# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Parker R. Amstutz

**Project Number**
**J1201**

**Project Title**
**Icebreakers**

**Abstract**

**Objectives/Goals**
My project was to test the strength and durability of ice. I believe that ice can be made stronger and more durable by adding various substances to it.

**Methods/Materials**
Three half-gallon cartons were filled with tap water, three with an identical water/flour mixture and three more with an identical water/wood shavings mixture. Once all nine containers were frozen, three strength and durability tests were conducted on each group. The first was a Heat/Melting Test utilizing an electric skillet, the second was a Drop Test (from a height of 5'10") and the third, an Impact Test, involving a 16 lb. sledgehammer being dropped onto each block from a height of 3'4".

**Results**
The results of the Heat/Melting Test showed that the wood shavings ice block by far outlasted both the flour ice block and the tap water ice block. The results of the Drop Test showed the flour ice block outlasting both the wood shavings ice block and the tap water ice block. The results of the Impact Test showed the flour ice block and wood shavings ice block similarly outlasting the tap water ice block.

**Conclusions/Discussion**
My conclusion is that by adding various substances to ice, it can be made stronger and more durable as the the ice blocks made with flour and with wood shavings out-performed and outlasted the tap water ice block in all three tests.

**Summary Statement**
My project tested for increased strength and durability of ice after adding various substances to it.

**Help Received**
My dad helped me with the things my mom didn't allow me to do on my own; My sister let me use her scapbooking stuff for my board; and my mom proof-read and typed my report AND let me use her electric skillet, which will never be the same after the Heat/Melting Test.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Shreve M. Archer, IV

**Project Number**
**J1202**

**Project Title**
# Does a Go-kart Have a Faster Lap Time with Hard Compound Tires, or Soft Compound Tires?

**Abstract**

**Objectives/Goals**
To prove my theory that soft tires have a faster average lap-time than hard compound tires on a go-kart on an average go-kart track.

**Methods/Materials**
I drove a go-kart for 5 laps on the go-kart track, (being timed by my mechanic) averaged all of the lap times, then recorded them. I did this with both hard and soft tire compounds. We took tires temperatures, track temperatures, and tire pressures also. Also, to prove my result, I tested on two seperate tracks, bu used the exact same methods and materials.

**Results**
I found that soft compound tires had a faster lap time than hard compound tires on an average go kart track.

**Conclusions/Discussion**
I conclude that soft compound tires have a faster average lap time than hard tires.

**Summary Statement**
My project is about weather soft compound tires have a faster average lap time than hard compound tires or visa versa on an average go-kart track.

**Help Received**
My mechanic took pictures of me out on the track and lap timed me.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Joshua M. Arreola

**Project Number**
**J1203**

**Project Title**
# Let's Heat Things Up! Making the Most Efficient Solar Hot Water Panel

**Abstract**

**Objectives/Goals**
The objective was to test various materials in a solar water panel, to see which materials would absorb the most heat to make it the most efficient. Using four different materials and a control variable, I hypothesized that sand would absorb the most heat.

**Methods/Materials**
Five solar water panels were created using cardboard boxes painted black inside, flexible black tubing, and glass. Soil, fiberglass insulation, heat shield insulation, and sand were placed in four boxes individually, and the fifth box was the control with no material added. A 45° angle frame support was constructed to hold all the panels in place. All panels were then placed in the same location facing the sun. A digital stem thermometer was used to measure the initial temperature of the water, and then the water was measured again after the water had been left in the tubing of each panel for ten minutes. Each panel was tested in the same order, and a total of seven trials were conducted per panel. A run was completed when seven trials were tested for all five panels. To establish validity of my results, a total of three runs were conducted during the same day noting weather conditions and time of day.

**Results**
The overall results showed that the soil made the water heat up the hottest, followed by the fiberglass insulation, then the control variable, then the heat shield insulation, and finally the sand.

**Conclusions/Discussion**
My results showed that my hypothesis was incorrect. My background research shows that darker colors make a difference in heat absorption. The sand, which was somewhat dark, absorbed the least amount of heat. For future experiments, I might change the type of tubing and the materials used, place the panels in a different location such as the roof or on cement, and finally, test this experiment at different times of the year. This experiment can help scientists and consumers by creating an energy and cost-efficient way to provide warm water to homes, and can also help reduce the use of fossil fuels in order to create a safer, cleaner environment.

**Summary Statement**
The purpose of this project was to determine what materials would be the most efficient when placed in a solar water panel.

**Help Received**
Dad advised on how to pour the water and how to take the measurements. Mom took pictures and took the readings. Mr. Bradford Oliver, an engineer, helped me have a better understanding of my project.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Jaimie J. Aurelio

**Project Number**
**J1204**

**Project Title**
## Out of the Three Materials, Fiber Glass, Rock Wool, or Insulation Foam, Which Works as the Best Housing Insulator?

**Abstract**

**Results**

On average, the starting temperature for the control box was 146 degrees inside the cup and the end temperature was 96 degrees, giving it a total temperature change of 50 degrees. The starting temperature for the control box outside the cup was 95 degrees. The ending temperature for outside the cup had been 87 degrees, giving it a total temperature change of 7 degrees.

On average, the starting temperature for the fiber glass was 143 degrees inside the cup and the end temperature was 99 degrees, giving it a total temperature change of 44 degrees. The starting temperature for the fiber glass outside the cup was 99 degrees. The ending temperature for outside the cup had been 89 degrees, giving it a total temperature change of 10 degrees.

On average, the starting temperature for the rock wool was 143 degrees inside the cup and the end temperature was 98 degrees, giving it a total temperature change of 45 degrees. The starting temperature for the rock wool outside the cup was 112 degrees. The ending temperature for outside the cup had been 84 degrees, giving it a total temperature change of 14 degrees.

On average, the starting temperature for the insulation foam control box was 140 degrees inside the cup and the end temperature was 91 degrees, giving it a total temperature change of 49 degrees. The starting temperature for the insulation foam outside the cup was 97 degrees. The ending temperature for outside the cup had been 89 degrees, giving it a total temperature change of 8 degrees.

**Conclusions/Discussion**

The experiment shows that fiber glass is the most effective material. The research had proven that the material that had the least temperature change would be the most effective housing insulator.

Out of all the material, fiber glass had the least temperature change inside the cup of 44 degrees Fahrenheit. Rock wool was next in line with at temperature change of 45 degrees and Insulation foam was last with a total temperature change of 49 degrees Fahrenheit.

The reasoning for these results was that since fiber glass is made up of spun glass fibers, it would be the best insulator, since glass is a poor heat conductor. It also has a softer texture that should be better for insulating.

**Summary Statement**

My project is about taking fiber glass, rock wool, and insulation foam and comparing them to find out which works as the best housing insulator.

**Help Received**

Mother helped with advice; Father helped with graphs; Uncle donated materials

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Caitlin R. Bransby

**Project Number**
**J1205**

**Project Title**
## Whether the Weather Is Hot, Whether the Weather Is Cold

**Abstract**

**Objectives/Goals**
The objective of this project was to determine which type of insulation will keep a house at room temperature during extreme weather: fiberglass, cellulose, or foam.

**Methods/Materials**
The three types of insulation, fiberglass, foam, and cellulose, were tested inside of a box constructed of drywall and 2 by 4 studs. The box was sealed with drywall compound. Each type of insulation was tested inside the box and the temperature was monitored by a wireless indoor outdoor thermometer. The box was first placed in a preheated oven at 170 degrees. The temperature inside the box was monitored every 15 minutes until the temperature inside of the box had risen 10 degrees. Next the box was removed and allowed to cool to room temperature. Finally the box was placed in a refrigerator and again the temperature was monitored every 15 minutes to see how long it would take for it to drop 10 degrees. This procedure was repeated with the fiberglass insulation and the foam insulation. Each type of insulation was tested two times each in the hot and cold. I only tested each twice because the other variables were controlled (oven temperature and refrigerator temperature).

**Results**
The results showed that the cellulose insulation took the longest time to change temperature and therefore it resisted the heat and the cold the best. These results show that homes using cellulose insulation will be the most cost effective when it comes to heating and air conditioning. Also, because cellulose insulation is made from compost paper that has been soaked in chemicals, this insulation would be the best choice for creating an eco friendly home.

**Conclusions/Discussion**
After these experiments were completed and the graphs put together it was quite amazing to see the final results of this project. When doing the heat testing it was found that it took cellulose an hour before it started to rise in temperature but foam immediately rose in temperature.It was also found that in the cool resistance testing it took fiberglass 30 minutes before the insulation started to rise in temperature. In the end cellulose won out over the other insulations with fiberglass following in second, and foam coming in last. If this project were to be done again temperature gauges would be place every one inch or so inside of the box so that the speed of the heat and cold seeping through the insulations could be taken note of.

**Summary Statement**
Which insulation will keep a house at room temperature during extreme weather; fiberglass, cellulose, or foam?

**Help Received**
Father helped use power tools.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Andrea M. Cerda

**Project Number**
**J1206**

**Project Title**
## Does the Color of Your House Affect the Temperature Inside?

**Abstract**

**Objectives/Goals**
The objective of my project is to see which color house would have the highest temperature inside. The colors of the houses are: blue, black, white. I believe that the black house will have the highest temperature, because in the past I had learned that dark colors attract heat.

