CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Madina M. Ansari

Project Number
J1301

Project Title
Which "Wood" You Believe Is the Most Fire Retardant?

Abstract

Objectives/Goals
The goal of this project is to find the best wood type and fire-retardant solution combination. It was hypothesized that the painted, fire-retardant sprayed redwood would have the greatest performance.

Methods/Materials
This project tests three different wood types: pine, cedar, and redwood, with four different solutions: borax, copper sulfate, borax and copper sulfate together, and a commercial fire-retardant spray. Also tested was whether adding paint to the solutions improved the wood's fire resistance. The procedures of these experiments included treating each wood type in the four different solutions (the first experiment, non-painted, and the second, painted). There were 3 samples each wood type and solution combination which was burned in one minute increments on high heat using an outdoor grill. The weights of the wood pieces were recorded before and after burning. The results were compared and graphed using Microsoft Excel.

Results
Based on my results, I was able to discover four conclusions: the best combination of wood type and solution, the best overall solution, the best overall wood type, and whether adding paint increases effectiveness. It was found that the best combination of wood type and solution was the non-painted borax solution with redwood which lost an average of 1% of its weight. Fire-retardant spray on non-painted wood proved to be the best isolated solution, losing an average of 2% of total weight. Redwood proved to be the best wood type, losing an average of 4% of its weight. Finally, it was found that adding paint to the solutions does not prevent a significant amount of weight loss.

Conclusions/Discussion
My hypothesis was both supported and disproved in this experiment. It was hypothesized that the painted redwood treated with the fire retardant spray would be the most fire resistant. Redwood was the best overall wood type, and the non-painted wood pieces treated with fire retardant spray was the best overall solution. The combination of the two, however, was not the most effective- this is where my hypothesis was disproved. The results of my experiment and also further research proved to be beneficial to lumber and construction companies, and consumers. When constructing buildings and homes, whether in fire prone areas or elsewhere, consumers will know the most fire resistant wood type and solution combination, the best overall solution, and the best overall wood type.

Summary Statement
This project experiments with different wood types and solutions to find the combination that is most fire retardant.

Help Received
Mother purchased all the materials needed for this project and assisted me through experimentation; Science fair mentor guided me throughout experiments and in recording data.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Davis R. Boring

Project Number

J1302

Project Title

What Is the Best Material for a Helmet Lining to Reduce G-forces?

Abstract

Objectives/Goals

The objective is to determine the best material to create a safer helmet for impact sports by reducing g-forces upon impact, which may reduce the risk of athletes developing Chronic Traumatic Encephalopathy (CTE). The hypothesis was that a crushable material would decrease g-forces to the head by limiting rebounding behavior and spreading the impact over a longer time-frame with a constant deceleration.

Methods/Materials

Six materials were tested. The elastic modulus of each material was determined by testing specimens on a Materials Testing System. Helmet linings were made by designing a mold on CAD software and using a HAAS computer machining center to cut out the mold. A silicone skin bound the test specimens together. To test the helmet lining specimens, a Riddell 360 helmet was fitted with a test lining and placed on a dummy head with a three-axis accelerometer embedded inside. To simulate a severe football helmet impact, the dummy head with helmet was attached to a NOCASE drop test station and released from 5 feet, recording g-forces and high-speed video.

Results

The materials testing indicated that three of the materials were elastic and required a continuous increase in pounds of force throughout the compression test. Three materials were crushable and maintained constant load throughout the compression test. Two of the crushable materials (Mousse and Dry Foam) crushed at the same pounds of force, ~20 lbs. throughout the compression test. All three crushable materials performed with lower peak g-forces than the Riddell 360 control test lining- currently the official helmet of the NFL. The best lining, Dry Foam, performed with 30.1 less g-forces or a 25.2% reduction from the control.

Conclusions/Discussion

The crushable materials, with constant load displacement material behavior, resulted in the highest energy absorption. Upon impact (head drop test), the peak g-force was spread out over a longer period of time resulting in a lower peak g-force, thus supporting the hypothesis that crushable materials would outperform elastic materials. Because the crushable linings do not rebound upon impact, they perform best on the first hard hit, and would therefore have to be replaceable. Implementation of a one-time use crushable lining is feasible because as awareness of sports related brain injuries grow, new technologies for safer football helmets will be embraced.

Summary Statement

This project suggests an innovative and dramatic change to current sports helmets by using a crushable and replaceable helmet lining that could reduce g-forces by 25% over the current NFL helmet, thereby reducing potential for brain injury.

Help Received

Testing equipment, high-speed camera, supplies and mentoring at San Diego Composites under the supervision of President Robert Kolozs; Mother taught me graphing on Excel; my brother showed me how to use CAD software

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Carmon D. Brown

Project Number
J1303

Project Title
Fire Starters

Abstract

Objectives/Goals
The purpose of my project was to test if wood hardness affects the time it takes to start a fire when using a bow drill. My hypothesis was that if I use harder woods to start a fire, then the harder woods would burn faster because it takes more energy to turn the bow drill which would create more heat.

Methods/Materials
I checked my hypothesis by measuring the temperature change of a piece of wood after I rubbed it with a bow drill for 1 minute. I used six woods with different hardness for my experiment. The woods had Janka Hardness measurements from 450 to 1450. I made 4, 3/8 inch holes in each wood sample to help hold the bow drill. My bow drill was a 5/8 inch dowel. I used an IR thermometer to measure the temperature of each hole before and after my experiment.

Results
My hypothesis was wrong. The softer woods had a greater temperature change after rubbing them for 1 minute with the bow drill. These woods were rougher and created more friction with the bow drill, which made more heat. The softer woods came closest to 450F, which is the temperature that wood burns.

Conclusions/Discussion
Wood hardness does effect the time it takes to start a fire when using a bow drill. I also learned that the size and shape of the hole in the wood samples changed the results of my experiment. If I did my experiment again I would use a stronger bow and test more holes with longer drill times.

Summary Statement
My project showed how friction works by testing the effect of wood hardness on the time it takes to start a fire when using a bow drill.

Help Received
Dad helped prepare wood and do experiment; mom helped prepare parts of project display

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Zane J, Calini

Project Number
J1304

Project Title
Making the Strongest Concrete

Abstract

Objectives/Goals
This projects goal was finding the perfect ratio of sand to cement in order to make strong concrete. Because the world has been experiencing major natural disasters such as earthquakes, stronger and safer buildings are at demand. The concrete made was designed to help the creation of these stronger buildings for the safety of society.

Methods/Materials
During the experimentation of this project I used materials including Portland cement, 3/4 inch gravel, sand, and water. The equipment includes buckets, scales, mixing rods, cylinder molds, a shovel, a hoe, a mold, a thermometer, deep tray, and a compression machine. There were 2 main methods used in the making of the concrete. The first method was mixing the dry materials then adding the water to the mix, after thoroughly mixing the batch and placing the wet mix in the cylinder molds, the samples were placed in a controlled room. The second method was placing the samples in a compression machine to measure the compressive strength. The data was then taken from the machine and recorded.

