CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Sahil Alim; Garrett Gwinn

Project Number
J1301

Project Title
Comparative Testing of Cool Roof Materials to Conventional Roofing Tiles

Abstract

Objectives/Goals
In response to Assembly Bill 32 (the Global Warming Solutions Act of 2006),on January 1, 2010, the California Energy Commission required all new residential buildings comply with Title 24 Building Energy Efficiency Standards. My objective was to learn if Title 24 compliant Energy Star roofing tiles significantly reduce the interior temperatures of residential buildings when compared to conventional roofing tiles. I believe that Energy Star rated tiles will have a significant impact on the interior temperature.

Methods/Materials
A model house was constructed and five different roofing materials were selected from a local roofing contractor. Four roofing tiles were selected for testing; two Title 24 compliant Energy Star rated tiles and two conventional tiles. A PVC roofing material, commonly used on commercial buildings was also selected for comparison. The model house was equipped with a temperature sensor. Each tile was positioned on the roof of the house and exposed to the heat of two 275 watt heat lamps. The model house interior temperature was measured and recorded over a two hour time period in five minute intervals.

Results
The two Title 24 compliant Energy Star rated tile consistently kept the house cooler than the two conventional tiles. The Energy Star rated tiles provided a 23% reduction in final interior temperature relative to conventional tiles.

Conclusions/Discussion
Our results proved that Energy Star rated tiles do significantly reduce the interior temperatures of residential buildings as compared to conventional tiles when exposed to a radiant heat source. This information expands our knowledge of Environmental Engineering by determining ways to design roofing systems to reduce the amount of energy used to cool your house.

Summary Statement
Our project is about cool roof technology and how it can reduce residential building interior temperatures, thus reducing the demand for energy.

Help Received
Mr. Miner, Mr. Cooper and Ms. Garland helped us prepare for our presentation. Mr. Montoya helped us select materials for testing. Wilson and Son's Roofing donated roofing tiles for testing.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Braeden C. Benedict

Project Number

J1302

Project Title

Effect of Material Composition on Shear Strength Yield Point of Magnetorheological Fluids

Abstract

Objectives/Goals

Magnetorheological (MR) fluids increase their apparent viscosity when exposed to a magnetic field due to the presence of iron in the mixture. The purpose of my experiment was to determine the optimum ratio of iron powder to mineral oil and lithium grease mixture for the MR fluid. The best MR fluid would behave as a liquid while non-magnetized and have the greatest change in its shear strength yield point between its magnetized and non-magnetized states.

Methods/Materials

My setup consisted of two acrylic plates with inward-facing ridges cut into them. MR fluid was poured between the plates. The top plate slid on a track when pulled by a cup of pennies linked to a pulley. In repetitive runs, the number of pennies needed to reach the yield point (the point at which the top plate slid) was recorded for each MR fluid composition. This was conducted both with and without a magnet for eight different mixtures, ranging from 0% to 70% iron powder by volume.

Results

The 70% composition had the greatest change in yield point. As expected, the 0% composition (my control) had no significant change. As the amount of iron increased, change in the yield point between magnetized and non-magnetized states increased steadily. However, 70% (the highest percentage of iron tested) is not the ideal fluid because in its non-magnetized state, it did not behave as a fluid. The 60% composition did behave as a liquid and had the next highest change in yield point. Another interesting pattern I noticed in my data was that the yield point for all variable levels increased by a similar factor between their non-active and active states.

Conclusions/Discussion

I concluded the 60% composition is the most ideal MR fluid. My results can be used to create optimum MR fluids for their many real-world applications including seismic dampers, shock absorbers, clutches, brakes, and prosthetic limbs.

Summary Statement

My experiment tested how changing the percentage of iron in a magnetorheological (MR) fluid affected its performance as measured by the increase in its shear strength yield point between its non-magnetized and its magnetized states.

Help Received

My dad taught me how to use the tools needed to build my testing rig. My science teacher taught me about the scientific method and how to properly complete a science fair project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Jake D. Boring

Project Number

J1303

Project Title

What Is the Best Adhesive to Attach Carbon Fiber Landing Gear onto a Foam Radio Controlled Airplane?

Abstract

Objectives/Goals

The goal was to determine which adhesive would be the best to attach carbon fiber landing gear to a foam radio controlled airplane.

Methods/Materials

Two common lightweight materials for radio controlled planes are carbon fiber and depron foam. Test specimens were made using rectangular shaped pieces of depron foam (to simulate a plane fuselage) and a strip of carbon fiber (to simulate the landing gear). These substrates were bonded together using four different adhesives forming a lap joint. Surface preparations and proper curing times were key factors in having uniform test specimens and successful results. A Materials Testing Systems (MTS) hydraulic machine was used to pull on each of the specimens to test the lap joint and to record the breaking point of all the samples.

Results

Cyanoacrylate super glue, or CA glue, withstood 4.21 kilograms or about 21% less force than the other three types of glues. Hot glue, gorilla glue, and 5 minute epoxy averaged 19.75 kilograms of force before breaking. This was determined to be the depron foam breaking point as these adhesives did not fail before the foam broke.

Conclusions/Discussion

It was concluded that the CA glue didn#t withstand as many pounds of force as the other three adhesives because of the chemical, cyanoacrylate that was harmful to the depron foam (it dissolves and deforms the airy cell structure of the foam). Now that the breaking point of Depron Foam is known, Newton's formulas have determined that the foam plane must land from a height not to exceed 53cm.