**Methods/Materials**
I built three small houses, with the same size and shape. I painted one blue, one black and one white. To make sure the houses had the same amount of paint; I weighed the paint and then put it on to my houses. I drilled a whole in the center of each house to put the thermometer in, and then I began to test.

**Results**
Over all, the highest temperature was the black house in trial two with a Celsius of 28.1. In general, the lowest temperature was the white house in trial nine with a Celsius of 17. The black house was always had the highest temperature. The blue house always had a temperature between the black and the white houses temperatures and the white house always had the lowest temperature.

**Conclusions/Discussion**
In conclusion, people who want to lower their air conditioning bill might have an advantage in using certain colors. Such as people with dark colored houses may stay warm in the winter and people with light colored houses may be cool in the summer. I now know this because when I was testing I put my hand over all the houses and noticed that the black and blue houses were warm and the white house was cold.

**Summary Statement**
My project is about finding which colors on a house attract the most heat.

**Help Received**

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Claire Christensen; Alexis DeFendis

**Project Number**
**J1207**

**Project Title**
## Hanging by a Thread; Which Fabric Can Withstand the Most Tension?

**Abstract**

**Objectives/Goals**
We were interested in the different types of fabrics, and how strong they were. Therefore, we decided to test the durability of natural and synthetic fabrics. Our goal was to determine the fabric which had the highest tensile strength by creating a machine that specializes in testing the strength of fabrics.

**Methods/Materials**
To test the tensile strength of fabrics, we designed and made a contraption which pulls apart the fabrics, and measures the amount of force that was applied to tear the fabric. Our materials consisted of: two anchors, two scales, harnesses that were used for holding each piece of fabric in place (harnesses were made out of steel and bolts), two winches and braided cable. For our experimentation, we also used various types of natural and synthetic fabrics. The natural fabrics we used included flannel (made with 100% cotton), velvet (100% cotton), denim (100% cotton), silk (100% silk), wool (100% wool) and linen (100% linen). The synthetic fabrics we used were flannel (100% polyester), velvet (100% polyester), denim (50% cotton, 47% polyester, 3% other fibers), silk (100% polyester), wool (70% polyester, 20% rayon, 10% other fibers) and linen.

**Results**
Our results were accurate with what we had predicted. The synthetic fabrics, all together, were able to withstand 507 pounds, while the natural fabrics withstood 467 pounds. Out of all the fabrics, the natural silk was able to withstand the most pressure, breaking at 177 pounds, while the natural wool withstood the least amount of pressure, tearing at 20 pounds. Of the natural fabrics, silk was the strongest, and wool was the weakest. Of the synthetic fabrics, denim was the strongest, breaking at, 164 pounds, and flannel was the least strong, splitting apart at 45 pounds.

**Conclusions/Discussion**
We both learned a lot from doing this science fair project, regarding the tensile strength of fabrics. We learned that out of the twelve fabrics we tested, natural silk is the strongest fabric, and natural wool is the weakest. Of the synthetic fabrics, denim was the strongest, and flannel was the least strong. Between the natural fabrics, silk had the highest tensile strength, while wool had the least amount of strength. We both worked unbelievingly hard and each put forth a phenomenal amount of effort into this project. This project we worked on together was beyond our wildest dreams.

**Summary Statement**
Our project regards testing the tensile strength of fabrics.

**Help Received**
Father helped design project, helped put together machine, helped get us started on experimentation and helped get supplies; Mothers helped proofread report and get supplies needed for project.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Claire M. Clifford

**Project Number**
**J1208**

**Project Title**
## Which Travel Mug Insulates Best?

**Abstract**

**Objectives/Goals**
My objective was to determine which commercially used travel mug would be the best insulator for a hot beverage for the longest time period.

**Methods/Materials**
Five types of travel mugs composed of plastic, stainless steel, and a combination of the both were selected. An electric teakettle to boil water and a digital thermometer were used to measure water temperature. A specified measured amount of boiling water was poured into each of the mugs, and the starting temperature was measured and recorded before the lids were placed on each mug. Water temperature was measured after specific time increments for the mugs.

**Results**
It was determined that the double walled stainless steel mug insulated water the best for the longest period of time and at the end of the experiment it kept the water the hottest. The poorest insulator, however, was the single walled plastic mug.

**Conclusions/Discussion**
After testing was completed I determined that the double walled stainless steel mug was the best insulator, and this supported my hypothesis. I believe this occurred because metal is a better conductor of heat than plastic. In addition, the air pocket in the double walled mugs causes the heat to travel through one layer and stays trapped in between the two layers instead of going through the second layer and escaping. Since the heat takes a greater time to get though the second layer, the water remains hotter for longer, and the outside of the mug stays coolest to the touch.

**Summary Statement**
Tested commercially purchased travel mugs to determine which material would insulate hot water for the longest time.

**Help Received**
My mother helped me pour boiling water into the travel mugs, and took photographs while I measured temperature readings.

# CALIFORNIA STATE SCIENCE FAIR
# 2008 PROJECT SUMMARY

**Name(s)**

**Bridget Connolly; Kelly Eaton; Alyssa Sheen**

**Project Number**

**J1209**

**Project Title**

## Hot Hot Baby: The Flammability of Dye in Baby Clothes

**Abstract**

**Objectives/Goals**

Our objective was to determine if dye affects the flammability of baby clothes. We hypothesized that colored baby clothes will burn faster than white baby clothes because of the dye manufacturers put into them. We tested three different colors of 100% percent cotton baby clothes from two brands. We cut the cloth samples into equal squares, burnt them following a consistent procedure and recorded the time they took to burn.

**Methods/Materials**

We tested 6 samples of baby clothes (onesie): Gerber 100% cotton in white, light pink and light blue; Carters 100% cotton in white, light pink and light blue. We used the following supplies: scissors; ruler; black Fine Tip Sharpie; tin tray; metal tongs; paper; Ziploc plastic bags; propane blow torch; stop watch; camera. We cut six (6) 4 x 4 inch squares from each of the 6 samples of baby clothes. Holding the top of each square with the tongs, we used the blow torch to light the bottom of the cloth, removing the cloth from the flame when it caught fire. We used a stop watch to record the time it took for the cloth to completely burn.

**Results**

We first tested the 6 squares of Gerber-white. When we were done we added up the 6 time results and calculated the average burn time at 28.167 seconds. We repeated the procedure for each other sample. The average burn times were: Gerber-pink=25.5 seconds; Gerber-blue=20.5 seconds; Carters-white=30.1 seconds; Carters-pink=27.67 seconds; Carters-blue=27.3 seconds. The results supported our hypothesis, and showed that on average colored baby clothes burned faster than white baby clothes and blue burned faster than pink.

**Conclusions/Discussion**

The results of our experiment showed that on average colored baby clothes burned at a faster rate than white baby clothes and blue burned faster than pink.

In our research we found a lot of information about the flammability of clothes, including safety and testing regulations. Research has been done about flammability of different textiles. But we could not find information about the effect of dyes on flammability, other than some dyes or dye ingredients can be flammable. Based on our experiment, dye might affect flammability. Babies cannot stop, drop, and roll so we need to know how to make baby clothes safe. Our experiment shows that dye color might be a factor and should be studied more.

**Summary Statement**

Our experiment tested the effect of dye on the flammability of baby clothes.

**Help Received**

Mr. Eaton helped us burn the clothes with the blow torch. Our parents helped us with some parts of the research, supplies, display, and report. Mrs. Garamendi helped us with the computer graph and Mr. Sheen with the title banner. Our teachers helped us with editing our report.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Jerrica N. Cox

**Project Number**
**J1210**

**Project Title**
## Which Form of Insulation Preserves Thermal Energy?

**Abstract**

**Objectives/Goals**
My objective is to determine which cup preserves thermal energy the best.

**Methods/Materials**
Methods:
1. Water is heated to 100 degrees Celsius
2. Cup is filled with water.
3. Temperature is recorded every 60 seconds for 600 seconds.

Materials:
Plastic Styrofoam
Ceramic Glass

**Results**
My highest average for which cup preserves thermal energy was styrofoam. Out of the four cups my lowest average was glass.

**Conclusions/Discussion**
Out of the glass, plastic, and ceramic I concluded that styrofoam cups are the best insulations to preserve thermal energy. Out of those four cups I also concluded that glass would drop the temperature of the water the most.

**Summary Statement**
My project was to determine which cup would keep the water the warmest.

**Help Received**

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Forrest D. Csulak

**Project Number**
**J1211**

**Project Title**
## Edison's Bright Idea: Which Filament Produces Visible Light for the Longest Amount of Time?

**Abstract**

**Objectives/Goals**
The purpose of my experiment was to determine if the type of filament an incandescent light bulb has affects the length of time it would produce visible light. I hypothesized that of the six filaments tested (steel, nichrome, copper, brass, carbon, and tungsten) the tungsten filament would produce visible light for the longest amount of time.