Results
The results from the testing included many interesting facts. The amount of force the first batch (3:1 ratio of sand to cement) was able to withstand was about 10,000 kg while the fifth batch was able to withstand 30,000 kg. The other factor that increased the strength of the concrete was how long the samples were held in the curing room. The samples tested that were only held in the curing room for 3 days at most were able to withstand 17,000 kg while samples held in the curing room for 28 days were able to withstand 30,000 kg.

Conclusions/Discussion
The conclusions comparing the batch types and the change in ratio were truly amazing. The compressive strength of batch one to batch five was increased by about 300%. The ratio increase of cement proved to increase the strength exponentially. As for the amount of days the samples spent in the curing room, the longer the sample spent in the curing room, the stronger it would be. Although these facts can be used to find the strongest concrete mix, not all buildings will use this mix. The strength of the concrete really depends on the job. Many real life situations can be connected to this project deeming it useful and able to help society.

Summary Statement
The change in ratios of sand to cement from 3:1 to 2:1 can increase the strength of concrete by 300% or by 3 times.

Help Received
Grandfather helped send books to use for research; preformed part of testing at Nino & Moore (used equipment) under supervision of employees.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Gabrielle J. Charest

Project Number
J1305

Project Title
Will the Egg Break?

Abstract

Objectives/Goals
The objective of my project is to determine which material, air beads, memory foam, or fiber protects the eggs from cracking. Based on my research on the materials, the hypothesis is that the air beads will protect the egg the best because there are hundreds of tiny beads surrounding the eggs.

Methods/Materials
Three identical cylinders that were made of chicken wire, pull ties, and cellophane wrap. Each cylinder was labeled, wrapped and had a diameter of five by five and a height of three feet were constructed. Within each cylinder contained three white, non-organic, Grade AA eggs that were placed horizontally. On top of the eggs contained air beads, memory foam, or fiber. Each cylinder had a different material. The fill line for the materials was six inches from the bottom. A five pound weight was dropped from four heights, four times each six inches up. An average was concluded from the four times at the four points. In the process I constructed a stand that had a metal pan on top because the cylinder was not capped off.

Results
In trial one I dropped the weight twelve inches from the bottom of the cylinder, the average number of eggs cracked for air beads was 0, memory foam was 0.75, and fiber was 3. In trial two I dropped a weight eighteen inches from the bottom, the average number of eggs cracked for air beads was 0.75, memory foam was 2, and fiber was 2.5. In trial three I dropped a weight twenty four inches from the bottom, the average number of eggs cracked for air beads was 1.5, memory foam was 2.75, and fiber was also 2.75. In trial four I dropped a weight thirty inches from the bottom, the average number of eggs cracked for air beads was 2, memory foam was 2.5, and fiber was 3.

Conclusions/Discussion
In conclusion my hypothesis was correct; the air beads protected the eggs the best unlike the fiber and memory foam. The fiber was less dense, so almost all of the eggs cracked in each trial and in each height. This proved that air beads are an excellent material for packing fragile items and being used in a pillow.

Summary Statement
Three cylinders were made to test three types of materials, air beads, memory foam, and fiber; I conducted four trials by dropping a five pound weight from four different heights to see which material would protect three white eggs.

Help Received
My mother helped me buy the materials, assisted with the trials, and was the cleanup crew; Mr. McCready and Miss Smigielski, my teachers helped with advice and encouragement.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Maggie S. Chen

Project Number

J1306

Project Title

Thermosensitive Injectable Hydrogel for Localized and Controlled Drug Delivery

Abstract

Objectives/Goals

This project aimed to develop a thermosensitive injectable hydrogel that will form gel at body temperature. When loaded with antibiotics, the hydrogel can locally release the antibiotics to fight against bacterial infections.

Methods/Materials

First, I carried out parametric investigation with the hydrogel composition so that the gellation occured at 37°C, the body temperature. To make the hydrogel, I used the liquids chitosan aqueous solution and beta-glycerophosphate. Second, I loaded doxycycline, a wide-spectrum antibiotic, into the hydrogel and measured its release rate at 37°C. Because doxycycline is sensitive to UV rays, the release rate was measured by a plate reader. Lastly, I observed the antibacterial effect of the hydrogel formulation in stopping the growth of E-coli bacteria.

Results

The hydrogel formed a robust gel at 37 °C, using a rough volume ratio 1:7 of glycerol to chitosan. Although the drug release had a burst (dramatic increase of drug release) in the beginning, minimizing the amount of water in the hydrogel decreased that burst release. The full release would take 10-12 hours. After testing the hydrogel on stopping bacteria growth, there was a concentration of 8.1x10^9 bacteria/mL in the hydrogel without the drug, and a concentration of 1x10^9 bacteria/mL in the hydrogel with the drug. Overnight, the vial containing the hydrogel without drug had solution that was cloudy with bacteria growth, while the vial containing the hydrogel with drug had solution that was clear.

Conclusions/Discussion

The chitosan and glycerol solutions can form a gel at the body temperature of 37 °C. In order to form a robust hydrogel, a high concentration of chitosan is required. Decreasing the amount of water by directly dissolving the drug into the liquid hydrogel deterred the burst release and allowed for a smoother release rate. By decreasing the amount of water, I made the pores that encapsulated the drugs smaller, so the drug was more trapped in the gel. This is crucial in that the release of drug should be moderately steady so that not all the drug will disperse at once. It is also proved that the drug infused hydrogel staunched the growth of bacteria.

Summary Statement

My project is about developing a thermosensitive injectable hydrogel to localize and control drug delivery.

Help Received

I did this project in the Nanomaterials and Nanomedicine lab at the University of California at San Diego under the supervision of Dr. Liangfang Zhang and Dr. Weiwei Gao, who provided the safety training, equipment, and materials needed.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Matthew J. Cheng

Project Number
J1307

Project Title
Rust or Shine?

Abstract

Objectives/Goals
My objective was to find out what household liquid will take the rust off of pennies the best.

Methods/Materials
I selected 15 pennies of similar dullness. I picked 5 different household liquids: lemon juice, ketchup, dish soap, Coca Cola and white vinegar. I placed a penny in 2 tablespoons of each of the 5 liquids for 1 hour. After 1 hour, I removed the pennies, dried them off and recorded the results. The experiment was repeated 2 more times.

Results
I ranked the shininess of the pennies in each of the 3 trials on a scale of 1-7 (1= dullest; 7= shiniest). I averaged the rankings from the 3 trials for each liquid. My results were as follows: vinegar= 3.00; dish soap= 1.33; ketchup= 6.67; Coca Cola= 2.00; lemon juice= 5.00.

Conclusions/Discussion
Surprisingly, the best rust dissolving liquid was ketchup. This is because the main ingredients, tomatoes and vinegar, are acidic. Dish soap was the worst and had nearly no effect. This is because an object should be scrubbed with dish soap for maximum cleaning. Lemon juice was second best because it is highly acidic with a pH of 2.2. Vinegar was third best and Coca Cola came in fourth.

Summary Statement
My project investigates which household liquid takes rust off of pennies the best.