Summary Statement

Various adhesives used by hobby enthusiasts were tested precisely to find the pounds of force a foam airplane could withstand on a landing using that particular glue.

Help Received

President of San Diego Composites, Rob Kolosz-provided testing equipment, carbon fiber, aluminum and high speed camera. DW Foamies, Mike Morgan-Supplied Depron Foam. Mom-wrote a moving average formula to help summarize raw test data results from MTS machine.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Sean D. Brennan

Project Number
J1304

Project Title
A Study of the Relationship between Heat Energy and Density

Abstract

Objectives/Goals
The objective of my project was to determine if density affects the ability of a substance to absorb heat, and if so, to what extent. I hypothesized that a substance with a high denisty will have greater number of particles per unit volume and thus absorb heat better.

Methods/Materials
Five metal samples with various densities, (from 2.7g/cm^3 to 11.3 g/cm^3), were collected. Five styrofoam calorimeters were each filled with 100mL of water and their temperatures were recorded. Each of the metal samples was heated in boiling water, immediately placed inside a calorimeter filled with water, and cooled to equilibrium. This process was repeated three times for each metal sample. The initial and final temperatures for each calorimeter were recorded. The heat absorption of the metal samples was then calculated from their average temperature changes and masses.

Results
The metal sample with the lowest density consistently yielded the highest heat absorption, while the metal sample with the highest density consistently yielded the lowest heat absorption.

Conclusions/Discussion
My conclusion is that the density of a substance does not in fact increase its ability to absorb heat. As the negative association between density and heat absorption demsonstrated, the true influences of a substance's ability to absorb heat is indeed more complex than I originally assumed. Heat absorption of a substance is possibly related to the unique molecular structure of the material.

Summary Statement
The premise of my project is to investigate the relationship between the density and heat capacity of a substance.

Help Received
Mr. Edwards, my science instructor, provided materials and advice on data analysis; my father supervised my experiment.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Max J. Eisenstadt

Project Number
J1305

Project Title
Cutting Edge

Abstract

Objectives/Goals
Why does a nichrome wire get hotter than other wires? My hypothesis is that the elements in a nickel-chromium alloy wire must be more resistant to the flow of electricity and become heated more quickly. The purpose of this experiment is to identify and test some of the factors of wire resistance and the electrical laws that apply to them. This project was based on an actual incident using a craft wire in a foam cutter instead of a nichrome wire.

Methods/Materials
32-gauge wire: nichrome, stainless steel, copper screwed to wooden block
Digital multimeter; Foam cutter and Styrofoam; D-cell and 6 volt battery

1. I tested 3 types of 32-gauge wire: nichrome, stainless steel and copper for their resistance with multimeter.
2. I tested the 10" wire temperature with an electric current running through a 6-volt circuit.
3. I tested the three wires in a 3" foam cutter using a 3-volt battery, measuring the cutting ability and the temperature.

Results
The results from the resistance test were expected: NiCr had the highest average at 8.4 ohms, stainless and copper less than 1 ohm. Unexpected results from the temperature test: the stainless had the highest average at 198 degrees F and NiCr only 142 degrees. The results of the cutting/temperature test were expected: NiCr reached average of 218 degrees, stainless reached 168 degrees, but only the nichrome cut foam.

Conclusions/Discussion
The temperature test showed an anomaly when the nichrome didn't reach a high temperature, so I researched for reasons why that test failed. I believe the nichrome wire was damaged in the pre-equipment check by getting it red hot. I discovered that heat will start to oxidize metal and it will change the wire properties. Additionally, I learned that small diameter nichrome wire is used as ignition fuse because a low voltage will vaporize the wire. That was the key. I applied Ohm's Law (amps = volts / resistance) to my resistance data. My hypothesis was correct. Less amperage was needed to provide usable heat because of the high resistance. NiCr needed only 0.9 amps to turn electrical energy into heat energy; compared to 12.5 amps for stainless steel. Knowing how resistance affects different materials is helpful if you're working on a project that requires electricity.

Summary Statement
The purpose of this experiment is to determine why resistance causes a nichrome (nickel/chromium alloy) wire to get hotter than wires of different compositions when a current of electricity is applied.

Help Received
My Father supervised the temperature test after pre-test equipment check had red-hot wires. My Mother encouraged me to do more research after experiment failure and proof-read reports.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Eleanor O. Frost

Project Number
J1306

Project Title
Steel Stays Hot While Other Metals Do Not

Abstract

Objectives/Goals
After an experience in the kitchen with a skillet, I wanted to test four common metals and their resistance to a change in temperatures. My hypothesis is that the cast iron would cool the slowest due to my experience in the kitchen and the aluminum would cool the fastest.

Methods/Materials
I warmed four metal blocks in the oven to a steady temperature. I took them out of the oven and measured the temperature at the center of the blocks as they cooled in three different environments: still air, in front of a high speed fan and in an ice bath. I measured the block temperature with a thermocouple and a digital thermometer every two minutes and then two readings at the end of each experiment at 10 minutes each. I conducted multiple tests and average the results. The blocks were the same size and volume, but different mass and different heat constants. I also calculated m x C for each metal, which allowed for some interesting interpretation and prediction of the graphed data. The metals tested were copper alloy, aluminum alloy, stainless steel and cast iron.