**Methods/Materials**
The independent variable in my experiment was the type of filament used in an incandescent light bulb. The dependent variable was measured by using a stopwatch to record the amount of time the filament produced visible light, if any. In order to test each filament, I constructed an incandescent light bulb by mounting a clear plastic cylinder with a rubber stopper at each end to a wooden board. Two clips were suspended from the top stopper to hold the filament inside the cylinder. On the top of the same rubber stopper, test leads connected the light bulb to two 6-volt lantern batteries connected in parallel to produce a 12-volt direct current (DC) circuit. The installation of a knife switch provided ease of use and safety for turning the light bulb off and on. After the installation of each filament, air was extracted from the light bulb assembly through a small hole in the top stopper in order to produce a vacuum. Each of the six filaments was then tested seven times.

**Results**
After the testing was completed, the length of time each filament produced visible light was then averaged over the seven trials to produce the results. The resulting averages were as follows: tungsten - 33.101 minutes, nichrome - 28.729 minutes, steel - 15.667 minutes, brass - 8.8 minutes, copper - 4.509 minutes, and carbon - 2.052 minutes. Several trials produced no visible light although a few trials using the tungsten filament needed to be stopped before the light died out to prevent the batteries from overheating.

**Conclusions/Discussion**
The results showed my hypothesis to be correct. The average length of time the tungsten filament produced visible light was longer than the other five filaments. If I were to perform this experiment again, I would use a converter to convert alternating current (AC) into DC power so the voltage would remain constant throughout the experiment, batteries would not heat up nor have to be replaced. Another alternative would be using a spectrometer to determine the frequency the light produces.

**Summary Statement**
This experiment was conducted to determine which of six light bulb filaments (steel, nichrome, copper, brass, carbon, and tungsten) in an incandescent light bulb would produce visible light for the longest amount of time while in a vacuum.

**Help Received**
My mom bought the materials, assisted in extracting the oxygen from my light bulb, and helped design my board. My grandma let me use her computer with all of the printing supplies necessary.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Jonathan J. Davidson

**Project Number**
**J1212**

**Project Title**
## Conductive Resins

**Abstract**

**Objectives/Goals**
I wanted to find out how to make conductive epoxies using conductive materials and epoxy resin, and understand the factors that affect the electrical properties of conductive epoxies.

**Methods/Materials**
In my experiments, I mixed epoxy separately with copper filings, copper powder, aluminum granules, and graphite powder. I built an electrical circuit, and measured the resistivities of each resin using an ohm meter. Then, I tabulated the ohm meter readings for each type of resin mixture.

**Results**
My experimental results showed the greatest conductivity on graphite-epoxy mixture. The copper filings-epoxy mixture showed the next best conductivity. The aluminum-epoxy mixture did not show any measurable conductivity.

**Conclusions/Discussion**
My observations suggest that the type of conductive material and particle size determine the electrical characteristics of conductive resins. Larger particles form resins with higher conductivity as demonstrated by the graphite garnules-epoxy resin.

**Summary Statement**
Electrically conductive epoxies can be made by mixing epoxy with electrically conductive particles.

**Help Received**
My Dad acquired the materials for the experiment. My Mom helped in typing the report.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Sage J. Fanucchi

**Project Number**
**J1213**

**Project Title**
# Burn Baby Burn and I Don't Mean a Disco Inferno: How Does Density Affect the Combustion Rate of Wood?

**Abstract**

**Objectives/Goals**
The objective of my project was to determine if wood with a lower density combusts into flames faster than wood with a higher density.

**Methods/Materials**
For my project I collected six different types of wood at different lumberyards. I used Redwood, Madrone, Pine, Oak, Tan Oak, and Douglas Fir. I cut the pieces of wood into similar sizes, weighed, and calculated the densities for each piece of wood. I then set-up the burner, bowl of water, timer, rock weight, and tongs. I waited ten minutes for the burner to completely heat up. I took the tongs and used them to place the piece of wood on the burner while turning the timer on with my other hand. I then took the rock and placed it on top of the wood to keep the wind from blowing it away. Once the wood ignited into a flame, I turned off the timer and used the tongs to put the burning wood into the water. I then took the wood out and placed it into its own bag and labeled each bag with its name. I repeated these steps for each piece of wood.

**Results**
After completing my project I learned that pine, which had the lowest density, was the quickest to ignite. Tan oak had the highest density and ignited the slowest, proving my hypothesis right.

**Conclusions/Discussion**
From my research I learned that fire burns off of oxygen and particles of matter. So the higher the density (more compact) a piece of wood is, the less the oxygen will seep through. So if fire is fueled by oxygen and matter, dense material will have less oxygen that can seep through it, making it harder to ignite. These results occurred because pine had the lowest density, therefore letting the most oxygen seep through. I learned that if a piece of wood has a lower density it will burn the faster than a piece of wood with a higher density.

**Summary Statement**
My project is about how the density of different types of wood affects the combustion rates of wood.

**Help Received**
Mom drove me to lumber yards to collect wood and proof-read my work; My dad helped me cut the wood;

# CALIFORNIA STATE SCIENCE FAIR
# 2008 PROJECT SUMMARY

**Name(s)**

**Stephanie Garcia; Aria McCamant Berlin; Brenda Quezada**

**Project Number**

**J1214**

**Project Title**

## Cold to Caliente: A Study of Materials' Ability to Absorb and Retain Heat

**Abstract**

**Objectives/Goals**

We are studying several material's (sand,air,gravel,air and ash) ability to absorb and retain heat. We think soil will absorb and retain the most heat based on our observations of flowerbeds and pathways when they have been in the sun.

**Methods/Materials**

We used five identical bottles, all painted black, to hold the five materials studied: sand, air, soil, gravel, and ash. We put a thermometer into each bottle and got them all to the same starting temperature. Using heat lamps, we monitored their temperature every five minutes for thirty minutes. After turning off the lamps, we monitored the temperatures for another thirty minutes. We had to do this multiple times.

**Results**

The ash had the highest net gain in heat, 11.1 degrees. The sand had the second highest net gain in heat, 9.6 degrees. The soil came in third with a net gain of 8.1 degrees. Interestingly, although the air absorbed the most heat it also lost the most, so it ended with a net loss of .4 degrees.

**Conclusions/Discussion**

Our original hypothesis was wrong. We understand that these results reflect the density of the materials and their ability to absorb and give off heat. The less dense materials will absorb heat faster, but they also give it off quickly. Air is an example of this. Although gravel should be more dense than ash or soil, we think the gravel did not do as well because of the air spaces between. There was the least amount of air in the ash, which probably caused it to retain heat the best even though gravel, sand and maybe even soil are more dense.

**Summary Statement**

We are studying several materials ability to absorb and retain heat.

**Help Received**

Our teacher helped us think through the project and the results.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Grant M. Harmon

**Project Number**
**J1215**

**Project Title**
# Non-toxic Protection from Ionizing Radiation Produced by a Linear Accelerator

**Abstract**

**Objectives/Goals**
The goal of this experiment was to see if the density of a shielding material is related to its ability to shield ionizing radiation. My hypothesis is that a dense material will shield more ionizing radiation than a less dense material.

**Methods/Materials**
Lead is known to be an effective shielding material for ionizing radiation but it has some toxic properties and it is expensive. Three non-toxic materials with different densities were used as shielding materials. The materials used were steel, cement, and wood. A linear accelerator was used to shoot 6 million volt photons (ionizing radiation) through ten different thicknesses of each shielding material. An ion chamber was used to measure the transmission dose in picoCoulombs which was divided by 19.57 to convert to a dose in rads. The transmission dose was plotted against the thickness of the shielding material to get a transmission curve.

**Results**
My calculations show that steel has the highest density, wood has the lowest density and cement is in between. The best shielding material will have the steepest transmission curve meaning that less of the material is needed to shield the ionizing radiation. My data showed that steel has the steepest transmission curve, wood has the flattest transmission curve and cement is in between. These results show that as the density increases so does the ability to shield ionizing radiation.

**Conclusions/Discussion**
The data supports my hypothesis. Shielding of ionizing radiation is caused by the collision of a photon with the nucleus of an atom. The main difference between materials of different densities is the number of protons and neutrons in the nucleus. Since every nucleus of every atom, of every molecule consists of protons and neutrons, this was a controlled experiment. The type of atom or type of molecule is irrelevant. These results have real world applications because it can be used to help search for better shielding materials. Future study will be done to see if materials with similar densities have similar transmission curves. I also plan to repeat the experiment with lead.

**Summary Statement**
I studied the relationship between a material's density and its ability to shield ionizing radiation from a linear accelerator.

**Help Received**
Gary Ferrigno allowed me to use the linear accelerator at St. Joseph Hospital and Jason Durant operated the equipment for my experiment. My Dad helped me do research on the internet and get the shielding material.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Sean A. Horwitz

**Project Number**
**J1216**

**Project Title**
## How Is the Rate of Escape of Helium Molecules through a Semi-permeable Membrane Affected by Varying the Temperature?

**Abstract**

**Objectives/Goals**
My project goal is to determine how varying the temperature would affect the rate of Helium escape in Helium-filled latex balloons. I want to calculate how long it takes Helium to escape from a latex balloon. I want
to know how temperature affects the rate of Helium escape. I believe that the rate of Helium escape in a semi-permeable latex membrane will positively correlate with varying temperature.