Help Received
My mom purchased my display board and some materials used in my project. She took me to the bank to get rolls of pennies.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Catherine M. Colella

Project Number
J1308

Project Title
Heat Be Gone: A Study of Heat Transfer in Metal Foams

Abstract

Objectives/Goals
To discover how heat moves through porous metal foams, why some work better as heat sinks or insulators than others, and how changing porosity, density, pores per inch (PPI) and shape affect effectiveness in dissipating heat.

Methods/Materials
I tested the steady state heat flow of foams of different materials, pores per inch (PPI), pore densities and shapes. Three tests where conducted: free convection, forced convection test (fan), and wet convection. Other tests were conducted: free convection tests of various shaped, finned and plated structures. Materials: Corning PC-35 hot plate, Ryobi infrared digital thermometer, ruler, timer, bladeless fan (air speed 1.2 meters per second calculated),various copper, aluminum, and carbon foams from ERG Corp. sample kit with technical data. Measured temperature every half-inch up the foam.

Results
Overall, the smaller the PPI, the less air got through the foam and the more surface there was for convection. In wet test, evaporative cooling was more effective than free convection and forced convection, while forced convection was more effective than the free convection test. In fin test an inch from the left and right of the center of the fin (beyond the base) the temperature dropped. In solid plate test, having plate touch heat source was more effective than foam touching hot plate. On the vertical copper 20PPI foam cylindrical doughnut test, it was overall cooler than the 20PPI copper foam square. In horizontal foam test doughnut test doughnut was the same temperature as the 20PPI copper foam square. In the carbon insulator test the higher the PPI, the better the foam acted as an insulator.

Conclusions/Discussion
Desirable in foam heat sink is a balance between a large PPI for large outside surface area convection and a small PPI for large longitudinal conduction through the foam. I could note in concept the effects upon Nusselt, Rayleigh, and Prandtl numbers with changes in foam type and experiment type. A finned foam would be a good consideration because of more surface area to dissipate heat. Evaporative cooling, or wetting the foam is a successful way to dissipate heat. If plated on one side it is better to have plate at the heat source. If a cylindrical doughnut foam were to be used as a heat sink it would be more effective to place the foam vertically than horizontally. If a foam were to be used as an insulator use a larger PPI.

Summary Statement
The purpose of my experiment is to explore heat transfer in various types of porous metal foams.

Help Received
Borrowed hot plate from a lab and took it home. Metal and carbon foam sample kit was provided by ERG Corp. Mother proofread report. Science teacher helped me put procedures together.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Aerin L. Creek

Project Number
J1309

Project Title
Insulating and Light Transmitting Properties of Silica Aerogel

Abstract

Objectives/Goals
I was introduced to aerogel by my science teacher, and soon became curious about testing the insulating properties of silica aerogel against the properties of other common insulators. Based on my research, I hypothesized that a solid block of silica aerogel would be the most effective, then granular silica aerogel, then the aerogel PolarPad, then air, then polystyrene foam, and finally cardboard. I also wanted to test its light transmittance to explore the possibility of using silica aerogel in windows.

Methods/Materials
I performed a total of 256 thermal test results, using an i7FLIR camera measuring to the 0.1°C. I took three readings of the temperature of each insulator on a hot plate heated to 100°C (after waiting for the temperature to stabilize). I switched the position of the materials three more times, taking three readings in each location (for a total of 12), in order to eliminate the variation of temperatures throughout the hot plate#s surface. I tested the transmittance of the aerogel by measuring the lux of four different colors of LEDs, with and without the aerogel in front of them.

Results
For the temperatures taken on the 100°C surface, the average temperature of the solid silica aerogel was 44.4°C, the granular aerogel averaged 50.3°C, the PolarPad aerogel with glue averaged 48.5°C, the PolarPad with less glue averaged 43.4°C, the foam averaged 58°C, the cardboard averaged 62°C, and the air averaged 63.6°C. I added fiberglass and the Foamular board as test materials after I formed my hypothesis. The fiberglass averaged 50.5°C, and the Foamular board averaged 50.4°C.

Conclusions/Discussion
I cut the PolarPad open and observed glue saturating the aerogel inside it, which I found negatively impacted its performance, by approximately 2°C at 100°C, and by 6°C at 200°C. Based on these results, I believe that the PolarPad should not be made with glue. According to my results, the silica aerogel block was the most effective insulator among those tested, which supported my hypothesis, but perhaps not as significantly as a higher-quality aerogel. I believe that among the best everyday energy-saving uses for aerogel would be in refrigerators and freezers. Another application is in skylights (as indicated by the results of my transmittance experiment, because silica aerogel is translucent, but not transparent). Since aerogel is so expensive, I recommend using cheaper insulators for many applications.

Summary Statement
I tested the insulating properties and light transmittance of silica aerogel, and found it to be the most effective insulator of the materials tested, also with enough light transmittance to use as a translucent skylight /window insulator.

Help Received
I would like to thank my science teacher for inspiring me and loaning me equipment, my father for assisting me with experimentation and supervising safety, and my mother for editing/formatting my report and display board.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
William P. Edwards

Project Number
J1310

Project Title
How Is the Buoyancy of an Object Affected by Different Liquids?

Abstract

Objectives/Goals
My objective was to determine the effect of a liquid's density on the buoyancy of an object. I believed that the liquid with the highest density would result in the most buoyancy force on an object.

Methods/Materials
I used three hollow plastic objects (cube, sphere, and triangular prism) in four different liquids (distilled water, salt brine, kerosene, and isopropyl alcohol). The test objects, being hollow, floated in the liquids. I constructed a test set-up using a plastic container with a pair of pulleys at the bottom and a spring scale suspended over it. Using a thread attached to my test objects, then placed through the two pulleys and hooked to the spring scale above, I measured the apparent mass of each object while submerged in each test liquid. I did ten measurements (trials) of each object in each liquid. To get the experimental value of buoyancy for each test I added the actual mass of each object to the experimental value of apparent mass.

Results
The liquid with the highest density resulted in the largest buoyancy force for each of the three objects as compared to the other liquids. The lowest density liquid yielded the lowest buoyancy for each object as well. Also the largest (by volume) object, the cube, caused the most buoyancy force and the smallest object, the triangular prism, had the least buoyancy in each liquid case.

Conclusions/Discussion
From my research I found Archimedes' Principle: The upward buoyancy force is equal to the mass of the liquid displaced. Using this principle, I calculated the expected buoyancy of each object in each liquid using the object's calculated volume and a reference value of density for each liquid. I then compared my expected values to the measured values to get percent error. For the 12 cases (three objects times four liquids) all but one of my percent error results were about eight percent or better. Finally, I plotted the measured buoyancy with calculated volume for my three objects in each liquid, and using the slope of the line, I determined an experimental value of density for each of my liquids. I then compared this density value to my reference value to determine percent error. This analysis showed less than five percent error for each of the four liquids' densities. My conclusion is that higher density liquids do cause more buoyancy force and that my data analysis using percent error confirms that Archimedes' Principle is correct.