Results
The stainless steel remained hot the longest, showing the most thermal inertia while aluminum showed the least. The cast iron and copper graphs were very close to one another between the aluminum and the stainless steel graphs.

Conclusions/Discussion
Once the blocks came out of the oven, they were governed by the first and second laws of thermodynamics. An example of the first law is the heat transferring from a hot skillet to the food in it even though the gas is turned off. A common example of the second law comes from the laundry. No matter how long the drier runs, none of the laundry coming out of the dryer will be neat, even though that outcome is theoretically possible. And anyone who has done the laundry will tell you that it does require work to make the laundry neat after coming out of the dryer.

Stainless Steel demonstrated the most thermal inertia, Resistance to temperature change and aluminum the lowest. So if you want to have food cooking after the gas is turned off, stainless steel is the best material. But, when mom cooks a big meal and the kitchen gets very hot (Dad is reluctant to turn on the air conditioner), aluminum might be a good material selection for pulling the that waste heat out of the kitchen and putting it into the hot water heater. If we did this, we would use less gas to heat the hot water for my bath.

Summary Statement
I heated four blocks of dissimilar metals and measured their temperaturs as they cooled in three enviorments.

Help Received
mom and dad helped measure the temperatures and watch the timer. My teachers helped me with the basic science behind my project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Ryan D. Ghisetti

Project Number
J1307

Project Title
Which Wood Would You Buy?

Abstract

Objectives/Goals
My project was to determine which type of wood produces the most heat in relation to the cost per cord. It also compares burn length to determine the efficiency of each type of wood.

Methods/Materials
Five different types of wood were used in my project: oak, madrone, pine, fir and redwood. As each wood was burned, the highest temperature was recorded along with the length of burn time. The results were converted into BTU's/dollar and BTU's/minute. Each wood was retested to verify results.

Results
Fir is the hottest burning wood tested. It is the best type for getting quick heat and it is the most cost effective. If you are looking for a wood to provide heat and a long burn time, fir would be the best option. Fir is an excellent all purpose wood. Madrone is a good wood for burning for long periods of time, but is more expensive and doesn't burn as hot.

Conclusions/Discussion
Fir is the most cost effective wood, it averaged 50,227.2 BTU's per dollar paid. Madrone burned the longest. Fir also is the best overall wood, it tested well in heat production and burn length.

Summary Statement
My experiment was to determine the cost effectiveness of wood used for heating.

Help Received
My mom helped me learn to use Excel for my charts and my dad helped me cut the blocks of wood.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Jo Grode; Megan Larratt

Project Number

J1308

Project Title

Fuels of the Future: A Comparison between the Molecular Mass of a Fuel and the Amount of Energy It Produces

Abstract

Objectives/Goals

In our experiment, we tested the relationship between the molecular mass of a fuel and the amount of energy it produces. The whole idea of this experiment was to see if current fuels we are using are our best energy source option. In other words, why we use the fuels we use. We decided to include molecular mass because we were interested to see if there was a chemical reason why some fuels produced more energy than others. We believe that if the molecular mass of a fuel is small, then it will produce more energy because the smaller groups will oxidize more easily.

Methods/Materials

Tested 8 fuels; biodiesel, ethanol, soybean oil, peanut oil, diesel, motor oil, gasoline, & canola oil. First, we figured out each fuel#s molecular mass. Then, we placed 2.4 mL of the fuel on a regular size cotton ball. From there, we burned the fuel and the cotton ball under a can of 100 mL of water and recorded the change in temperature every 10 seconds. The amount of time each fuel burned was also recorded in our data. In our testing, the independent variable was the molecular mass of the fuel and the dependent was the amount of energy that was produced. Equipment: Metal Cup, Cotton balls, Metric Ruler, Soda Can, Liquid Measuring Cup, Immersion Alcohol Thermometer, Dropper, Tape, Water, Lighter, Paper Towels, Metal Clamp, Baking Soda, Ring stand with 3 inch ring.

Results

Our hypothesis, if the molecular mass of the fuel is small, then more energy will be produced because the smaller groups will oxidize more easily, was proven inconclusive. As we looked over our fourth graph, we discovered that there is virtually no relationship between the molecular mass of the fuel and the amount of energy the fuel produces. We are lead to believe that there is a possibility of a relationship between the molecular mass of a fuel and the time it takes to burn.

Conclusions/Discussion

Our hypothesis was not supported by the data we collected. We did determine that different fuel types produced different amounts of energy. However, with the data we collected, we did not find any relationship between the molecular mass and the amount of energy a fuel produced. If we were to repeat our experiment, we would do all of the trials on the same day. Also, we would test to see if there is a relationship between a fuel's molecular mass and its burn time and we would further examine the burn characteristics to see which fuels are better for the environment.

Summary Statement

Our project tested to see if there is a fuel characteristic (their molecular mass) that explains why some fuels produce more energy than others.

Help Received

We borrowed some equipment from La Reina High School for our experiment (i.e. ring stand, dropper, immersion alcohol thermometer). My Dad helped us build the apparatus and he oversaw the first two trials to make sure we were burning the materials safely.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Lauren E. Henske

Project Number
J1309

Project Title
Breaking Wood: What Is Stronger, Real Wood from a Tree or Plywood, and Are Heavier Woods Stronger Than Lighter Woods?

