CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Raven J.L. Alvarez

Project Number
J1401

Project Title
Project Inferno

Abstract

Objectives/Goals
Wood with a density between 0.6 and 0.8 g/cm^3 will burn hotter than wood with a density above 0.8 or below 0.6 g/cm^3.

Methods/Materials
To conduct this experiment I used small blocks of wood with different densities. A ruler and scale so I could calculate the density of each sample. A barbecue and charcoal chimney to get the fire started, and a thermometer and stopwatch to measure the temperature of the base flame at one minute intervals.
Wood samples were cut into three centimeter cubes and dried in an oven at 200oF for two hours. I recorded volume and weight of each piece so I could calculate density. In batches of five, wood samples were placed in a chimney with 27 burning briquettes. Once the samples were lit I took their temperature every minute, for five to seven minutes, depending on if they had turned to charcoal by the fifth minute.

Results
The wood in my experiment had densities between 0.401 and 1.15 g/cm^3. These samples burned at maximum temperatures between 526 and 742 C. When I conducted my experiment, wood with a density higher than 0.6 g/cm^3 took about one minute longer to reach a temperature of 400 C than woods with a density below 0.6 g/cm3. Also, those higher density woods burned at least two minutes longer before turning to charcoal. Generally there was less variation in maximum burning temperature within a species than when different species were compared, even when the densities were similar. California Walnut burned at the highest temperature of 742 C with a density of 0.4 g/cm^3. Cherry burned at the lowest temperature of 526 C and had a density of 0.6 g/cm^3.

Conclusions/Discussion
My results showed my hypothesis was incorrect. There is not a relationship between the density of wood and how hot the base flame gets when it burns. I found that each species of wood can have different densities even amongst different parts of the same tree. The wood that measured more dense, took longer to heat up and stayed burning longer than the less dense wood. Less dense woods excelled to high temperatures quickly, but the flame diminished just as fast, becoming charcoal while the higher density woods, such as African Leadwood, continued to burn. In an interview with Bill Wilkinson, a Senior Forester, I learned that studies similar to mine could also be used to help predict the duration and intensity of wildfires, or evaluate which forests could withstand brush burns.

Summary Statement
The density of wood does not affect how hot the base flame gets, but does affect how long it burns.

Help Received
I designed, and conducted the experiments myself. I got insight into how the results are applicable in the real world by discusing them with Bill Wilkinson, a forester, Charlie Quillman, a contracter, and Jeff Kahn, a fire scientist.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

William H. Bennett

Project Number

J1402

Project Title

Natural Insulators

Abstract

Objectives/Goals

The goal of this project is to find out which natural material is best insulator(best at resisting heat).

Methods/Materials

Cooler, natrual materials, microcontroler, controller/computer, fan, data logger, and heat source/lightbulb. Testing four materials each three times over a course of 30 minutes.

Results

From my testing I found that the best natrual insulator is the dirt. I found this out by making a rise rate table that displayed the average temparature rise rate over mintues. It showed that the dirt had the lowest average rise rate.

Conclusions/Discussion

The dirt was the best because of the density or the mass of the dirt. The dirt was dense and had lots of mass. It was better at filling in the spaces, which doesn't allow for air circulation.

Summary Statement

It is about what material, natrual, is the best at resiting the heat nad is a better insulatuar.

Help Received

I go help from my dad, with the data logging and all the computing systems.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Chloe Brandon

Project Number

J1403

Project Title

Eco-Insulation: Environmentally Friendly Options for our Homes

Abstract

Objectives/Goals

The objective of this project was to compare the effectiveness of non-traditional recycled materials versus commercial materials as thermal insulation.

Methods/Materials

The rate of cooling of warm water was measured, when surrounded by various types of non-traditional recycled or commercial insulating materials. A metal can was filled with warm water, and placed in a cardboard box. The spaces between the can and the sides of the box were filled with the material to be tested. The temperature of the water was measured at regular intervals using a thermometer, to determine the rate at which heat was lost.