**Methods/Materials**
I inflated a series of ten 9 inch latex balloons to a capacity of 7 ½ inches with Helium. Each balloon was tied shut, with a piece of thread suspended from it, and to that I suspended paper clips. My lowered and elevated temperatures were controlled by an air conditioner, and a space heater. My room temperature was the temperature in the room the day I began testing. I measured the diameter of my balloons in centimeters, and then calculated the volume. I measured each balloon on an hourly basis during each trial. I calculated how much Helium escaped during the number of hours each individual balloon remained aloft.

**Results**
I predicted that the Helium would escape more quickly from latex balloons as the temperature increased. How fast Helium molecules can escape from a latex membrane depends on the size of the holes in the membrane, and how fast the molecules of Helium are traveling. The molecules of Helium have more kinetic energy at higher temperatures than they have at a lower temperature. Therefore, I found the rate of Helium escape to be directly dependent on temperature

**Conclusions/Discussion**
My hypothesis was correct. Omitting my room temperature data, and using the elevated and lowered temperature data, the difference in the rate of Helium escape was dramatic. In the elevated temperature, the balloons stayed aloft for 3 hours, while the ones in the lowered temperature remained aloft for 8 hours!

**Summary Statement**
The rate of helium escape in a semi-permeable latex membrane correlates positively with varying temperature.

**Help Received**
My father helped me tie balloons, took photos, and helped me set up an Excel Spreadsheet.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Eric T. Jager

**Project Number**
**J1217**

**Project Title**
## What Burns Faster and Why? Cotton or a Cotton/Polyester Blend?

**Abstract**

**Objectives/Goals**
The goal of my project is to figure out which material burns faster and why it burns faster. I belive that the cotton/polyester blend will burn faster than the cotton.

**Methods/Materials**
Materials: 1. An OHAUS Scale; 2. Brass Masses; 3. Hardware Cloth; 4. Cotton; 5. Cotton\Polyester Blend; 6. A Lighter; 7. A Microwave Fan; 8. A Stopwatch; 9. Blue Painters Tape; 10. ¼ Inch Plywood; 11. A Stapler; 12. Staples; 13. Tin Foil.

Methods: 1. Cut the hardware cloth into six eight by eight squares. 2. Place the hardware cloth at a 45 degree angle with each other. 3. Cut ten 6.5 inch by 6.5 inch squares of both fabrics that weigh three grams each. 4. Place one square of the fabric on one side of the hardware cloth. 5. Place lighter at the bottom center of the cloth and ignite. 6. Hold lighter for ten seconds. 7. Time how long it takes the fabric to fully burn.

**Results**
The results that were obtained found the cotton\polyester blend burned faster than the cotton. The average burn time for the cotton/polyester was 42.130 seconds. The average burn time for the cotton was 56.026 seconds.

**Conclusions/Discussion**
My science fair project was, #What Burns Faster and Why? Cotton or a Cotton\Polyester Blend?# I thought that this project was going to be simple while in reality it was extremely frustrating and difficult. It took three design failures to figure out how to get one that worked. This experiment was conducted by placing two sheets of hardware cloth together at a 45 degree angle and placing a piece of fabric on one side of the hardware cloth. then I ignited the fabric while my brother worked the stopwatch. My hypothesis was proven correct.

The reason why the experiment turned out the way it did is because polyester is more flammable than cotton since polyester melts as it burns. If you have a material that will easily catch fire and that will spread the flame throughout the material fast you will have a much faster burn time. These two factors in the experiment played a big role in why the cotton\polyester blend burned faster.

I believe that the experiment was a success. It may have taken us a few tries to get everything straight but once we figured out our design everything was great. If I could redo this experiment I would change the material that was burned. Other than that I believe that the project was a huge success.

**Summary Statement**
The cotton/polyester blend burned faster than the cotton, because as polyester burns it melts and spreads the flame throughout the material faster.

**Help Received**
Dad helped with the experiment design and pictures; Mom helped with the cutting of both fabrics; My brother helped by working the stopwatch.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Skye-Marie M. Jensen

**Project Number**
**J1218**

**Project Title**
# Why Are Polyurethane and Expanded Polystyrene Preferred over Other Types of Foams for Surfboard Cores?

**Abstract**

**Objectives/Goals**
My goals were to find out why Polyurethane and Expsanded Polystyrene are the best or not bes foam for surfboard cores. My second goal was to find out if any of the three other foams could replace the other two foams (PU and EPS).

**Methods/Materials**
materials: 1" cubes of Polyurethane, Expsanded Polystyrene, WetFoam (Floral Foam), Styro Foam,and Polystyrene, water, graduated cylinder (ml), notebook and pen, camera, digital scale (g), Pennies, small bowl.

**Results**
The results show that four of the foams were relatively very buoyant and that Wet Foam was not buoyant at all. Of the four foams that showed high levels of buoyancy, Polyurethane had the highest at just over 1.8 dekagrams per cubic inch. Both Polystyrene and EPS Foam were only slightly less buoyant at just under 1.6 dekagrams per cubic inch. Styrofoam measured just over 1.3 dekagrams per cubic inch.
The mass measurements did not match the buoyant force measurements for each type of foam. Polystyrene had the greatest mass at 1 gram per cubic inch. This was followed by Polyurethane at .7 grams per cubic inch, EPS at .5 grams per cubic inch, and Styrofoam at .2 grams per cubic inch. Wet Foam had the least mass at .1 grams per cubic inch.

**Conclusions/Discussion**
In my hypothesis I thought that the heavier foam would have the least buoyant force. The data from my experiments show this not to be true. From the data there appears to be no relationship between the mass of the foam and its buoyancy. I began this experiment believing that Wet Foam would probably have the least buoyancy but was quite surprised to discover that it also had the least mass. But the data does make sense because the Wet Foam was created as an open-cell foam to absorb water so it must have a lot of air space in it that can absorb water, which would also make it light weight. I am equally surprised to see that Polystyrene has equal buoyancy with EPS but twice the mass. Based on the data, I have to conclude that mass is not related to buoyancy when comparing different types of foam.
To answer my project question I will need to conduct further tests with hypotheses on the amount of force it takes to break the foam or how much force it takes to compress the foam. The data show that Styrofoam and Polystyrene have similar buoyancy so my new question would be, #why don#t surfboard makers use Styrofoam or Polystyrene to make surfboards?#

**Summary Statement**
I'm testing wether other foams can be used for surfboard cores and why Polyurethane and Expanded Polystyrene are used for surfboard cores.

**Help Received**
Dad helped type a little bit of the report.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Adam Kaplan

**Project Number**
**J1219**

**Project Title**
## Corrosion Corrupts

**Abstract**

**Objectives/Goals**
Corrosion damage is very expensive destroying billions of dollars of equipment and structures in the US alone, each year. Applying protective coatings that significantly reduce the effect of corrosion extending the life of equipment will provide the economy with tremendous costs savings and reduce irreparable damage to the environment.

**Methods/Materials**
An easy to handle thin sheet of copper foil was cut into small strips. These sheets were cut into strips that were treated with one or more corrosion protective materials. The strips were then attached to a wire rack that was placed into a heated oven to accelerate the simulated environmental effects of temperature on the metal. The strips were then sprayed with a salt spray to simulate the effect of sea water. Finally the strips were subjected to a mild acidic spray simulating the effect of acid rain. At each step the samples were evaluated for corrosive attack and the results tabulated and compared to results for the uncoated control strips.

**Results**
The protective effect of the combination of the urethane coating and the prior BTA, closely followed by the BTA/Acrylic Polymer coating sequence provided the best overall protection from the accelerated thermal aging tests. These tests were combined with a simulated environmental salt spray and acid rain simulations to provide a more effective test process in determining the coatings performance level in their protection of coated/treated copper.

**Conclusions/Discussion**
Although costly it is worth the additional expense and manufacturing time to provide protective coating on metals. In most cases it adds to the benefit when the metals are coated with more than one coating as this assists in providing the surface with protection from additional sources of corrosion. In the case of the metal, copper and the combination of a chemical treatment followed by a polymer material sealant the combination effect provides improved protection even under an accelerated thermal lifecycle test combined with salt spray and mild acid exposure.

**Summary Statement**
Developing a protective coating or sequence of coatings that are effective in preventing metal corrosion.

**Help Received**
Father helped be obtain materials and chemicals used in the experiment. My mother proof read my report and presentation.

# CALIFORNIA STATE SCIENCE FAIR
# 2008 PROJECT SUMMARY

**Name(s)**
Jacob M. Kohlhepp

**Project Number**
**J1220**

**Project Title**
## Crystal Energy: Harnessing the Power of Piezoelectricity

**Abstract**

**Objectives/Goals**
My objective was to see which mineral type displayed the greatest piezoelectric effect. This can be discovered by measuring the amount of electrical displacement (voltage) across the rock due to mechanical stress.
The property of piezoelectricity can mostly be said to be a characteristic of certain crystaline minerals/rocks that allows them to convert applied mechanical energy into electrical energy.