Abstract

Objectives/Goals
In my "Breaking Wood" project, I wanted to learn what was stronger - real wood from a tree, or plywood, and if the heaviest woods are strongest. Based on research, I hypothesized that real wood would be stronger than plywood, which is made from bits of wood, and that denser/heavier woods are going to be stronger than lighter woods.

Methods/Materials
To test this, I built a test apparatus with my Dad that attaches weights to same-size wood samples until the wood breaks. Since wood varies by density, age, and moisture content, I had to weigh each wood sample separately and evaluate sample weight as a variable. Then, I recorded the weight that the sample cracked and/or broke at. Since I did not have 60 one pound weights, my father poured little lead bricks that I spray-painted pink (to decrease my risk of lead poisoning), weighed individually, loaded into the apparatus sequentially, and added up total ounces to see how much weight each sample could support.

Results
My tests indicate that plywood breaks under less weight than real wood and that heavier, denser woods are stronger than lighter woods. My hypothesis was correct, but some plywoods are stronger than real wood and some softwoods are stronger than hardwoods. I had to graph my data to fully understand it. Initial samples required more weights than my test apparatus could accomodate, so I had to redesign my test and add weights and use smaller pieces of wood. Some samples bent or did not break, but at least 3 samples per wood species snapped to give me usable test data.

Conclusions/Discussion
Learning that real wood from a tree supports more weight than plywood indicates that natural products may be better than man-made ones. However, wood is a natural resource, so plywood should be used as needed. My results should be used when building strong structures like bridges or buildings. Since wood is used in sporting goods, musical instruments, boats, planes, cars, cabinetry and other items, my research can help people find attractive and durable wood. In hindsight, my research would be better if I found the lowest priced hardest woods (or bamboo) and that is how I would change my project in the future. Given the recent earthquake in Japan, I think additional research understanding which woods are strongest and most flexible could be helpful. Perhaps it would encourage tree farmers to grow more of them, making the wood more available.

Summary Statement
"Breaking Wood" shows that all woods are not the same and that denser, more complex-celled hardwoods tend to be stronger than less dense two-celled softwoods or man-made plywoods.

Help Received
My dad helped pour lead into molds to form my weights. He also helped me make my test apparatus and slice the wood samples because using a tablesaw and power tools was a new experience for me.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Lindsey Jergensen

Project Number
J1310

Project Title
Will That Break My Braces?

Abstract

Objectives/Goals
The objective of this project is to determine if the type of porcelain conditioner has an effect on the bond strength of orthodontic brackets when bonded to porcelain.

Methods/Materials
Methods: Porcelain crowns were obtained from dentists that had not been placed on patients teeth. These teeth were then mounted in dental stone prior to using various porcelain conditioning agents to prepare the surface of these crowns for the bonding of orthodontic brackets. Six different groups were tested with ten samples in each group. The porcelain conditioning agents were common orthodontic conditioning agents used by orthodontists. A testing machine was fabricated to which weight could be added to determine the force needed to break the bond. This data was then analyzed to get the results.
Materials: Porcelain crowns, dental stone, latex gloves, orthodontic metal brackets,Hydrofluoric acid etch, APF etch, Silane coupling agent, Phosphoric acid etch, composite, curing light, scaler, handpiece, sheer bond strength testing machine.

Results
Mean bond strengths (N): Group 1 (Bonding agent)- 36.87; Group 2 (Silane)- 62.72; Group 3 (HF + bonding agent)- 56.62; Group 4 (HF + silane)- 77.53; Group 5 (APF + bonding agent)- 66.63; Group 6 (APF + silane)- 57.29.
Adhesive Remnant Index Scores: Group 1: 0-4,1-1,2-3, Porcelain Fracture-0; Group 2: 0-0,1-2,2-5,3-3, Porcelain Fracture-0; Group 3:0-1, 1-4, 2-4, 3-1, porcelain fracture-0; Group 4: 0-1, 1-3, 2-5,3-1, porcelain-0; Group 5: 0-1, 1-7, 2-2, 3-0 porcelain fracture-0; Group 6: 0-1, 1-6, 2-3, 3-0, porcelain fracture-0.

Conclusions/Discussion
Silane when combined with hydrofluoric acid etch gave a greater bond strength between the orthodontic bracket and porcelain crown. This was shown by the force in Newtons that was needed to cause a bond failure. Silane when combined with the normal etch increased the bond strength to the porcelain as demonstrated by the ARI score which showed more adhesive on the porcelain crown than on the bracket. This indicated in another fashion greater bond strength than just in the 'force needed' test. This experiment demonstrated that the type of porcelain conditioner used in preparing the crown does make a difference. This is helpful to an orthodontist and patient in that it will decrease emergency appointments and subsequent costs.

Summary Statement
This project was to determine which porcelain conditioning agent will create the highest bond strength between orthodontic brackets and porcelain.

Help Received
Brother helped me design my testing apparatus; Dad helped me prepare the crowns and helped me perform the experiment; Mom helped me put my display board together; Other brother took pictures; Worker at metal fabrication shop made my testing apparatus; Teacher helped with graphs.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Andrew Johnson; VanderKlught

Project Number
J1311

Project Title
Hot and Cold

Abstract

Objectives/Goals
The objective of this experiment is to prove that a white wood roof is a better thermal insulator than other possible materials and color combination in this experiment.

Methods/Materials
Materials: Wood, Aluminum, Rubber, Power saw, Hammer, Nails, Seven Thermometers, Glue, Clamps, Plywood, and Paint.