Results

The material used affected the rate at which the heated water cooled. Although one of the commercial insulation materials (which was used as a comparison baseline) kept the water the warmest for the longest time, some of the sustainable materials had very similar results. The sustainable material with the best performance was a custom blend I prepared of shredded paper and loose-fill cellulose insulation.

Conclusions/Discussion

Repeated trials showed that a non-renewable insulation option was able to keep the water the warmest. However, there were several other materials options that were almost as efficient and were also recycled and less expensive. A composite blend of commercial and recycled materials also proved to be a viable and realistic option.

Summary Statement

I tested the thermal insulation properties of several recycled materials, and found they have similar performance to standard insulation which is less sustainable and higher in cost.

Help Received

I researched how insulating materials work, and performed the measurements. My mother helped with the purchase of materials. My father helped with taking pictures while I was performing the experiments.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Jacob J. Bright

Project Number

J1404

Project Title

Bringing the Heat: Testing Synthetic Plastics to Determine Melting Point and Heat Resistance

Abstract

Objectives/Goals

The goal of my science project was to determine which of six different plastics (polyester, polycarbonate, polypropylene, polyethylene, polystyrene, and ABS) took the longest period of time to show signs of melting when subjected to extreme heat. My hypothesis was that polyester would take the longest amount of time to melt because it has the highest predicted melting point of the six (about 482-500°). I used a butane torch to melt the plastics. The potential applications of my project include any real-world scenario where plastics are subjected to extreme heat. For example, recently there have been incidents where cell phones overheated and either burst into flames or exploded. My project could help determine better materials for cell phone casings that could minimize damage.

Methods/Materials

I tested each of the 6 plastics 6 times using a 4#x1#x1/8# plastic strip each time. I placed each strip onto two piles of washers situated on top of a platform. I secured the butane torch into a consistent place using a vise and kept it aimed there for the entire course of the experiment. I identified when the plastic had melted using two brass weights placed near the center of the strip. I aimed the flame at the center of the strip, and when the weights drooped or the strip collapsed, I defined the plastic as having been melted. I timed the melting process with two stopwatches to ensure accuracy.

Results

Once I had tested all 36 samples, I took the results of the experiment and formed averages based on the accumulated times of each plastic. They were (from lowest to highest) polystyrene (average time of 15.57 seconds), polyethylene (21.22s), ABS (21.94s), polypropylene (23.31s), polycarbonate (26.35s), polyester (37.36s). I was able to melt all 36 samples and from that data, I came to a conclusion about which plastic melted most slowly.

Conclusions/Discussion

The data supported my hypothesis that polyester would be the plastic that melted at the slowest rate (about 37.36 s). These results can help to expand our knowledge about this subject. Using this data, scientists could design better protective casings for phones that can withstand greater amounts of heat in the event of a battery failure or similar condition. Based on my project, polyester would be the best casing material. This data would also be relevant to any other situation where a plastic with good heat resistance is required.

Summary Statement

My project is about determining which of six different types of plastics takes the most amount of time to melt when subjected to extreme heat and applying the results to real-world situations where materials must undergo these conditions.

Help Received

My grandfather assisted by helping me cut the plastics into consistent sizes. My father and grandfather helped me perform the experiment.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Adam Chaabane

Project Number

J1405

Project Title

How Do Wireless Signals Propagate through Different Media?

Abstract

Objectives/Goals

My objective is to determine how different materials (such as cardboard, plywood, aluminum, glass, plastic, steel, and bricks) affect the propagation of wireless signals in the 5.8Ghz bandwidth. The main goal of my research is to measure the attenuation of the wireless signal as it goes through materials with different characteristics.

