powered vehicle, by testing it repeatedly and finding the average velocity achieved by each gear. We tested a 7.62 cm (3-inch) diameter drive shaft with a 10.16 cm (4-inch) diameter gear, 7.62 cm diameter gear, and a 5.08 cm (2-inch) diameter gear.

Methods/Materials
This vehicle was constructed primarily from 1-inch diameter PVC pipe. #T# connectors and glue hold the pipes together, and the wheels are mounted on lag screws driven into wood dowels rooted in the PVC pipe. The motor itself is a winch. Two bungee cords are attached to a 7.62-cm drive shaft. When the bungee cords are tightened, then released, the drive shaft turns a gear, which winds a rope attached to a stationary object. Therefore, the vehicle pulls itself along the rope, much like a cable car.

We test each gear with the vehicle, 5 times each to ensure accuracy. The vehicle travels 12 meters, and we record the time it took to travel the 12 meters. The gear setup that propelled the vehicle at a higher average velocity is considered the most effective.

Results
The 4-inch gear achieved an average velocity of 4.688 meters/second, while the 3-inch gear achieved an average velocity of 4.364 meters/second. The average velocity of the 2-inch gear was 4.149 meters/second.

Conclusions/Discussion
The test results confirmed our hypothesis. Although the two-inch and three-inch gears rotate faster, thus accelerating faster, the four-inch gear winds more rope with each turn, consequently achieving a higher top speed. This is crucial during the last five meters of the run, because once the vehicle travels roughly seven meters, the motor no longer produces enough torque to keep the rope taut, subsequently causing the winch to stop winding. Therefore, the vehicle travels the last five meters due to momentum. Since momentum equals mass multiplied by velocity, expressed as p=mv, the vehicle with the greater velocity will have a greater momentum. With more momentum, the vehicle would have a higher tendency to retain its state of motion, thus retaining its top speed for a longer time. Due to this fact, the vehicle with a greater momentum would have a greater average speed, in this case, the vehicle with the four-inch gear.

Summary Statement
We tested a spring-powered vehicle with three different gear sets, and found which gear setup propelled the vehicle 12 meters at a higher rate of speed.

Help Received
Uncle assisted in using drill press for axle holes

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Kristina Smith

Project Number
S0223

Project Title
A Study of the Influence of the Type of Reinforcement on the Structural Efficiency of Concrete Wall Panel Specimens

Abstract

Objectives/Goals
Will steel fiber reinforced concrete wall panels have strength characteristics that will meet or exceed the strength characteristics found in conventionally reinforced wall panels when bending and compressive forces?

Methods/Materials
Build manometer, deflection meter, manifold, steel forms, test stand, and 9 concrete wall panels(3 unreinforced, 3 re-bar reinforced, and 3 steel fiber reinforced). Tested wall panels using bending and compressive loads while measuring pressure and deflection.

Results
The wall panels containing steel re-bar showed strenght characteristics which were greater than the panels containg steel fibers and no reinforcement.

Conclusions/Discussion
Even though the strength characteristics did not exceed those of the re-bar, the fiber reinforced specimens showed characteristics that were quite similar to those with re-bar reinforcement. Both types of reinforcement gave the wall specimens# added strength and ductility.

Summary Statement
I studied the influen that the type of reinforcement has on the structural efficiency of full scale concrete wall panel specimens.

Help Received
Howard Turner - opperated crane, Joseph Engel - mentor, Mark Neal - assisted board construction

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Brodyjohn D. Stancliff

Project Number
S0224

Project Title
Evaluating Filtration Options

Abstract

Objectives/Goals
I did my project to draw a comparison between different aquarium filters available on the market for the first time aquarist wishing to start small.

Methods/Materials
I used 5 10-gallon tanks, each divided into two segments, to create 10 closed systems. I used five different types of filtration, power filter, power filter/undergravel filter combination, undergravel filter, sponge filter, and a control. Each tank also was equally lit, and had an equal amount of gravel. Five shrimp of the genus Macrobrachia were placed in each tank, and then the pH, carbonate hardness, general hardness, ammonia concentration, and nitrite concentration were tested daily over a two-week period.

Results
The power filter tanks did well initially, but not in the end. The undergravel/power filter combination tanks and the undergravel filter alone tanks did likewise. The sponge filter tanks did well for the duration of the experiment, and the control tanks quickly failed.

Conclusions/Discussion
Surprisingly, the cheapest filter available, the sponge filter, performed the best. When considering using a sponge filter, however, one should also consider the filter cartridges that need to be replaced every two weeks.

Summary Statement
My project tests different kinds of beginner's aquarium filters against each other for initial effectiveness.

Help Received
Father had materials industry contacts and design influences; Neptune's Reef tropical fish store contributed aquariums; Mr. Thomas Jett (science teacher) provided guidance

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Gregory S. Wiese

Project Number
S0225

Project Title
Sunshade

Abstract

Objectives/Goals
Objective: Three types of vehicle window shades were tested to assess their effectiveness in reducing vehicle interior temperature.

Methods/Materials
The three tested sunshades were made of nylon, foam or cardboard. Each were compared with each other and with a control of no sunshade. Temperatures inside and outside the vehicle were recorded every half-hour between 9:00 AM and 3:00 P.M. Measurements were made on sequential sunny days. Data were collected on two days for each shade and for control and the data averaged over the two separate measurement days. For statistical analysis the value of (Interior - Exterior)/Exterior temperatures was computed. The values of this ratio over three two-hour periods were compared using student's t-test .

Results
The numerical results are listed in table 1 in the log book (duplicated on display board.) During the first two-hour period (9-11AM) there was no significant difference between control values and any of the three window shades. During the second two-hour period (11AM - 1PM) each of the window shades significantly lowered interior temperature to at least the $p < .01$ (p=probability) level of significance. During the third two-hour period (1-3PM) each of the shades significantly lowered interior temperature to at least the $p < .001$ level of significance. There was no significant difference between the shades in their ability to lower interior temperature during any of the test periods.

Conclusions/Discussion
The three types of sunshade all significantly lower the inside temperature of the vehicle on sunny days. This effect became more pronounced as the exterior temperature increased. There was no statistically significant difference between the shades in their ability to lower interior vehicle temperature.

Summary Statement
Three types of vehicle window shades were tested to assess their effectiveness in reducing vehicle interior temperature.

Help Received
Grandfather: For use of his greenhouse thermometers. Mother: For help with producing backboard display. Father: For help with statistics. Mr. Bartel: For guidance.