Method: Six miniature scale houses were built, with either wood, rubber or metal roofs. One roof of each material was painted black and on roof of each material was painted white. These houses were then exposed to simulated day and night time, with inside and outside temperatures taken at intervals.

The difference between the inside and outside temperatures was calculated and recorded in a table for each twenty-minute period.

Results
The average of the temperature differences shows that while the lamps were on the white houses conducted the least amount of thermal energy and the black houses absorbed the most. The black rubber house consistently absorbed the most thermal energy but the white houses varied between the three materials. While the houses cooled, the black houses retained the most thermal energy and the white houses lost the most thermal energy. Again the black rubber house was consistent.

Conclusions/Discussion
The hypothesis is plausible because all the white roofed houses stayed cooler during the daytime and all of the black roofed houses retained more heat in the nighttime. The black rubber roofed house held heat the best at night, making them better in cold climates with ample sun. The white roofed houses reflected the heat the best, making them better for warmer climates.
Improvements can be made in the future experiment by adding insulation around the exterior of the houses. This insulation will help reduce the absorption of heat through the sides of the house. Another improvement is the use of a control group of houses with unpainted roofs. We have determined that the roofing material does not have as large of an affect as the color of the roofing material. When using the averages of all the testing the best material and color for heat reflection is white metal. The best material and color combination for heat absorption is black rubber.

Summary Statement
A shelter's roof made of wood and painted white, will be a better thermal insulator for the shelter than other materials and color combinations.

Help Received
Drews Mom for editing. Drews Dad assisting us in building. Matthews parents for getting us together. Mrs. Dixon for giving us input throughout the project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Michelle A. Karpishin

Project Number
J1312

Project Title
Stopping the Impact: Impact Resistance of Liquid Body Armor

Abstract

Objectives/Goals
The purpose of this experiment was to test the impact resistance of an STF (shear-thickening fluid) at different temperatures. STFs have been investigated as possible replacements for Kevlar in body armor, however the effects of temperature have not been looked at. Determining the effect of temperature on the ability of the STF to reduce impact may allow the use of STFs in body armor or pierce-resistant materials.

Methods/Materials
The STF was prepared by mixing cornstarch and water in a 2-1 ratio. I dropped a pointed, heavy object into a 14-millimeter layer of STF and measured the impact in a thin layer of clay that was placed behind it. By measuring the depth of impact with and without the STF, I could determine the impact resistance. The temperatures of both the clay and the STF were then varied over the temperature range of 8 C - 45 C, and the impact resistance again measured.

Results
When the temperature increased, the percent of impact resistance decreased, and when the temperature was lowered below room temperature, the impact resistance went up. This was consistent with my hypotheses.

Conclusions/Discussion
For use as liquid body armor, we need to know that this STF has less impact resistance in warmer temperatures, and more impact resistance in colder temperatures. For use in hot climates, this STF will not protect as well as in cold climates. In ocean diving, pierce-resistant materials are often used as shark suits, and this STF would work better in lower temperature waters than warm tropical waters.

Summary Statement
I examined the effect of temperature on the impact resistance of a cornstarch/water suspension, which can be used as liquid body armor.

Help Received
My father helped me make the recipe for the shear-thickening fluid and took the photographs of the experiment's results.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Kerris Lassley

Project Number
J1313

Project Title
Which Household Substance Will Slow Down the Ice Nucleation Process of Water?

Abstract

Objectives/Goals
The purpose of my science project is to determine which household substance will slow down the ice nucleation process of water. The reason I'm investigating this is because farmers lose millions of dollars every year due to droplets of dew freezing on fruit and damaging the crop.

Methods/Materials
For my control I will be placing 10 plain droplets of water on a piece of foil in the freezer and timing it to see how long it takes for the droplets to freeze. I will repeat this test with all of my test groups. My test groups are: 1/2cup of water with 1/2 teaspoon of salt, 1/2cup of water with 1/2 teaspoon of sugar, 1/2cup of water with 1/2 teaspoon of orange juice, and 1/2cup of water with 1/2 teaspoon of white vinegar. I will record my results in my data log.

Results
The results of my investigation showed that all control droplets were frozen in 8 minutes. My orange juice mixture was the most effective at slowing down the process of ice nucleation because only 8 droplets were frozen after 8 minutes. After just 6 minutes 9 out of 10 droplets for the salt mixture were frozen and after 6 minutes all of the droplets for the sugar and white vinegar mixtures were frozen. These results prove that a mixture of orange juice and water will slow down the process of ice nucleation.

Conclusions/Discussion
After completing my investigation I found that the orange juice mixture was the most effective test substance at slowing down the process of ice nucleation. I feel that further testing is needed to determine if this could be a cost effective and eco friendly way to slow down the ice nucleation process which would help farmers save crops during times of freeze.

Summary Statement
The objective of my project is to find a substance that will help slow down the ice nucleation process thereby helping farmers lower the negative impact of the freezing temperatures they face before crops go to market.

Help Received
Mr. Carl Gong helped me determine a testing process for my theory, Marshall Farms helped me with research information on fruit damage due to ice nucleation, Mom helped type.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Sierra E. LeBeau

Project Number
J1314

Project Title
Which Material Collects the Most Solar Energy?

Abstract

Objectives/Goals
My objective was to determine which material (black paint, tin or cement) collects the most solar energy and if the materials could be used for an alternative renewable energy resource.