Summary Statement
My project measured the buoyancy force on three objects in four different liquids to determine the effect of a liquid's density on the buoyancy of an object.

Help Received
My dad helped me get the materials and construct my test set-up. He also helped me understand the math and reviewed my work. My mom helped me with my board and proofread my work.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Zoe Fairlie; Malika D. Gellman

Project Number
J1311

Project Title
Weather or Not

Abstract

Objectives/Goals
The main question of our experiment is, what type of roofing material will keep a house coolest in the summer heat, insulates a house in the winter, insolates the best in the rain, and the warmest in ice water rain.

Methods/Materials
1.6 metal shingles, 2.2, 12"x12" pieces of sod, 3.6-10 succulents, 4.4, 13"x13"x ## pieces of wood, 5.1, 12"x12" piece of wood.
1.Get all materials; 2.Build and roof all model houses; 3.Bring houses to a temperature controlled area; 4.Bring houses to testing area; 5.Preform tests; 6.Repeat steps 3 to 5 for multiple tests.

Results
From the warm test we discovered that the tile roof kept the house the warmest. We put the tile house outside, and tested for the temperature every five minutes for up to a maximum of fifteen minutes. From the cold test we collected the results that the succulent house was the best it had the coolest temperatures while sitting in strong, direct heat for 15 minutes. After looking at are data we came to the conclusion that the grass roof would be the best in hot weather for long periods of time, and the metal roof would be the best for short periods of time. From the rain test we acquired the information that when it is raining the best choice roof would be a tile roof, because it will insulate your house the best.
In the ice water test we discovered that the metal roof would keep the house the most insulated.

Conclusions/Discussion
Our results do not support our hypothesis. We said, in our hypothesis, that the sod roof would have the warmest temperate in cold weather conditions. This was incorrect because our data shows that the tile roof would keep the house the warmest in cold weather conditions. We also said that the metal roof would keep the house the coolest in the cold test. We were mistaken. The succulent roof turned out to be the coolest house when we put the houses in heat, cold test. Then we said that the metal roof would insulate the house the most in the rain, we were proven wrong! Finally we said that the tile roof would be the keep the house the warmest in the ice water test but we were proven wrong by are results which showed that the succulent house would remain the warmest. Our results showed us that the tile (control) house would provide a much more insulated house in the rain, then any of our other model houses.

Summary Statement
We built model houses with different roofing materialsand tested the seperate houses temperature wise.

Help Received
Dad helped supervise the building of the houses

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Amelia G. Gleixner

Project Number
J1312

Project Title
Polymer Properties

Abstract

Objectives/Goals
The purpose of this project was to test the plastic deformation of polymers made from different amounts of borax, glue, and water. My hypothesis was that the more glue added, the more plastic deformation the polymer would have.

Methods/Materials
I designed a set of experiments with different ratios of borax and glue. I mixed the chemicals and then let them sit for two minutes. Then I rolled them into a ball. I tested to see if I could make polymers that could be plastically deformed by the force of gravity, but gravity wasn#t strong enough. Instead of gravity I stretched the polymer continually until it broke. Also, some of the mixtures of borax and glue weren#t practical because there was some borax or glue not mixed in. I tested all of the ratios of borax and glue in my design of experiment and found three that worked. I realized that the borax was still not all mixed in so I decided to heat the borax in water in the microwave for 15 seconds, and then mix it into the glue. The three mixtures that worked became Chemistry A, B, and C. I did each of these five times, still mixing the borax with water and then heating it in the microwave for 15 seconds. For each polymer, I measured the size of the ball before stretching. I timed the rate I stretched it and recorded the length at breaking.

Results
Of the three chemistries that worked, there were definitely some differences. Chemistry A which had a ratio of borax:glue:water of 1:2:0.6 and chemistry C which had a ratio of borax:glue:water of 2:3:1.3 stretched the farthest before breaking. Chemistry B which had a ratio of borax:glue:water of 1:3:0.6 was hard to stretch. My pull rates varied with all the samples. I think this happened because the stretching was not entirely consistent, this is also the reason there was so much scatter in my data.

Conclusions/Discussion
I concluded that it is better to have more borax, since the two chemistries that had higher ratios of borax had the most plastic deformation. I believe the borax may have made longer polymer chains but the chains weren#t cross-linked. Therefore the polymer chains could untangle and slide past each other before breaking. My hypothesis was wrong, because I had hypothesized that the polymers with more glue would have more plastic deformation. I accomplished my goal to find the polymer mixture with the largest plastic deformation.

Summary Statement
My project was to find the polymer chemistry with the most plastic deformation before breaking.

Help Received
Mother acted as assistant in taking the measurements.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Michael F. Hair, III

Project Number
J1313

Project Title
To Pinhole or Not to Pinhole?

Abstract

Objectives/Goals
The objective of this project was to determine if pinhole glasses provide better vision than prescription glasses or lenses.

Methods/Materials
Ten human subjects were tested for distance, peripheral, and darkness vision. During the distance vision testing, the subjects were 20 feet away from an eye chart. Their vision was checked in each eye separately, with and without pinhole glasses. Next, during the peripheral vision testing, the subjects were placed 15 feet away from a center cabinet while an assistant was placed 10 feet to the side while waving a yellow piece of paper. The subjects stated if they could see the yellow paper with each eye separately, with and without pinhole glasses. Lastly, for darkness vision testing, the subjects were placed 55 feet away from an assistant holding papers marked with single letters. The subjects identified three different letters in each eye separately, with and without pinhole glasses.

Results
Distance vision testing showed that 75% of the subjects saw better with pinhole glasses. Ninety-five percent of the objects seen during peripheral vision testing occurred while the subjects were not wearing pinhole glasses. Only 20% of the objects were seen while wearing pinhole glasses. Results from the darkness vision testing showed that an average of 2.7 out of 3 letters were seen without pinhole glasses and only an average of 1.3 out of 3 letters were seen with pinhole glasses.

Conclusions/Discussion
Based on the results of each step of vision testing, pinhole glasses did provide better distance vision when compared to other lenses. Pinhole glasses did not provide better vision during peripheral and darkness vision testing. Overall, pinhole glasses didn#t provide better vision than other lenses. Therefore, my hypothesis, pinhole glasses will provide better vision than other lenses, was proven incorrect.

Summary Statement
The objective of my project was to prove if pinhole glasses provide better vision then other lenses.

Help Received
My mom helped me with my board layout and my uncle helped me perform the tests at his office.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Arabella B. Howard

Project Number
J1314

Project Title
Increasing Albedo: Determining if the Composition and Color of a Roof Impacts Interior and Exterior Temperature

Abstract

Objectives/Goals
Does the composition of a roof that has been painted white, and therefore the albedo of the structure increased, impact the interior and exterior temperature of the structure?

Methods/Materials
9 bird houses of same shape and size, 21 asphalt shingles, 72 terra cotta tiles, one paint sprayer, 1 bottle of white Behr house paint, 1 bottle of Gorilla Glue, 18 thermometers. Paint three bird houses white and do not attach any roofing materials to those houses (control). Attach 7 strips of asphalt shingles to each of the three houses and then paint the structures white. Attach 24 terra cotta squares to each of the three houses and then paint the structures white. Place a thermometer on the exterior of each structure by using a rubber band and in the interior of each structure. Monitor and record the interior and exterior temperatures every ten minutes.