Methods/Materials

In this project, I used two AirGrid M5 Ubiquiti radios. The first was set up as the transmitter while the second as the receiver. The Ubiquiti radio software enabled me to vary the amount of emitted power (in dBm and mW) and measure the amount of received power (in dBm and mW) at the receiver end. The two radios were separated by exactly 24ft. After establishing the free space path loss with no obstacles between the radios, I conducted the same experiment but with obstacles of known material characteristics between the two radios. With available materials at home, I fabricated cubes that measure 12"x12"x12" but have different materials. I then measured the received signal after it propagates through each of material. My data analysis focused on how different material characteristics affected the propagation of the wireless transmitted signal.

Results

The results of my experiment show that wifi signals are most affected by the electric and magnetic characteristics of materials. Dielectric materials such as glass and plastic had received signals that are four to sixteen times stronger than non-dielectric materials such as steel and foil.

Aluminum Foil received signal strength was -76dbm

Wood received signal strength was -74dbm

Steel received signal strength was -70dbm

Plastic received signal strength was -67dbm

Glass received signal strength was -64dbm

Conclusions/Discussion

This project shows that wireless signals propagate as electromagnetic waves that are most affected by the electric (mainly permittivity and conductivity) and magnetic (mainly permeability) characteristics of materials.

The data analysis in this project shows how important it is to select the right materials when good wireless signal reception is desired. A computer or receiving device received signal strength from an access point (or emitting source) is very much affected by the medium through which the wireless signal propagates

Summary Statement

My project is about how different material characteristics affect the propagation of wireless signals

Help Received

I would like to thank my science teacher Mr. Bud Smith at All Saints Day School, Carmel, CA

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Jack W. Collins

Project Number

J1406

Project Title

The Shear Strength of Velcro

Abstract

Objectives/Goals

The purpose of this experiment is to find out if the shear strength of Velcro will be affected by the amount of times it is pulled apart and put back together "cycled#.

Methods/Materials

Tested the shear strength of Velcro by hanging a bucket of weight from a 4"x 4" section of Velcro attached to plywood until failure, then "cycling" the Velcro by pulling it apart and putting it back together 25 times and then repeating the process. Materials included rope, bucket, various weights, and plywood pieces with 4" x 4" of Velcro attached.

Results

The results showed that after just one cycle of the Velcro, the shear strength was dramatically reduced. On the first try, instead of the Velcro failing, the screw hook in the wood failed at 280 pounds. The next test became baseline 1. Further cycling of the Velcro showed additional reduction in shear strength until the reduction started to level out at 50 cycles. The shear strength started to reduce again at 150 cycles, where the experiment ended.

Conclusions/Discussion

What the results concluded is that Velcro was indeed affected by the number of times it was cycled and 25 cycles resulted with the biggest reduction from 265 pounds to 165 pounds. Velcro is made up of tiny hooks and loops, and every time it is pulled apart, those hooks and loops are weakened. The deterioration is due to some of the hooks and loops breaking and some probably just bending so they are not as strong. In conclusion, Velcro is affected by the number of times it is cycled and it can show a big difference in the amount of weight it can hold in shear.

Summary Statement

I tested and found that the shear strength of Velcro is affected by the number of times it is pulled apart "cycled", with the highest reduction in strength with 25 cycles.

Help Received

I designed, built (with the help of my father), and performed the experiments myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Amelia A. Forrest

Project Number

J1407

Project Title

Electric Pressure: How Conductivity Changes When Pressure Is Applied

Abstract

Objectives/Goals

The objective of this project is to test how the conductivity of different materials change when pressure is applied to them.

Methods/Materials

3 10in. pieces of wire, 9-volt battery, Multimeter (includes milliamps), Sponges soaked in various solutions. Tested the conductivity of several sponges soaked with different solutions using a multimeter. The solutions used were distilled water, tap water(from the San Mateo County Water System), sugar water(with a 1 tbs of sugar for every cup of water, saltwater(with the same ratio), and a dry sponge(as a control).