Methods/Materials
I got 4 cardboard boxes and lined the sides and bottom of each with extra cardboard. I used hot glue to attach foil to the bottom of each box. Then I sprayed one box with black paint, put a sheet of tin in the other box and a cement brick in the third box. I placed a thermometer in each box and using duct tape, I sealed each box with plastic wrap. I placed all three boxes in the sunlight at an angle so they were directly facing the sun's rays. Lastly, I performed 10 trials in which I recorded the temperature change every 2 minutes for 10 minutes.

Results
The temperature in the box with the black paint increased the most by an average of 47 degrees F. The temperature in the box with the tin increased by an average of 41.7 degrees F and the temperature in the box with the cement increased the least with an average of 32.7 degrees F.

Conclusions/Discussion
My results showed that when comparing these three materials (black paint, tin and cement), black paint absorbs the most solar energy and would be the best choice for a renewable energy resource.

Summary Statement
My project is about determining which material (black paint, tin or cement) absorbs the most solar energy and therefore, would be the best choice for an alternative renewable energy source.

Help Received
Mother helped proofread and correct typed mistakes; My science teacher, Susan Wright, helped me edit my project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
John J. Musilli

Project Number
J1315

Project Title
Interfering with a Magnetic Field

Abstract

Objectives/Goals
For my experiment I tested to see if specific non-furious elements can interfere with a magnetic field.

My hypothesis was that if I place different elements between my magnet and iron filings, then the magnetic field will be changed in some way.

Methods/Materials
For my experiment I would place a magnet a fixed distance from the iron filings, with an element in between, and see if the field looks any different from the control.

Materials:
1 bar magnet, 2 Petri Dishes, Iron Filings, 1 Iron Filing Filter, Mineral Oil, Camera, Foam Structure built to hold camera, Graph Paper, 1 Small Beaker, and Elements: Sodium (table salt), Zinc (modern pennies), Copper (a copper sheet), Magnesium (a fire starter), Sliver (mini .9999 sterling silver bars), Gold (5 grams of pure gold), Sulfer (inside of a road flare), Lead (fishing weights)

Results
The results of my experiment were exactly what I expected. My results show the density of the magnetic field (defined by the amount of lines made by the iron filings) in the bottom left square of my pictures. Control-27, Gold-21, Silver-23, Sulfur-25, Lead-24, Zinc-23, Sodium-20, Magnesium-17, Copper-25 (the lower the density the more of a change).

Conclusions/Discussion
These results show that all of the elements I chose for my experiment did interfere with the magnetic field (some more than others), proving my hypothesis to be correct.

There could have been other unknown variables causing sulfur, lead, and copper to not make as big of an impact on the magnetic field as other elements.

Practical applications of my research include shielding of magnetic interference or providing a barrier to magnetic fields. Examples: cell phone case.

Summary Statement
Can elements affect a magnetic field?

Help Received
My father helped to me to find the materials I needed.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Anne S. Otterbein

Project Number
J1316

Project Title
How Different Materials Insulate

Abstract

Objectives/Goals
For my science fair project I chose to research how different materials insulate. My hypothesis was that water resistant materials, like fleece, would insulate the best.

Methods/Materials
I used four pairs of socks made of four different materials (cotton, wool, fleece and polyester), five identical glass bottles, hot water, and five thermometers. I covered four of the bottles with the different kinds of socks and left one control bottle uncovered. I filled each of the bottles with hot water to test how well each material insulated. In the first experiment I used only dry socks and then I repeated the steps a second time using only wet socks.

Results
The fleece socks insulated the best when the socks were dry. Wool insulted the best when I repeated the experiment with wet socks.

Conclusions/Discussion
In conclusion, the material that insulated the best when dry was fleece. Fleece insulated the best because it retains air which helps to maintain the starting temperature. Therefore, my hypothesis was correct! However, my hypothesis was incorrect when the socks were wet because fleece traps in air and when it is wet there is no air to trap. Therefore, wool insulated the best when wet.

Summary Statement
My project tests how well four different materials (cotton, wool, fleece and polyester) insulate.

Help Received
My mother helped me purchase materials for the project.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Olivia D. Partone

Project Number
J1317

Project Title
Building a Sound Barrier

Abstract

Objectives/Goals

My objective was to determine which type of fencing would be the most effective at reducing noise: wood, rock and mortar or strawbale, so that we could build a fence of the chosen material in the front of our house.

Methods/Materials

I used an airhorn to create a consistent noise, a battery-operated sound level meter to record the decibels of the noise, and three types of fencing: wood, rock and mortar, and strawbale.

The procedure was to find three fences approximately the same height, use the airhorn to create a consistent noise in front of each fence, and use the sound level meter to record the decibels. I then went one foot in back of each fence and had my grandfather use the airhorn to make the noise while I used the sound level meter to take the readings. To be as consistent as possible, the airhorn was used for the same amount of time on each reading. I took ten readings in each place and used the averages to calculate the percentage decrease in decibels to determine which fence was the most effective at reducing noise.

It should be noted, I found a wood fence almost identical in height to a rock and mortar fence, which made those readings consistent. Unfortunately, the only strawbale fence I could find was significantly taller, so my uncle helped me construct a "makeshift" strawbale fence out of just the strawbale (which did not have the stucco encompassing the straw), to ensure the fences tested were the same height.