Results
Control Average Temperature Change for interior was an average change of -10 Celsius, Exterior -9.7 Celsius

Tile Average Temperature Change for interior was an average change of 7.3 Celsius, exterior was -14.7 Celsius

Shingle Average Temperature change for interior was an average change of -8.7 Celsius, exterior was -15 Celsius

The tile kept the interior the warmest.

Conclusions/Discussion
My conclusion is that the exterior temperature readings all showed a decrease of approximately ten degrees Celsius while the tile interior temperature was the only variable to show an increase in temperature. Individuals wanting to conserve energy and regulate the interior temperature of their buildings should use tile roofing materials.

Summary Statement
My project investigated roofing materials that would regulate the interior temperature of a structure, after the albedo had been increased, in order to decrease the amount of energy used to regulate the interior temperature of a structure.

Help Received
Mother helped me print and finish my bibliography. Father helped me test, prep for testing, and review data.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Holly M. Jackson

Project Number
J1315

Project Title
Sewing Science

Abstract

Objectives/Goals
I am a self-taught seamstress, and I love to sew. The objective of my science project was to determine which stitch type makes the strongest seam and see how that strength varies with different thread and fabric types.

Methods/Materials
In my experiment, I sewed seams in 120 different fabric samples and tested them to find the force at which the seam broke. I created samples with 4 different stitch types, 2 different thread types, and 3 different fabric types. I repeated each combination 5 times and analyzed the results. I built a custom setup that could apply up to 140 kg of force to pull the sewn samples to failure. For repeatability, I used an electric winch to apply tension at a constant rate and a slow-motion camera to record the exact failure point.

Results
After measuring all my samples, I was shocked at how strong a single 4" (10 cm) wide sewn seam could be. Some of my samples broke at over 130 kg of force! For each sample, I calculated the force per unit length at which the seam failed. I also calculated the average force and the min and max error of each group of 5 data points. My results showed the weakest seam (at 3.91 kg/cm) was a 3 point zigzag stitch using polyester thread in denim fabric. A straight stitch with the same thread and fabric was almost 3 times as strong! The strongest seam (at 13.4 kg/cm) was a straight stitch using nylon thread in nylon fabric. This seam was almost 4 times stronger than the weakest!

Conclusions/Discussion
My hypothesis that thread failure would occur with polyester thread was correct. My results also support my hypothesis that straight stitch was strongest. However, while my experimental results showed that straight stitch was, on average, the strongest, I cannot say conclusively because, taking measurement error into account, there was overlap with the stretch and zigzag stitches. I hypothesized correctly that fabric failure would occur in all the cases with nylon thread. I was incorrect that zigzag stitch was strongest. My results show that straight stitch, on average, was strongest. This result was conclusive in the case of nylon thread in denim fabric. But the other combinations were inconclusive due to overlapping measurement error.

Summary Statement
For my science experiment this year, I decided to test which sewing stitch type makes the strongest seam and see how that strength varies with different thread and fabric types.

Help Received
My father supervised and assisted me with the use of power tools during the construction of my experimental setup.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Harrison N. Jennings

Project Number
J1316

Project Title
Noah Good Wood?

Abstract

Objectives/Goals
The goal of my project was to find the best wood to use when building in a flood zone. My hypothesis was that the wood that absorbed the least amount of water would be the best to use.

Methods/Materials
I tested nine different types of wood that are commonly used as building materials. Prior to testing them, I weighed each sample. I set them in a pan of warm water dyed with food coloring and let them soak overnight. The next day I weighed them again, and calculated the difference in the weight and the percent of change. I also conducted a rate of absorption test to determine how fast the samples absorbed water in 2 minutes.

Results
Oak absorbed the least amount of water and had the lowest percent of change. Although Douglas fir did not absorb the most water, it had the highest percent of change. This led me to conclude that oak is the most practical for building in a flood zone and Douglas fir is the worst building material for construction.

Conclusions/Discussion
I found that Oak is one of the hardest woods used in the construction of buildings. It is very commonly used because of this property. I also found out that soft woods are not very strong and absorb water easily, making them poor building materials. My hypothesis was correct. The wood that absorbed the least amount of water would be the best for building in a flood zone.

Summary Statement
The focus of my project was to find what wood is the most resistant to continual exposure to water denoting natural disasters such as floods, hurricanes and major storms

Help Received
Dad taught me how to use a saw so I could cut the wood samples.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Michael Kao

Project Number
J1317

Project Title
The Strength of Alloys: Testing Industrial Alloy Strength against Cavitation Erosion

Abstract

Objectives/Goals
The objective of this experiment will be to investigate the behavior of cavitation and cavitational erosion conducted towards industrial alloys. The experiment will be evaluating metals that resist cavitation, factors that affect cavitation resistance, and the behavior of cavitation with proportion to the experiment time.

Methods/Materials
A Branson 450 Sonifier was used to generate an ultrasonic field producing oscillating voids in a 1000mL water container to cause cavitation. Test specimens will include 4 mm, 6mm, and 8mm tablets of Aluminum 6061 T6, Nickely Alloy 200, UM Brass A353, Stainless Steel 316, Grade 2 Titanium, and GP Low Carbon Steel. Metals machined into tablets with sizing appropriated to the Sonifier horn tip size, and thread sizing will follow standard UNC sizes. Metals will be placed within the container of water at intervals of 10 minutes, where material loss will be subsequently recorded. Test duration for each specimen continues until cavitation reaches a horizontal asymptote.

Results
Consistent erosion rate charts prove cavitation is not a linear process, but a phenomena whose erosion rate depends on the experiment time itself. Erosion amounts followed an exponential trend and then subside into a logarithmic trend. Testing results showed that stronger materials such as nickel (ex. average 144 mg loss, 120 min.) lasted longer than materials such as aluminum (ex. average 58 mg loss, 120 min). Note that due to machine failure from over-usage, not all 18 tablets could be properly tested.

Conclusions/Discussion
Analysis of cavitation behavior and research shows that cavitation acts in an incubation, accumulation, attenuation, and steady state process order. Using alloy properties, cavitation resistance is the reciprocal of material loss rate but does not correlate to any other property of metals such as elongation or tensile strength. Resistance depends on a variety of factors of the metal, not just single characteristics that determine metallic strength. Machines such as valve systems, hydraulic pumps, and hydrofoils require proper materials to effectively avoid substantial cavitation damage. Information provided by this experiment is useful for industrial manufacturers to determine preferable alloys for use in pressurized fluid machines and hydrodynamic devices.

Summary Statement
Industrial alloys will be subject to ultrasonic non-inertial cavitation to determine factors affecting cavitation resistance and behavior of cavitation with proportion to time.

Help Received
Acknowledgements to father for assistance in machining tablets and minor troubleshooting; mother assisted in acquiring materials.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Gabriella J. Malamed

Project Number
J1318

Project Title
We Love That Basketball

Abstract

Objectives/Goals
My project was to determine which playing surface is best for dribbling a basketball.