**Methods/Materials**
To begin creation of my experimental setup, I acquired 8 mineral samples, including three different types of the mineral quartz. I created a clamping setup that allowed me to have a good connection between the rock sample and the test leads. I purchased a multimeter with a computer interface that takes samples every second. I attached the leads on the meter to the clamps, and started the program. For each mineral, I applied 50 taps of mechanical stress using a wooden tool. Each rock had three sets of 50 taps. The computer logged the acquired voltage measurements.

**Results**
Once I finished my experimenting , I received many interesting results. The data showed that my control, which was a piezoelectric igniter, displayed the greatest voltage and amperage. (max. spike of 4 volts) But, I was not testing the igniter, it was mainly just for reference or comparison. The mineral that displayed the greatest maximum and overall voltage when tapped was the amethyst variation of quartz. (max. voltage of 0.128 volts and 0.036 amps)

**Conclusions/Discussion**
From my results, I found that my hypothesis could be said to be true, since it predicted that the most piezoelectric mineral would be the amethyst variation of quartz. From the fact that the amethyst variation of quartz displayed the greatest effect, it would seem that the larger the crystal, the greater the effect. But this is not so, because my control, the igniter, showed many times greater voltage than the amethyst, and it used a miniscule crystal. I can gather that the amethyst crystal either had the best crystal structure for the piezoelectric effect to take place, or amethyst quartz is simply the most piezoelectric of all the minerals I tested. This information can be used to develop alternative sources of energy, such as seismic generators that convert seismic energy into electrical energy using piezoelectric minerals.

**Summary Statement**
My project was conducted to test which of the eight minerals I used most effectively converts mechanical stress applied into electrical energy through the property of piezoelectricity.

**Help Received**
Mrs. Vodraska gave me advcie and helped me register; Ms. White lent me her large amethyst sample; My mother helped me with my Excel data sheets; My father allowed me to use his tools to construct my experimental setup.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Ayako C. Kuki

**Project Number**
**J1221**

**Project Title**
## How Full Is Full Spectrum?

**Abstract**

**Objectives/Goals**
My objective was to evaluate the claims of "full-spectrum" light source manufacturers in order to determine whether their products imitate the qualities of sunlight more accurately than ordinary light sources. Additionally, I sought to determine which of the light sources tested would produce a spectrum most similar to that of sunlight, and to determine which of these light sources would produce a spectrum least similar to that of sunlight. I hypothesized, based on qualitative experience, that the spectrum of the Ott-Lite Tru-Color fluorescent desk lamp would most resemble the spectrum of sunlight, and that the spectrum of the GE Crystal Clear incandescent bulb would least resemble the spectrum of sunlight. I also hypothesized that the lights advertised as "full-spectrum" would produce spectra which resembled the spectrum of sunlight more closely than lights not marketed as "full-spectrum."

**Methods/Materials**
My apparatus consisted of a light-tight chamber with a small slit on top to admit a single ray of light. A lens focused this beam of light onto a diffraction grating mounted at a 45° angle to the incoming light. The light was diffracted into its spectrum and reflected onto an index card marked with quarter-inch reference lines. I tested 10 different light sources in this way. A digital camera was then used to take high-resolution images of these spectra, which were uploaded onto a computer. For each spectrum, Adobe Photoshop 7 was used to extract RGB values from 11 sample points at regular intervals, resulting in a total of 110 sample points. I calculated the summed squared deviation between the data gathered from each light source's spectrum and the spectrum of sunlight.

**Results**
I found that the Ott-Lite Tru-Color fluorescent desk lamp was the most similar to sunlight, with a squared deviation of 10.8. The GE Soft White compact fluorescent bulb resembled sunlight the least, with a squared deviation of 167.1.

**Conclusions/Discussion**
The Ott-Lite Tru-Color fluorescent desk lamp did resemble sunlight the most, but in my experiment, the GE Crystal Clear uncoated incandescent bulb, with a squared deviation of 44.4, was not the most dissimilar to sunlight. The four "full-spectrum" lights I tested were the most similar to sunlight. These results indicate that the lamps do stand up to the manufacturers' claims, and will reproduce the qualities of natural sunlight more effectively than other light sources.

**Summary Statement**
Using a spectrometer built around a diffraction grating, a digital camera, and Adobe Photoshop, I quantitatively analyzed the spectra of full-spectrum light sources to evaluate thier similarity to sunlight.

**Help Received**
Father helped with spectrometer design; science teacher provided guidance.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Bolun Liu

**Project Number**
**J1222**

**Project Title**
# The Hysteresis Curve of a Compressible Fluid

**Abstract**

**Objectives/Goals**
Many things exhibit hysteresis curves: electromagnetic components, some mechanical systems (compliance), and elastomers. The goal is to experiment with compressible fluids and to find quantificable hysteresis curves. Using a newly designed apparatus, I sought to identify synthetic elastomer materials that were compressible and to measure the relationship between stress (force applied) and strain (displacement produced) when compressing a fluid (painter's putty). I hypothesize that the painter#s putty would be the only compressible fluid. Also, I assert that this material would have a double-J hysteresis curve.

**Methods/Materials**
To find the compressibility of the tested materials: drum putty, painter's putty, play dough, window caulk, an experimental apparatus was designed and constructed to compressed a fluid filled chamber using a screw mechanism. The force applied to the fluid was measured using a scale and the displacement is enhanced with the use of an optical amplifying device which works by turning the angle of a laser to project on a wall. I then compressed the fluid by turning the screws until they read the needed force (strain) on the scale and recorded the displacement (stress) on the projection. Each of 21 trials had 20 data points in increments of 5 kilograms from 0-50-0. The data was statistically analyzed using an EXEL program. The resultant data was used to construct the hysteresis curves.

**Results**
DAP Painter#s Putty ʻ53# was the only fluid found to be compressible. Also, it did had a significant, repeatable, hysteresis curve. While force was added, it compressed linearly much like Hooke's Law, but when the force was relaxed, a non-linear (second degree) curve was observed. While loading appeared to follow Hooke's Law unloading did not. The typical lead-lag relationship of a non-linear material was observed showing a significant dissipation of energy as "heat."

**Conclusions/Discussion**
The hypothesis was supported for a hysteresis curve under compression (a one-loop curve). The custom-made experimental apparatus performed well giving accurate and repeatable results. Given the results of the experimentation, a modification to the apparatus was designed to produce hysteresis curves under both compression and tension (the characteristic double-loop curve) with torsion controlled. The results clearly demonstrate an important physical property of elastomers undergoing stress.

**Summary Statement**
Hysteresis curves of elastomers were experimentally produced and analyzed.

**Help Received**
Dr. John C. Howe provided on-going mentoring and my parents provided financial assistance.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Max C. Lutton

**Project Number**
**J1223**

**Project Title**
# Is Green Insulation More Effective than Pink in Maintaining Home Temperatures?

**Abstract**

**Objectives/Goals**
My objective was to determine if home insulation batts made from natural fibers were as effective in maintaining home temperatures as the standard, manmade fiberglass batts.

**Methods/Materials**
Recycled denim or cotton batt, sheep's wool batt, and fiberglass batt were the samples tested. For each sample, a test wall was made with two pieces of glass and clamps, with an insulation batt in between. One side of the 'wall' was heated. Temperatures of the heated side and the opposite side of the wall assembly were recorded at different time intervals. Average temperature differences from the various trials were calculated and compared.

**Results**
The greatest average temperature differences were seen with the denim based insulation followed by the fiberglass and then the sheep's wool.

**Conclusions/Discussion**
The natural fiber cotton batt was more effective than the manmade fiberglass and the natural fiber sheep's wool at stopping heat transfer. Cotton is a renewable resource and safety wear is not needed when installing it. The cotton batt is a product made from 85% recycled denim.

**Summary Statement**
This project is about comparing energy efficiency of natural fiber insulations to the widely used manmade fiberglass batt.

**Help Received**
Mom took me to an interview and construction sites; Coach Souza gave me a timeline.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Anna H. Machuga

**Project Number**
**J1224**

**Project Title**
## Acid Rain: Our Monuments Feel the Pain

**Abstract**

**Objectives/Goals**
Which building material is the least susceptible to acid rain: limestone, granite, or marble?

**Methods/Materials**
12% sulfuric acid solution (11 L), 7 pieces of each material: granite, limestone, marble, and sandstone, digital balance (precision +/- 0.1g), 18.9 L distilled water, 5 plastic (HDPE) containers 475 ml capacity, pH paper (0-7), paper towels, Rooto Professional Drain Opener (2 L), 3.8 liter PE container, measuring cup (238 ml capacity), goggles, gloves.

**Results**
Overall, the average percentage of material that the limestone lost in the acid was 42.76% of its original weight. The average percentage that the marble lost in acid was 35.50%. Granite lost an average of 0.10% in acid. The sandstone averaged a mass gain of 0.16% of its starting mass. The limestone gained an average of 0.25% in weight in the plain water. The sandstone gained 2.28% in mass in the plain water. The mass of the marble remained unchanged in the plain water. The granite gained 0.33% in the plain water.