Results

The results showed that wood fencing was the least effective at reducing noise. Rock and mortar and strawbale were fairly close, but ultimately, the strawbales, even without the stucco, were the most effective. It can be reasonably assumed that had the strawbale fence been complete, with the stucco, it would have been significantly better at reducing the noise.

Conclusions/Discussion

My results supported my hypothesis that strawbale fencing would be the most effective at reducing noise, and helped us determine this would be the best choice for our house. My research and project made clear that strawbale fencing and homes are not only sustainable, but also very affordable and effective at reducing noise.

Summary Statement

My project is about finding a sustainable and affordable fencing option to reduce the noise in front of my house.

Help Received

My grandfather helped me use the airhorn while I recorded the readings; my uncle helped me construct a strawbale fence and my mother proofread my work.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Isaac P. Raval

Project Number
J1318

Project Title
Does Sound Travel Loudest through Solids, Liquids, or Gases?

Abstract

Objectives/Goals
The objective of this project was to conduct a scientific experiment to answer the question "Does sound travel loudest through solids, liquids or gases?"

Methods/Materials
The experiment design used the following as variables: The medium through which the sound travelled (solid/liquid/gas) as the independent variable; Sound measured in decibels (db) after it passed through the medium as the dependent variable; Sound level at the source, the distance that sound traveled, sound receiving equipment, and sound measurement equipment kept constant as the controlled variables.

Air, Water and Dirt were used as the mediums, and they were placed in a plastic bottle one at a time for the experiment. A plastic-wrapped microphone was suspended into the medium from the top of the bottle. The microphone was connected to a laptop PC with the sound measurement software Adobe Soundbooth CS4. A stack of post-in notes were dropped from a fixed height to generate the source sound uniformly. The sound was measured in db after it passed through the medium and reached the microphone. The experiment was done 3 times for each medium and the results were recorded into the logbook.

Results
After passing through the gas medium, the average sound loudness was -45db. It was -27db for the liquid medium, and -21db for the solid medium.

Conclusions/Discussion
The experiment showed that Solid was the best of the 3 mediums for the sound to travel the loudest. Liquid medium was in the second place. Air medium gave the worst result.

The results can be explained as follows. Sound travels as a wave of mechanical vibrations through mediums. Molecules in solids are closer to each other compared to liquid, so the sound vibration (wave) can transfer from one molecule to the next more easily. The same way, as liquid molecules are closer to each other compared to gas, sound travels better through liquid than through gas.

Summary Statement
A scientific experiment to answer the question "Does sound travel loudest through solids, liquids or gases?"

Help Received
The author thanks the following for their help: 1. Mrs. Carmen Bowen, Author's Science Teacher: For mentoring on this science project and the report. 2. Mr. Parag Raval, Author's Father: For helping type the report and the display board, and providing technical support for the sound measurement.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Emma J. Rucker

Project Number
J1319

Project Title
Money in Your Wallet and Fire off Your Roof

Abstract

Objectives/Goals
My objective was to learn which fire-resistant roofing material was the best at insulating a home.

Methods/Materials
Various roofing tiles- asphalt, concrete, clay, metal, and slate- were set in direct sunlight atop a small box made of insulation material. Six thermocouples recorded the inside temperature over a period of time.

Results
The clay covered box had the lowest temperatures during the tests. At times it had a 120% lower temperature than its closest contender, asphalt. After asphalt, concrete had the next lowest temperatures followed by metal, then slate.

Conclusions/Discussion
Clay proved to be the best choice for a homeowner because of its insulating abilities in a warm environment. Slate is the worst choice because the slate box had internally high temperatures and insulated the box poorly.

Summary Statement
This is an investigation of fire-resistant, energy-efficient roofing material.

Help Received
Dr.Walt Whatley (General Atomics) provided thermocouples and DAQ system. Father helped conduct experiment.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Efrain D. Sharkey

Project Number
J1320

Project Title
Insulation Properties of Roofing Materials

Abstract

Objectives/Goals
The objective of the project is to find which roofing material can keep the inside temperature of an enclosed box the most consistent over the course of a day. The roofing materials used in the project are plant matter, wood, tile and asphalt.

Methods/Materials
Four wooden boxes with identical shape and size, but different roofing materials, were assembled. Each box contained its own thermometer, visible through a piece of clear plastic acting as a window. The temperature of the interior box is then recorded over the course of a day.

Results
The results showed that plant matter kept the temperature of the inside of the box the most consistent over the course of the day, then wood, tile, and finally asphalt.

Conclusions/Discussion
The conclusion is that plant matter would keep the inside temperature of a house the most consistent over the course of the day. It did this because of the moisture content in the plant itself and in the soil.

Summary Statement
My project is about finding the roof with the best thermal insulator.

Help Received
My mom and dad paid for my materials and showed me how to use a glue gun. They also used the power tools whenever necesary and gave advice.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Anthony D. Stuart

Project Number
J1321

Project Title
Sound Barriers

Abstract

Objectives/Goals
My objective was to determine which of five household material insulated sound the best.

Methods/Materials
A scale model of two rooms were built using a 12:1 inch ratio. The rooms had a hollow wall in between them. In one room there was a set of speakers connected to an mP3 player that played two sound frequencies, 100 hz (typical frequency for male human voice) and 440hz (typical frequency for music). In the other room there was a sound level meter used for measuring sound level. The test materials were inserted into the hollow wall to be tested. The five materials I tested were porcelain tile, fiberglass, bubble wrap, felt ,and styrofoam. Three measurements were taken for each frequency for each material. Measurements were averaged and plotted. I also took measurements with no wall and with a hollow wall as a control. Materials ability to insulate relative to a hollow wall was calculated.