Methods/Materials
Each surface area was prepared by taping a meter stick to a wall or pole and videotaping the basketball drop from a consistent height with one bounce measured. This was repeated ten times at each surface area. Data was collected and the height differences were calculated.

Results
The smallest difference in drop and bounce height was the tile floor, meaning that the ball rebounded higher on that surface. The asphalt absorbed the most energy and the ball did not bounce back as high.

Conclusions/Discussion
The tile floor absorbed less energy from the ball and allowed the ball to bounce higher. From my playing experience, the tile floor is a harder surface than the wood floor, but less hard than the asphalt. Maybe it is just the right amount of hardness but I like playing on the wood court better.

Summary Statement
This project tested which surface a basketball bounces highest on and requires the least amount of energy dribbling.

Help Received
Mother helped run statistical analysis in Excel.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Bodhi R. Merrill

Project Number
J1319

Project Title
Airsoft and the Environment: What Happens to All the BBs?

Abstract

Objectives/Goals
The objective of this project was to determine if biodegradable airsoft BBs biodegrade and whether they biodegrade faster than non-biodegradable airsoft BBs. I also examined what environmental conditions affected the breakdown of the BBs.

Methods/Materials
I set up this experiment using a control group and 15 test trays with 3 different types of BBs (biodegradable, non-biodegradable, and plastic) and exposing them to 3 environmental variables (exposure to sunlight, exposure to soil, and exposure to soil and grass clippings). I tested them with 2 different tests I designed to replicate conditions that would either crush or abrade them at 90, 180, 365, and 545 days. For the crush test, I squeezed the BBs in a bench vice measuring the force applied to the vice handle with a fish scale until they cracked. For the abrasion test, I measured the diameter of the BBs using a micrometer before and after rubbing them 100 times between two bricks.

Results
The abrasion test results show that the biodegradable BBs with exposure to soil and to soil and grass clippings degraded dramatically after the 365-day test, shrinking by 5mm (83%) at the 545-day test. The non-biodegradable and plastic BBs showed very little change. The results also show that exposure to soil and grass increases the degradation. Two of the shade samples completely disintegrated at 545 days indicating that biodegradable BBs degrade more completely when exposed to biological activity. The biodegradable BBs required less force to crush than the other types of BBs throughout the experiment, never exceeding 10 lbs. of force. The non-biodegradable BBs showed what I believe was a seasonal variation possibly related to temperature or moisture content requiring over 20 lbs. of force when dry and dropping as low as 8 lbs. when cold and moist. The plastic BBs weakened over time, rapidly at first then more slowly over time, likely due to the plastic becoming more brittle.

Conclusions/Discussion
My results supported my hypothesis that biodegradable BBs will degrade faster than non-biodegradable BBs. Although it took much longer than I expected biodegradable BBs do eventually biodegrade with exposure to biological activity. My results also showed that non-biodegradable BBs do not biodegrade over the time span of my experiment and plastic BBs slowly weaken over time. My project shows the importance of using biodegradable BBs to reduce plastic in the environment.

Summary Statement
My project was designed to determine if biodegradable airsoft BBs biodegrade, whether they biodegrade faster than other types of BBs, and what environmental variables affect the breakdown.

Help Received
My mom helped me glue my information to my board and she answered questions when I was using the computer. My dad helped me learn how to make a table for my test data and how to make a graph on the computer. He also let me use his workshop and tools for my tests.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Ishani P. Narwankar

Project Number
J1320

Project Title
Who Dunit? Does Age and Surface Material Affect the Detection of Fingerprints?

Abstract

Objectives/Goals
The objective of my experiment was to study the effect of surface materials, such as paper, glass, wood, and metal on the detection of fingerprints. As part of my project, I also tested the effect of the age of the subjects from age groups 11-13, 40-50, and 60-70 years old on the detection of fingerprints.

Methods/Materials
1. Informed consent was received from 36 volunteers for fingerprinting data set.
2. Make a control sample set by taking five fingerprints from one hand using fingerprinting ink.
3. Using the fingerprint ink, take the fingerprints on glass, wood, and steel metal from the same volunteers.
4. Using the microscope app on the iPhone, record the number of ridges seen in a 2 cm circular area around the center of the fingerprint with a 2.5 x magnification.
5. Using the UV light/ flashlight at an angle will be easier for the detection of fingerprints on the glass and metal slides.
6. Document observations such as breaks in ridges, invisible ridges, spacing between ridges, blurriness of any ridges, etc. in the table.
7. Once the best surface material is found. Take 10 fingerprints from each age group of the thumb on the best surface. (Age Groups # 11-13 years, 40-50 years, and 60-70 years)

Results
The fingerprint data collected on glass tracked the control data taken on fingerprint paper better than that on wood and metal. The samples taken on glass consistently had the highest number of visible ridges. Compared to the 11-13 and 40-50 age groups, the 60-70 age group consistently showed lower ridges on the fingerprints.

Conclusions/Discussion
In conclusion, surface materials and age has an important role in the detection of fingerprints. Fingerprints on glass tracked the control set of fingerprints on paper, while the fingerprints from metal and wood did not. The senior age group (60-70 years) consistently showed lower number of ridges on the fingerprints, due to the loss of collagen from old age.

Summary Statement
My project is about the effect of surface materials and age on the detection of fingerprints.

Help Received
Parents helped me with resources required for the project. Mother helped gather data from different subjects. Science Teacher for her guidance and encouragement.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Andrew Pantera

Project Number
J1321

Project Title
Rising Force: The Science of Diamagnetism

Abstract

Objectives/Goals

My objective is to measure the diamagnetism of different materials. I hypothesized that pyrolytic graphite would be the most diamagnetic because the material is known for its diamagnetic properties.

Diamagnetic materials are materials that are repelled by both sides of a magnet. The material doesn#t provide any magnetic force by itself, it actually reflects back the magnetic force of the magnet. If the magnet is strong enough, diamagnetism can be used to levitate objects.

Methods/Materials

I compared the diamagnetism of four different materials. The materials were placed under a magnet, their diamagnetism providing an upward force. If the magnet had been light enough, it would have floated. A second "lifter" magnet compensated for gravity. A knob lowered the lifter magnet until levitation was achieved. The more diamagnetic the underlying material was, the more upward lift it applied to the magnet, reducing the need for the lifter magnet, so levitation was achieved with it further away.

Results

My experiment compared the diamagnetism of pyrolytic graphite, paper, glass, and aluminum. I found that pyrolytic graphite was the most diamagnetic, followed by aluminum, glass, and then paper. The experiment was repeated with little variation. Each material's diamagnetism differed from the others' by at least one standard deviation.

Mean Number of Turns to Achieve Levitation (sample size=15)
Pyrolytic graphite: 9 3/40 (std deviation .068)
Paper: 10 1/5 (std deviation .046)
Glass: 10 5/96 (std deviation .028)
Aluminum: 9 4/5 (std deviation .088)

Conclusions/Discussion

My hypothesis was correct; pyrolytic graphite was the most diamagnetic.