**Conclusions/Discussion**
The data I obtained did support my hypothesis. My experiment showed that the limestone and marble were the two materials that lost the most mass. The granite and the sandstone lost a very little amount of mass or didn#t lose any. I predicted this in my hypothesis, based on my background research. In the end, the sandstone didn#t lose any mass and gained some in both the acid and the water. I believe the reason why this happened was because it absorbed some of the water that was used to clean off the acid.

**Summary Statement**
I determined which building material used in monuments; limestone, sandstone, marble, or granite are least susceptable to acid rain.

**Help Received**
Sande Petty-Weeks took pictures under microscope. Dad cut materials and helped make acid solution.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Courtney N. Melanson

**Project Number**
**J1225**

**Project Title**
## Keeping the Finish!

**Abstract**

**Objectives/Goals**
The objective was to find out what happens to 20 car panels when 10 were striped of everything but the paint and 10 were striped of everything but paint and then had protective sealant and materials that are hazardous to paint applied and left to sit.

**Methods/Materials**
1. 4 Eggs
2. 4.5 ounces Soda
3. 6 ounces hard-water
4. 5 ounces ketchup
5. 5 ounces mustard
6. 5 ounces shaving cream
7. 5 ounces shoe polish
8. 5 ounces break fluid
9. 4 ounces saliva
10. 5 ounces salt
11. 20 Car Panels
12. 6 feet of masking tape
13. 6 ounces Protective Sealant (Teflon)
14. Micro-fiber rag
15. 21 baby wipes

**Results**
Most of the car panels had very little damage. The few panels that did have damage though had severe damage, such as the panels containing eggs, brake fluid and mustard.

**Conclusions/Discussion**
I think the project was successful in what I was trying to accomplish but if i were to re-conduct this experiment I would probably change the materials I used on the panels.

**Summary Statement**
The effects of enviornmental and industrial materials on a car's painted surface.

**Help Received**
Father helped apply materials to panels; Dad's co-worker cut panels; Sister took pictures.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Daniel C. Minter

**Project Number**
**J1226**

**Project Title**
## Wingardium Leviosa: The Effect of Temperature on Magnetic Repulsion

**Abstract**

**Objectives/Goals**
The objective my project was to determine if a change in a magnet's temperature would affect the strength of the magnetic repulsion of two opposing magnets, and if so, to measure those changes. I hypothesized that the strength of the magnetic repulsion would decrease as the magnet's temperature increased, caused by an increase in the random motion of the atoms of the magnets.

**Methods/Materials**
To test this, two Neodymium-Iron-Boron ring magnets and two ceramic ring magnets were used. Each set of magnets were submerged in a solution of dry ice and 91% isopropyl alcohol. When the magnets reached -20 degrees Celsius, they were removed and placed on the wooden test stand with their magnetic fields opposing each other. An infrared thermometer was then used to check the temperature of the magnets and using a digital height gauge, the magnetic repulsion was measured at five degrees Celsius intervals until the magnets warmed up to room temperature. The two magnets were then placed in the oven until they reached 100 degrees Celsius. They were then placed back on the wooden stand and tested as above until the magnets cooled to room temperature. The above test was repeated four times with both the Neodymium-Iron-Boron magnets and the ceramic magnets.

**Results**
The neodymium test data showed an average magnetic repulsion of 87.76mm at -20 degrees Celsius decreasing to an average of 62.36mm at 100 degrees Celsius. Also, the ceramic test data showed very similar results with an average magnetic repulsion of 25.73mm at -20 degrees Celsius decreasing to an average of 22.41mm at 100 degrees Celsius.

**Conclusions/Discussion**
After reviewing the data, it was found that the experiment's results supported the hypothesis. An increase in a magnet's temperature does cause a decrease in the strength of the magnetic repulsion of two opposing magnets.

**Summary Statement**
The central focus of this project was to determine if a change in a magnet's temperature would affect the strength of the magnetic repulsion of two opposing magnets, and if so, to measure those changes.

**Help Received**
My father helped with the dry ice and the construction of the test stands.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Jacob R. Moe

**Project Number**
**J1227**

**Project Title**
## Seal the Deal

**Abstract**

**Objectives/Goals**
To determine which water sealant works the best on cedar and redwood.

**Methods/Materials**
Three different water sealants were tested on untreated cedar and redwood fencing boards. A control sample of each type of wood was also included. Two coats of the sealants were applied to each sample. The samples were than submerged in water for four days, weighing the samples every 12 hours to see how much water had been absorbed.

**Results**
The wood samples that were coated in Thompson's oil sealant had an average water absortion weight gain of 1.23 oz for the cedar samples and 6.5 oz for the redwood samples. With the Olympic oil sealant, the water absortion weight gain was 1.25 oz for the cedar wood samples and 1.18 oz for the redwood samples. Lastly, the results of the Olympic Water sealant was a water abortion weight gain of 1.2 oz for the cedar samples and 1.42 for the redwood samples. The cedar and redwoood samples were than average to get the net results which showed that the Olympic Oil based sealant worked overall the best for both types wood.

**Conclusions/Discussion**
The results proved my hypothesis correct. The Olympic oil-based sealant on both the cedar and redwood fence boards worked the best to seal out the water.

**Summary Statement**
To find out which brand of water sealant protests the new wood the best.

**Help Received**
Dad helped gather supples , cut the samples and paint the samples because my arm was in a cast.

# CALIFORNIA STATE SCIENCE FAIR
# 2008 PROJECT SUMMARY

**Name(s)**
Madalyn A.F. Morris

**Project Number**
**J1228**

**Project Title**
## Sizzling Hot Sunscreen 2: Waterproof Spoof

**Abstract**

**Objectives/Goals**
The objective of this project is to determine whether or not being waterproof affects the SPF level of sunscreen based off of previous tests.The sunscreens with an SPF of 30 will not work better than 30 and being waterproof of the sunscreen will aid sunscreen performance in UV light.

**Methods/Materials**
1x1 inch pieces of banana peel,225 3#x 4# pieces of S.G.P.,225 3# x 4# pieces of overheads,log,pens,fake sun light,scissors,plastic syringe,9 different sunscreens,banana mats.Rub 1/10 tblspn thoroughly onto a banana piece.Place on setup on banana mat according to SPF level, and brand.Leave them in fake sunlight for 30 minutes,checking back every 2 minutes.The same procedure is used for all sunscreens.On 2nd time,use real sunlight.Rub ¼ tblspn of sunscreen thoroughly onto a transparency.Place on setup on SGP mat according to SPF level,and brand.Attach SGP to overheads and place on SGP mats.Leave them in A.S. for 7 minutes,checking back every 1 minute.The darker the color of the SGP,the more amount of protection.The same procedure is used for all sunscreens.Repeat all,for each sunscreen twice.Repeat and use real sunlight.Repeat all,but wetting all tests.

**Results**
After 3 trials with the banana peels it was determined that the banana peels did not show any difference between each other enough for there to be any data collected.It was determined there would be no promising way to get any useful data.The S.G.P. results had better results than the banana peel method.It took longer for the tests to obtain full exposure from the fake sunlight,so it was determined that the time for the S.G.P. had to be extended to a longer time period.The sunscreens were affected by the water,even though they claimed to be waterproof,and they performed with harmful results.The controls that were taken had Hawaiian Tropics,SPF 30 perform the best yet again in bothwet and dry tests.The sunscreen that performed the worst was Fruit of the Earth SPF 45 in both wet and dry tests.It protected with a roster number of 7 after only 12 minutes had passed in the tests.

**Conclusions/Discussion**
The hypothesis was rejected by the data.The hypothesis that being waterproof would not affect the results in a bad manner,but aid the sunscreen to help protect the skin.Being waterproof affected the results in a bad manner.It made the sunscreens perform much worse and they all performed terrribly after being wet.

**Summary Statement**
In my project, i tested how well SPF levels and being waterproof works to help protect your skin.

**Help Received**
Mom helped me buy needed materials., my teachers helped me deciding on a project and graded board.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Tyler G. Myers

**Project Number**
**J1229**

**Project Title**
## Linear Acceleration

**Abstract**

**Objectives/Goals**
Can magnets propel a metal ball? If so, what combination of magnet spacing and trigger angle create the most velocity? I believe the ball will go the fastest when the trigger is at its highest point and the magnets are at such a spacing so the ball will hit the next magnet when it is at its top speed.

**Methods/Materials**
One wooden track, six magnets with about thirty pounds of pulling force each, thirteen steel balls, trigger mechanism, chronograph, sand pit, yardstick.
For my methods I'll test every half inch from three inches to ten inches for magnet spacing. Then, I'll test every ten degrees for the angle of the trigger. I'll do this until I find the best average velocity of five shots of each combination.

**Results**
At eight inches apart the magnets propelled the ball the best. At six inches the ball went almost as far but not quite. At nine inches the ball didn't go nearly as far.

Note: Student is conducting additional experiments and collecting more data for updated results and conclusions.

**Conclusions/Discussion**
The hypothesis was correct. The magnets propelled the ball through the power of kinetic energy.