Results
Fiberglass was the best insulating material for 100 hz frequency, reducing sound level by 16 dB relative to a hollow wall. Styrofoam did the best for 440 hz reducing sound level by 5 dB. Porcelain tile did the worst job of reducing sound level for both frequencies reducing sound level by 8 dB for 100 hz and 0 dB for the 440 hz. Over all, fiberglass insulated both sounds best, doing the best job of lowering sound levels at frequencies of 100 hz and second best at insulating frequencies at 440 hz. Felt was the second best at lowering sound level for 100 hz, followed by bubble wrap, styrofoam, and porcelain tile.

Conclusions/Discussion
My conclusion was that out of the five materials, fiberglass did the best overall job of lowering sound level and porcelain tile did the worst. Based on my results, I think that materials with more air space insulate sound best because fiberglass, a material with a lot of air space, did the best while porcelain tile, a material with almost no air space, did the worst. If I did this experiment again, I would test more materials with varying levels of density to see if my new hypothesis is correct.

Summary Statement
My project is about evaluating different material's ability to insulate sound using a scale model.

Help Received
Father helped build the test structure

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Shaelyn P. Topolovec

Project Number
J1322

Project Title
Reflect the Heat

Abstract

Objectives/Goals
My hypothesis is that a radiant barrier will work more efficiently with a larger air space between it and the heat source.

Methods/Materials
I made an apparatus (a 12"x12"x24" insulated plywood box) by using plywood, 1x2 pine, and polystyrene for insulation. A fifteen watt light bulb was used as a heat source at one end of the apparatus. The inside of the apparatus was divided in half by 12"x12" roof panels made of 1x4 framing, 1/2" OSB sheeting, 15 lb. building paper, and asphault shingles. Four different roof panels were made that had a radiant barrier (heavy alminum foil) mounted in different positions. One was mounted on the shingles facing the heat source, one on the sheeting facing away, one on the rafters facing the heat source, and one was a control that didn't have a radiant barrier. I tested each roof panel in the apparatus measuring the temperature on both sides with digital thermometers every five minutes for two hours. I tested each panel three times each and averaged the three outcomes. I used the largest temperature differential on each panel tested to determine the performance of the radiant barrier.

Results
The control had an average temperature differential of 15.8° C (28.4° F) at 120 minutes. It had the lowest performance of all the tests. The shingle mounted radiant barrier had a temperature differential of 23.2° C (41.8° F) at 120 minutes. This was the highest temperature differential. The other radiant barrier positions performed within these two outcomes.

Conclusions/Discussion
After completing my investigation, I found that my hypothesis was correct. My hypothesis stated that a radiant barrier will work more efficiently with a larger air space between it and the heat source. My investigation showed that a radiant barrier in that position (mounted on the roof shingles facing up) had the greatest effect against radiant heat. Second place goes to the rafter mounted radiant barrier (4" air space facing heat source). The sheeting mounted radiant barrier came in third. This placement had a larger air space (the attic), but that air space was not between the barrier and the source. It was on the other side. In contrast, the control (standard roof with no radiant barrier) performed the worst.

Summary Statement
I am testing if radiant barriers work better with a larger air space between them and the heat source.

Help Received
Dad: Construction Help, Mom: Board Assembly Help, Grandpa: Material and Supplies, Teacher: Project Advisement.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Kent K. Yamamoto

Project Number
J1323

Project Title
Block Those Beats

Abstract

Objectives/Goals
The purpose of this project is aimed for business buildings that either have sound that does not want to flow out to the streets (e.g. Music Schools, Bands, etc.), or buildings that DO NOT want outside sounds (e.g. major business offices, banks, libraries, etc.) can find out what materials are best suitable for soundproofing. I want to prove and show which kind of material is the best for soundproofing.

Methods/Materials
For this experiment, I will be using six 5 1/2 x 5 1/2 inch patches of each soundproofing material to patch up my mock-up room. Then, after each kind of material was used, I will use the graphs and see, numerically, which material insulates sound the most.

The materials I used in this experiment are: Acoustic Foam (pyramid), Acoustic Foam (wedged), Soundproofing vinyl, Rock Wool, Open-Celled foams, Lego Technic Pieces, Mindstorms NXT Sound Sensor, Lego sound brick, Tape, Computer, Mindstorms NXT DATA LOGGGING

Results
From my data analysis, I have found that vinyl foam was the best insulator. I also found that rock wool is the worst insulator. I think rock wool wasn#t good because it was very light weight and hollow. Also, because it is fiber glass, I think sound passed through.

Conclusions/Discussion
In my experiment, I had 2 possible sources of error. The first one is the noise level of where I tested. I tested in a decently quiet place, but there is no such thing as absolute silence. Without knowing, I tested where there were a lot of doors, so people were going in and out. The final possible source of error is how there are small gaps in my LEGO box. Some sound might of escaped from those cracks.

In the end, my hypothesis was incorrect. Open-celled foam was the second best insulator, but not the first. If I were to redo my experiment, I would start from a pre-made wooden box, so there won#t be any gaps. I would also go to a much quieter room to test.

Summary Statement
Which materials are best for soundproofing

Help Received
Parents helped buying materials