Our world is full of friction, causing heat and wasting energy. If we can find a way to reduce friction, we can save energy. Diamagnetic materials can be used to reduce, or even eliminate, friction. If one part of a machine is coated with pyrolytic graphite and another part magnetized, then the components will resist touching- no lubricant required, no friction, no wear.

Summary Statement

Friction wastes energy. The diamagnetic materials that I tested can be used to reduce or eliminate friction.

Help Received

Father proofread and corrected spelling and grammar mistakes.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Saloni R. Patel

Project Number
J1322

Project Title
Solving the Puzzle of Rooftop Garden Planting Substrate

Abstract

Objectives/Goals
The purpose of this project was to find the optimal light weight rooftop farm substrate with the lowest organic to inorganic matter ratio that will still support the growth of produce, so as to avoid potential problems of organic material breaking down and causing drainage and replacement problems.

Methods/Materials
Procedure for Plant Growth Experiment:
Create 7 different substrate mixtures with varying percentages of organic material (20%, 30%, 40%,..., 80%). The inorganic matter would be pumice and the organic matter would consist of equal parts coir and worm castings. Pot and plant these substrates with 2 different types of plants (3 sets per plant type per substrate), a fast growing mustard and romaine lettuce. Place the pots under 24 hours growing light system. Water with 75 ml water every other day. For mustard, record height and number of seed pods. For lettuce, record leaf count and appearance. Take pictures to record appearance.

Procedure for Water Retention Experiment:
Create 7 different substrate mixtures as described in the above procedure. Make sure all materials are dry. Put funnels on top of graduated cylinders and line them with filter paper. Fill 1 cup of each type of substrate into funnels. Pour 50 ml of water over all funnels slowly. After 5 minutes, record the amount of water that collects in the graduated cylinders.

Results
Lettuce plants grew best with at least 60% organic matter.This shows that a certain percentage of organic matter is important as it provides the nutrients necessary for optimal plant growth. Same results were obtained for the mustard, where optimal growth and better seed production was observed in plants with at least sixty percent organic material.
The water retention experiment showed that the higher the organic content, the better the substrate was at retaining water.

Conclusions/Discussion
In conclusion, the sixty percent organic material soil type was the optimal soil type for a rooftop farm because the data clearly shows that the sixty percent soil mixture has the best balance between keeping a relatively low amount of organic material, while still providing enough nutrients and water retention so that the plants can grow well.

Summary Statement
Finding the optimal percentage of organic matter in rooftop garden substrate to grow produce.

Help Received
My mom helped me build the light system and buy materials necessary to perform the experiments.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Nicholas A. Perez

Project Number
J1323

Project Title
Polymer: The Ultimate Barrier to Fire and Smoke

Abstract

Objectives/Goals
The objective of my project is to discover a fire retardant/smoke barrier material that is nonflammable, nontoxic, easy to use, and long lasting using household products. My goal is that this material will help save people from dying of smoke inhalation.

Methods/Materials
For my experiment, I used a real life scenario of a burning hallway with a closed door in the center. First, I built a hallway and 1/10 scale doorway. Then, I deployed 600 grams of various mixtures into the door jambs and door gaps. I exposed one side of the door to 10 minutes of direct fire from a propane torch. In the second experiment, I thoroughly sealed a smoke generator to one end of the hallway. I marked the time of fire and smoke penetration from each experiment. My independent variable was a variety of different mixtures of common household products. My dependent variable was the time of fire resistance and smoke barrier. My controlled variables (constants) included: the type of fire, the smoke generator, the measurement tools (laser digital thermometer and smoke detector), the construction materials, the mass of fire resistant/smoke barrier material, and the duration of time exposed to fire and smoke.

Results
The only mixture that went the full 10 minutes of sealing the doorway from fire and smoke was the polymer. It withstood up to 1100 degrees Fahrenheit of direct flame without any significant degradation. Also, it sealed the doorway from any smoke penetration past the 10 minute time frame.

Conclusions/Discussion
In conclusion, I learned the best substance was a polymer/distilled water mixture. This performed better than the cornstarch, boric acid, talc, and baking soda. I also learned that the polymer was fire resistant without having to add water. The type of polymer used was sodium polyacrylate. I proved my hypothesis that compounds containing water and minerals are the most effective fire retardants.

Summary Statement
A polymer solution is the best life-saving tool in stopping fire and smoke from entering a room.

Help Received
Mother helped with graphs/tables; uncle helped build hallway and use propane torch.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Brendan C. Powell; Bryce C. Powell

Project Number

J1324

Project Title

Is Radiant Barrier a More Energy Efficent Alternative to Fiberglass Insulation?

Abstract

Objectives/Goals

The purpose of our science project was to determine if relying on radiant barriers instead of the standard insulation used in home construction can result in homes that are more energy efficient to cool and equally as efficient to heat.

Methods/Materials

We built five 30 inch high, model A-frame houses. The houses were built the same with inside and outside walls, an attic and a living room. Each model had vents that opened and closed to allow or prevent air movement. The inside the walls and attic were varied:
Model #1 was the control with no radiant barrier and no insulation;
Model #2 was the base with standard fiberglass insulation;
Model #3 was a modified base which added radiant barrier to the fiberglass insulation;
Model #4 was the test with radiant barrier only; and
Model #5 was a modified test which added foam insulation to the radiant barrier.
We put thermometers in the living room and in the attic of each model and recorded the temperatures as they were exposed to winter and simulated summer conditions at regular intervals over 2 days for each season.

Results

In the summer test, when we compared Model #4 with Model #2, we found that Model #4 was almost 200% better than Model #2. Model #3 did almost the same as Model #4 but Model #5 was the best. It was 300% better than Model #2. In the winter tests, when we compared Model #4 with Model #2 we found that Model #4 was about 33% worse than Model #2. Model #3 did almost the same as Model #2 but Model #5 was the best. It was about 50% better than Model #2.

Conclusions/Discussion

Our hypothesis for the summer was correct but our hypothesis for the winter was incorrect. Our study suggests that people who have existing homes that are built in warmer climates should consider adding radiant barrier to the underside of their roof in addition to the fiberglass insulation that is already there. This will help keep the home cooler in the summer and cut down on energy costs for air-conditioning. In cold climates, fiberglass insulation is effective at keeping the home warm. But people who are building new homes in either hot or cold climates could consider using foam backed radiant barrier in the walls and in the attic instead of fiberglass insulation to make the home more energy efficient in both summer and winter.

Summary Statement

We wanted to see if radiant barrier would keep a house cooler than fiberglass insulation in the summer.

Help Received

Mother helped type report and take photos; Father designed and helped construct houses and testing facility

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Lilliya S. Reid

Project Number
J1325

Project Title
Safe and Cold

Abstract

Objectives/Goals
I wanted to create a lunchbox/personal cooler that would keep food at safe temperatures for at least five hours. I designed a prototype of a cooler using a carbon based aerogel as the insulating material along with separate cooling and dry goods compartments, My goal was to design a lunch/personal cooler which would keep its contents cold enough to comply with the USDA temperature recommendations for perishable food safety.