**Summary Statement**
My project is about finding out the highest velocity I can reach for a steel ball using magnets.

**Help Received**
Father helped build wooden track and make data graphs, Mother and Sister helped glue information on science board.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Dylan C. Ochoa

**Project Number**
**J1230**

**Project Title**
## It's Getting Cold

**Abstract**

**Objectives/Goals**

The purpose of this project was to determine whether cloth, paper or sand were the superior heat insulator for conductive heat. A testing chamber was designed to simulate a housing unit, with exterior and interior walls separated by the insulation material. To build the testing chamber, ## inch thick plywood planks were measured, cut and nailed together to create the inner and outside boxes, and the outer box lid. The access hole for the thermometer was then located and drilled through the outer box lid. Wood stud supports for the inner box and the Pyrex beaker were measured and cut. The inner box was placed in the middle of the outside box, creating the space in which the chosen insulation materials were positioned. Once the paper, cloth or sand had been placed inside this space, the beaker was filled with 500ml. of water heated to 210 degrees Fahrenheit and stationed on a small support inside of the inner box. The outer box lid was placed on the top with the access hole plugged. The box was placed inside of the refrigerator (to mimic exposure to inclement weather). Temperature was checked and recorded every hour during the four-hour testing period.

The final results showed that cloth was the overall superior heat insulator, followed by closely by paper. While at the end of the testing period both the cloth and the paper retained 96 degrees Fahrenheit, cloth retained more heat than paper during the interval hours. Sand, however, retained only 87 degrees Fahrenheit at the testing end, and at every interval measurement.

Discovering that sand was the least effective insulator was surprising. Because the sand covered more space between the two boxes than the other materials tested, it should have had greater heat conductivity. However, this result can be explained because sand is more porous than the paper or cloth, and therefore is the most susceptible to thermal bridging. The testing results regarding paper were surprising because the cloth towels were a higher density material; however, the closeness in the testing results between cloth and paper can be explained because there was a greater volume of paper material that could be placed in the testing chamber than the cloth towels.

**Summary Statement**

Testing the heat retaining capabilities of paper, sand, and cloth as insulation.

**Help Received**

Dad helped construct the box

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Michael M. Pilegard

**Project Number**
**J1231**

**Project Title**
## Which Dog Food Is Digested Better?

**Abstract**

**Objectives/Goals**
My project was to see which dog food is best digested by a dog, expensive or inexpensive. My hypothesis was that the most expensive dog food would be digested better.

**Methods/Materials**
To conduct the experiment I made a miniature digestive system of a dog by putting dog food with lemon juice (representing stomach acid) into a balloon (resembling a stomach). Next, I took a stocking (which was the small intestine) and put meat tenderizer ( serving as enzymes) with the dog food squeezed from the stomach and let it sit overnight in cup of water. Next, I recorded the weight of the squeezed dried dog food (representing feces) and the clarity of the water left in the cup (representing the food absorbed). I did this 20 times for 3 types of dog food, Atta Boy, Complete by Purina, and Iams. Then I calculated the amount of dog food needed to meet the guaranteed analysis on the dog food labels and analyzed the amount of digestible protein provided from the ingredient list on the label. I also calculated the cost per serving of dog food.

**Results**
The range of the cost of dog foods was smaller once the cost per serving was calculated compared to the cost per pound. Atta Boy, which costs $0.11 per serving, produced the most waste (feces), and Iams, which costs $.14 per serving, produced the least amount waste. This indicated that more of the food stayed in the body (was digested). Complete, which costs $0.11 per serving, had the least amount of transparency in the liquid that would be absorbed in the body and Atta Boy had the most. This indicated that most of the food went to waste from Atta Boy. Iams, the most expensive, contained the most digestible protein and Atta Boy ( which was less expensive) contained the least. Iams also required the least amount of dog food to meet the guaranteed analysis on the label and Atta Boy required the most.

**Conclusions/Discussion**
Given all this information, weight of waste, clarity of liquid to be digested, cups of dog food needed, and digestible protein content, Iams won 3 out of 4 of these categories. Complete won one and Atta Boy lost all of the categories. Therefore, my hypothesis was correct. If you want the most digestible dog food at only $0.03 a serving more, choose Iams (the more expensive dog food tested).

**Summary Statement**
I determined which differently priced dog food is digested better by replicating a dog's digestive system and analyzing label information.

**Help Received**
Mother/Teacher typed, used paper cutter, taught the difficult concepts & graphing program, and provided a second pair of hands when needed during the experiment.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Brian W. Pinner

**Project Number**
**J1232**

**Project Title**
## Magnets: Hot or Cold?

**Abstract**

**Objectives/Goals**
My objective is to discover the effects (if any) of temperature on the strength of a magnet.

**Methods/Materials**
My method for testing this was to place a pure magnet at a variety of temperature zones for 1 hour and then sliding it towards a metal indicator to determine the magnetic strength by the distance the indicator jumped. My materials included a pure neodymium magnet, a magnetism meter created with a ruler, pvc pipe, and piece of framing on a wooden board together, a digital laser thermometer, and a metal indicator.

**Results**
My results showed that temperature can affect magnets in both positive and negative ways. If I heated up a magnet then it got weaker but if I cooled a magnet then the magnet's strength increased.

**Conclusions/Discussion**
I conclude that temperature does have an effect on magnets because it affects the tiny magnets fouund inside its electrons.

**Summary Statement**
My project looks at the effects of temperature on the strength of a magnet.

**Help Received**
Mr. Miles Stoudenmire helped me by answeing questions and my father helped me with my magnetism meter.

# CALIFORNIA STATE SCIENCE FAIR
# 2008 PROJECT SUMMARY

**Name(s)**
Kes Rushing

**Project Number**
**J1233**

**Project Title**
## Effects of Temperature on Magnets

**Abstract**

**Objectives/Goals**
The purpose of this project is to learn more about the properties of magnets when they are subjected to different temperatures. Does the temperature of a magnet have any effect on its strength?

**Methods/Materials**
Hypothesis:
1. The strength of a magnet is affected by temperature.
2. As the temperature of a magnet increases, it becomes stronger. As the temperature of a magnet decreases, it becomes weaker.
Experimental Method:
My experiment was run with experimental and control variables.
Experimental Variables:
1. Temperature: Each magnet was exposed to three different temperatures (-78 deg. C, 0 deg. C, 100 deg. C ).
2. Two types of magnets were used: neodymium (rare earth) magnet, and ceramic magnet.
Control Variables:
1. Size of paperclips: 1.25" standard #1 paperclips.
2. Length of time magnet was exposed to each temperature: 15 minutes.

**Results**
The experiment was repeated 5 times for each temperature and then the average was calculated. The reason for doing multiple trials was because the process of picking up the paperclips was not very accurate.

The experiment proved that magnet strength is affected by temperature, but it did not produce the expected results. For both magnets, more paperclips were picked up when the paperclip was colder than when it was hotter.

**Conclusions/Discussion**
Based on the results of the experiment and the comparison of the observed data to the theorectical data, the following is concluded:
1. Part 1 of the hypothesis (magnet strength is affected by temperature) is True.
2. Part 2 of the hypothesis (magnets are stronger at higher temperatures) is False. Magnets are stronger when they are colder.

**Summary Statement**
I showed that the strength of a magnet can be significantly increased by making the magnet colder.

**Help Received**
My Father helped me create graphs of my data.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Laurine J. Shahmirian

**Project Number**
**J1234**

**Project Title**
## Do Metallic Medical Implants Corrode in the Human Body?

**Abstract**

**Objectives/Goals**
The purpose of this project is to investigate corrosion effects of human body fluid on titanium, stainless steel and copper.

**Methods/Materials**
I used titanium, stainless steel and copper and immersed them in distilled water, in saline, and in hydrochloric acid, representing gastric acid solution with pH of 1.5. I used 3 pieces of titanium, copper and stainless steel, measured their initial weight, and placed each in a lidded jar filled with the solutions and kept them in an incubator set at 37 oC. I took each metal out of its jar, measured its weight, the pH level of the solution, and the conductivity of the solution. I repeated this experiment for three trials.

**Results**
My results show that the weight loss for copper was 8 times that of stainless steel and 16 times that of titanium in hydrochloric acid solution. Titanium and stainless steel weight loss in saline solution and distilled water was less than 1%.
The pH level of all three solutions with all three metals changed about 30%, however, the pH of the hydrochloric acid solution with copper increased by 180%. The increase of pH in hydrochloric acid and copper could be attributed to the increase in H+ ions in the solutions which are released by the chemical reaction of the hydrochloric acid with copper. Conductivity in all of the solutions remained about the same. The conductivity of copper in the hydrochloric acid solution decreased by 50%. This could be due to additional charged particles that are released in the solution due to corrosion of copper. The copper and HCl solution turned greenish blue with visible solid precipitates that covered the surface of the solution. I believe that when hydrochloric acid solution reacts with the solid copper, the hydrogen ions, H+, and the chloride ions, Cl-, in the HCl react with the copper resulting in a complex copper chloride ion, $CuCl_3^-$ . As the solution becomes diluted, the $CuCl_3^-$ ions tend to lose Cl- and their color shifts toward green indicating a mixture of different copper/chloride material, and eventually to blue indicating $Cu^{2+}$ ions.