Methods/Materials
The method I used to measure the temperature of the coolers was to pack a typical lunch; turkey sandwich, yogurt stick, granola bar, pretzels, and a tangerine and a readily available medium-sized igloo freezer pack. I used a probe thermometer with an extension cord inserted into a turkey sandwich to test the most perishable item's temperature. All of the tests were done for exactly five hours. There were two trials for each cooler. I also decided to do another test on my aerogel cooler design where I put all of the perishable foods on the bottom and the dry foods in a separate compartment on the top.

Results
The tests showed that the aerogel insulated cooler with a widely available medium ice pack kept the lunch food perishables colder than the other coolers. The data that I recorded also suggests that the commercially available lunch boxes do not keep perishables at safe temperatures below the 40 degrees recommended by the USDA.

Conclusions/Discussion
I concluded that the name brand coolers are not safe because the food was only briefly at the food safe temperatures that inhibit bacterial growth. I also learned, during my tests, that aerogel is a super insulating material that works even better when there is separate dry storage as in my design. The aerogel insulated lunch cooler that I designed and made could also have other applications such as pumped breast milk storage, or even short term severed limb transport for emergency vehicles or military field medics.

Summary Statement
My project was about testing an aerogel insulated cooler that I designed against two common, name brand, personal coolers.

Help Received
Consulted mother on grammar.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Maxon G. Repass

Project Number
J1326

Project Title
How Does Viscosity Affect Shock Absorption?

Abstract

Objectives/Goals
HOW VISCOSITY AFFECTS SHOCK ABSORPTION. Max Repass and D. Shah (teacher) Portola Magnet Center, 18720 Linnet Street, Tarzana, CA 91356.
This study examined the question of how viscous liquids can absorb shock.

Methods/Materials
The study involved using water, syrup, corn syrup, canola oil, honey, and antibacterial hand soap to examine the velocity of a marble dropped into said liquid, then calculating viscosity. Each experiment was tested 3 times. The liquids were then transferred to small containers in which eggs were dropped into, going as high as needed to until the egg was broken.

Results
The results showed that both corn syrup and honey were good shock absorbers. Upon further observation the corn syrup was deemed greater, for honey would return an equal or greater force to the egg being dropped.

Conclusions/Discussion
Viscosity compared with shock absorption acts as a parabola with water starting at (0,0) going to its peak, (corn syrup) and falling with honey and materials of greater viscosity.

Summary Statement
This study examined the question of how viscous liquids can absorb shock.

Help Received
Father helped purchase materials

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Jana Soucar

Project Number
J1327

Project Title
The Fabric Truth

Abstract

Objectives/Goals
The objective of my experiment is find which fabric is the most effective insulator. The supposition of this experiment was that wool would insulate the best, due to its thickness and napped state.

Methods/Materials
Four groups of ten cups were filled with one cup of hot water and set outside on a cold balcony from 5:00PM - 9:00PM. Each group was covered with a different fabric; one group with wool, one group with flannel, one group with cotton, and one group uncovered.
Each cup's temperature was checked, and after exactly one hour, each cup was checked again. The group with the least average decrease in temperature is the most effective insulator.

Results
The group of cups covered in wool was the most effective insulator, while the uncovered group was the least.

Conclusions/Discussion
The conclusion is that the thickest, most tightly woven, and napped materials insulate the best, because fabric in this state traps more air and body heat, and stops air from moving in and out of the material, which causes cold.

Summary Statement
Determine which fabric type is the most effective temperature insulator

Help Received
Both parents helped with board set up

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Vasily A. Tremsin

Project Number
J1328

Project Title
Acoustic Insulation: Propagation and Reflection of Sound Waves of Various Frequencies for Different Materials

Abstract

Objectives/Goals
The objective is to determine which materials have best sound-proofing properties. Both propagation and reflection of sound waves of different frequencies are studied for various materials. This information, for example, can be helpful for insulation of my piano practice from a sensitive neighbor and explain why we hear low pitch voices through the walls.

Methods/Materials
The sound insulation properties of these materials were studied: thick drawing paper, aluminum foil, foam, wood, cardboard, foam paper, insulation material, and velvet paper.
A dedicated measurement system was built. The square tube (4 feet by 6x6 inch) was built from ½ inch thick insulation foam. Two speakers were placed at one end of the tube. A set of 7 microphones was installed along the tube. Each microphone is connected to a separate sound amplifier followed by a frequency splitting circuit. Their outputs are connected to an Arduino board, which measures the signal amplitude for 5 frequency bands. These values are sent to the computer.
Inserts are installed inside the tube. The variation of sound amplitude before and after the barrier or along the reflecting inserts is measured for 0.4, 1, 2.5, 6.25 and 16 KHz.
All sound amplitudes are also visualized in real time on an 8x8x8 LED cube to demonstrate the measured values.
First I measure the background level in each microphone, then sound in the empty tube, then with inserts. Ratio of amplitudes for empty/with insert is the result of measurements. That way only the change in sound amplitude due to the inserts is measured.

Results
Among the materials measured it was found that wood had the lowest sound transmission. It effectively blocks sounds of >1 KHz frequencies. The lowest measured frequency is not blocked by the wood as efficiently as the higher frequency sounds. This explains why we hear neighbors with low voice, drums, and bass instruments better than those sounds with a higher pitch. The cardboard was the least blocking material. The reflectivity was the lowest for the textured foam and the velvet paper. I also discovered that inserts physically touching the speakers easily transmit the sound.

Conclusions/Discussion
My results indicate that sound from low pitch sources (e.g. drums, bass, etc.) is harder to block. Combination of wood and foam is best for sound-proofing. Also the sources of sound should be mechanically insulated from the walls (e.g. with rubber pads).

Summary Statement
In my experiments it is measured and displayed in real time how various materials transmit and reflect sound of various frequencies helping in materials selection for sound-proofing of loud instruments or music from sensitive neighbors

Help Received
My father helped me to design the electronics for the sound amplifier and the band filter, as well as helped me to build the LED cube.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Lindsey Jo Woods

Project Number
J1329

Project Title
The Effect of Fabric Content on Heat Absorption

Abstract

Objectives/Goals
The main objective of this science project was to find out how fabric content might have an effect on heat absorption of different fabrics.

Methods/Materials
Six fabrics were used, each made of a different content. They were cotton, linen, silk, rayon, polyester and a cotton-polyester blend. An ice cube was weighed, then covered with a fabric square and placed under a 100 watt heat lamp for ten minutes. Then the cube was weighed again and the percentage melted was calculated for each fabric content.

Results
The results showed that cotton fabric absorbed the least amount of heat. The synthetic fabric, polyester, absorbed the most heat.

Conclusions/Discussion
This information about fabric content and heat absorption could be useful in choosing clothing for comfort in different seasons. It was clearly shown that natural fibers absorb less heat than artificial or synthetic fibers.

Summary Statement
This project tested natural and synthetic fibers to see how much heat they absorb.

Help Received
Grandmother provided recources.