**Conclusions/Discussion**
My results indicate that the titanium and stainless steel are less likely to corrode in saline and hydrochloric acid solution, and my hypothesis was proven to be correct

**Summary Statement**
This project compares corrosion effects on titanium, stainless steel, and copper immersed in distilled water, saline solution, and hydrochloric acid

**Help Received**
Father helped getting the material and test set up.

# CALIFORNIA STATE SCIENCE FAIR
# 2008 PROJECT SUMMARY

**Name(s)**
Harold F. Smith

**Project Number**
**J1235**

**Project Title**
## An External Magnetic Field Temporarily Changes the Conductivity of a Ferrofluid: A Novel Effect

**Abstract**

**Objectives/Goals**
This study examined the effect of an external magnetic field on the conductivity of a Fe(3)O(4) ferrofluid.

**Methods/Materials**
A ferrofluid was prepared using the published UCLA protocol. The conductivity of the fluid was measured indirectly, using an Ohm meter to measure resistance. With the Ohm meter in place, a magnet was moved under the tray containing the ferrofluid. The resistance was recorded every 10 seconds for 2 minutes. Then the magnet was removed and the resistance was recorded every 10 seconds for 2 minutes. This process was repeated 3 times.

**Results**
The ferrofluid was slightly conductive. Moving a magnet under the ferrofluid caused the conductivity to increase. Over the period of two minutes, the conductivity returned to normal with the magnet still in place. Upon removal of the magnet, the conductivity decreased below the starting value. Again, this change returned to normal in two minutes.

**Conclusions/Discussion**
There are two unexpected aspects of the results. I expected that the conductivity would change, but I expected that it would be permanent once the nanoparticles realigned due to the influence of the magnetic field.

The first unexpected aspect was that the conductivity returned to the starting value with the magnet still in place. The second unexpected aspect was that the conductivity decreased below the baseline when the magnet was removed. That decreased conductivity also returned to the starting value in time.

Conductivity is caused by free ions in solution. How could these ions be affected by the arrangement of the nanoparticles? How could the change return to normal? Why does it take minutes to happen? Literature searches and discussions with Nanoscience researchers at UCLA have not yielded a satisfactory explanation for these observations.

**Summary Statement**
Addition or removal of a magnetic field on a ferrofluid causes a surprisingly temporary change in conductivity.

**Help Received**
Dad helped me collect the Ohm meter readings and helped make some of the ferrofluid. Mom helped me type and prepare the poster. The meters were borrowed from my dad and the chemicals were given to us by UCLA.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Alec G. Swager

**Project Number**
**J1236**

**Project Title**
## Putting to Test Different Materials Designed to Reduce Heat Transfer

**Abstract**

**Objectives/Goals**
The hypothesis is more heat will transfer through convection than it would through radiation and is the most important transfer method to stop. Because of this it is believed that the foam rubber and fiberglass will be better at insulating than foil. It is thought that both the foam rubber and fiberglass containers will prevent equal amounts heat because the packages stated that they both had an R-value of 3.

**Methods/Materials**
To test the experiment four containers were used, three were insulated with fiberglass, foam rubber, foil, and the fourth was a control. The four containers were filled with seven oz. of water and placed in a refrigerator until all of them had reached 36 degrees Fahrenheit. They were then put into a 130 degree Fahrenheit oven and the water temperature was recorded versus time. The test was repeated 6 times rotating the positions of the bottle between tests. The test results were normalized, averaged and graphed.

**Results**
This experiment showed the foam rubber and fiberglass insulators were the most effective of the insulators tested at reducing heat transfer. The foam rubber and fiberglass, both having a R-Value of 3 were equally good at preventing heat transfer which supports the hypothesis. The foil container performed next best. Although it was not near as good as the foam rubber or fiberglass containers, it was significantly better than the control.

**Conclusions/Discussion**
The idea for this experiment originally was to see which insulator would keep water coldest in the summer heat. The results of this experiment indicate fiberglass and foam rubber containers would be equally good at insulating. However, the fiberglass may not be the most logical choice. Unlike foam rubber, it is not waterproof, and would need some protection. The research shows fiberglass would not perform as well if compacted or wet. It would be interesting to see how efficient the fiberglass and foam rubber containers would perform if aided by the foil insulator.

**Summary Statement**
This project tests the ability of different insulators to reduce heat transfer.

**Help Received**
My father #Lee Swager and teacher #Mrs. Turpin for advising me; Dr. Cooper from Bakersfield College reviewed my report

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Anne B. Tobias

**Project Number**
**J1237**

**Project Title**
## Some Like It Hot! An Energy Independent Slow Cooker

**Abstract**

**Objectives/Goals**
Development of an insulated cooking system that will keep hot (over 160 degrees F) over an extended period of time without additional energy input.

**Methods/Materials**
In two pots of similar capacity, one cast iron and one stainless steel, 2 liters of water were brought to a boil. Each pot was then wrapped in different insulation material (cotton fabric, space blanket, foam padding, volcanic aggregate and fiberglass house insulation). Temperature of the water was monitored over a three hour period using an internal probe. Each test was performed in duplicate.

**Results**
The fiberglass house insulation was the only material tested that was able to keep the water over 160 degrees over the 3 hour test period. All other products conserved only moderate heat compared to the control.

**Conclusions/Discussion**
This project showed that an energy independent cooker that can maintain temperatures safe for cooking is possible. Further development would improve the design and make this a practical alternative for cooking in undeveloped areas where energy is crude, unavailable, expensive or pollution causing.

**Summary Statement**
Development of a slow cooker that once heated is independent of additional energy input.

**Help Received**
Mother helped with moving pots of boiling water to test area.

# CALIFORNIA STATE SCIENCE FAIR
## 2008 PROJECT SUMMARY

**Name(s)**
Jamie T. Vigil

**Project Number**
**J1238**

**Project Title**
## Color vs. Temperature

**Abstract**

**Objectives/Goals**
My project is designed to show a probable cause of the heat trapped in houses #the color of the roof.

**Methods/Materials**
By using a 100 watt flood lamp to act as the sun, I will be able to test this in a controlled environment. I will place one fiberglass composite roof shingle sample on each of 5 single gang electrical boxes to act as my houses, which were placed in a circle around the lamp. The colors I tested were: Shasta White, Amber, Quarry Gray, Brownwood, and Chateau Green. I placed one thermometer in each of the boxes, and one thermometer directly below the lamp. I checked the temperatures in the boxes every 15 minutes for 1.5 hours.

**Results**
I found that the Quarry Gray shingle got the hottest because its color is very vibrant, intense, and saturated. This proves that the color of the roof is a cause of the heat in a house.

**Conclusions/Discussion**
My results stated that the dark color of a roof isn#t a factor which needs to be looked at when purchasing a roof. The more intense, vibrant, and saturated the roof shingle is, the hotter it will get inside. I was able to attain my objective through my experimenting. My original thoughts were that the darker the roof shingle color, the higher the temperature would be inside the house. My original thoughts were incorrect and my experimenting was successful.

**Summary Statement**
My project is about a cause of the heat which gets trapped inside a house - the roof color.

**Help Received**

# CALIFORNIA STATE SCIENCE FAIR
# 2008 PROJECT SUMMARY

**Name(s)**
Claire A. West

**Project Number**
**J1239**

**Project Title**
## Torsional Fracture Strength Tests of Sulfur Concrete

**Abstract**

**Objectives/Goals**
When sulfur is mixed with sand, heated to melting, and cooled it forms sulfur concrete. Sulfur concrete is becoming widely used industrially because of its attractive characteristics including good resistance to chemical attack and fatigue compared to Portland cement based concrete. The question to be answered in the study was: How does changing the sand-sulfur ratio, concrete temperature, and quench rate affect the strength of sulfur concrete?

**Methods/Materials**
The test coupons were made by pouring a mixture of sulfur and sand into metal containers. A bolt and washer were inserted into the mixture. The samples were then set in an oven for one hour at 450F. Once melted, the concrete was cooled for one hour. The samples were then clamped down and torqued with a torque wrench to determine the torsional fracture strength. For the sand-sulfur ratio test, various ratios of sand and sulfur were examined. For the temperature test, the samples were stored and torqued at different temperatures. For the quench test, the samples were quenched and held in an ice bath at different time increments.

**Results**
The key findings were:
-The fracture strength increased as the sulfur content increased, up to a sulfur content of forty percent. Beyond this value, the strength did not increase with increasing sulfur.
-Sulfur concrete strength varies little from -108F to 175F, but declines rapidly at 200F and above.
-As the time in the ice bath increases, the strength of sulfur concrete slowly increases until after about one day when it reached its maximum strength.

**Conclusions/Discussion**
-I found the maximum practical temperature of sulfur concrete is no higher than 200F which is well below sulfur#s melting point of 248F.
-It took about one day to reach sulfur concrete#s maximum strength in an ice bath likely because quenching the sample in an ice bath forms a plastic, amorphous sulfur state, which slowly converts to the harder crystalline state.

**Summary Statement**
How does changing the sand-sulfur ratio, concrete temperature, and quench rate affect the strength of sulfur concrete?

**Help Received**
Dad helped find a torque wrench. Mom helped take the molten sulfur out of the oven. Dad helped place the molten sulfur into the ice bath. Dad helped purchase the dry ice. Mom helped format the display board. Dad helped in editing the papers.