Results

For each of five sponge treatments, 24 trials each with and without pressure were performed. The biggest changes with pressure in the measured current were in sponges treated with tap water and distilled water. Sponges treated with sugar water and saltwater had the highest current flow, but the flow did not change with pressure. The dry sponges had the lowest (and most variable) current flow, but it did not change on average with pressure.

Conclusions/Discussion

The averages in my data table show that tap water had the largest average change when pressure was applied. The different sponges used in this experiment may have affected the outcome. The sponges could have had different pH balances, which would have affected the conductivity. The weather could have also changed how much liquid the sponges absorbed.

Summary Statement

I found that when pressure is applied to tapwater, the change is conductivity is the greatest of all the materials tested.

Help Received

I designed the project methods myself. Scientists Jamie Butler and William Forrest helped me to understand electricity. My science teacher helped me to problem solve.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Cassidy R. Gereke

Project Number

J1408

Project Title

Bioplastic: Will Using Different Potato Starches Affect the Strength of Bioplastic?

Abstract

Objectives/Goals

To determine how different types of potato starches affect the tensile strength of bioplastic.

Methods/Materials

A variety of 5 different potato starches, corn syrup, water, and vinegar were used to create bioplastic. After creating the bioplastic, it was then tested to determine the tensile strength using a spring scale. The same procedure was then used to create a cup from white potato starch.

Results

Results showed that the bioplastic made from white potato starch had the strongest tensile strength in trials 1 and 2. The bioplastic made from yellow potato starch had the weakest tensile strength. Bioplastic made from white potato starch had an average tensile strength of 19 Newtons. Tensile strength was measured using a spring scale. As a result of the white potato bioplastic being the strongest, a cup was made using a mold, to test pH levels. Bioplastic made from white potato starch was also placed in soil to test the tensile strength after it started to decompose.

Conclusions/Discussion

In conclusion, making a bioplastic from potato starch could be an alternative to petroleum based plastic. The sugar content in a potato affects the strength of bioplastic. Using bioplastic as a product to hold liquid may not be the best option. Instead it could possibly be used to package items for consumers. Further research is needed to confirm what the best option is for bioplastic made from potato starch.

Summary Statement

My project measures tensile strength of bioplastic created from different types of potato starches, determining which would be best to replace petroleum based plastic.

Help Received

My classmates helped peel and shred potatoes. I then performed the rest of the experiment myself.

Name(s)
Leia Gluckman

Project Number
J1409

Project Title

A Clean Conscience: Formulating an All-Purpose Dental, Hair, and Body Cleansing Powder for the Homeless Population

Abstract

Objectives/Goals
As the most requested hygiene items at homeless shelters are toothpaste, shampoo and body powder, I wanted to create an all-purpose tooth, hair and body cleansing powder that could be made from natural and inexpensive ingredients. Taking common ingredients found in tooth powder, body powder and dry shampoo, I set out to formulate a natural powdered product that would: (1) absorb sweat and oil, (2) clean teeth, (3) kill bacteria, and (4) have a pleasant taste/smell.

Methods/Materials
A variety of food-grade flours, clay, baking soda, salt, essential oils and stevia mixed in various proportions. Tested individual ingredients and combinations for absorptive and antibacterial effects, cleansing ability and taste/smell, using water, oil, sterile swabs, LB agar plates, tryptic soy agar plates, incubator (I built), sweaty shirt, toothbrushes.
For absorbency, I used a dropper to add water/oil to each powder and observed when the water/oil was fully absorbed. For antibacterial properties, I contaminated my science classroom counter, cleaned it with (1) essential oils, and (2) my best formulas, then swabbed the cleaned areas and grew bacteria in agar plates. For tooth-cleansing, I brushed coffee-soaked eggs with toothbrushes dipped in each of the powders. Taste and smell were my own opinions.

Results
I created 13 formulas, most of which had absorbent and antibacterial properties, but did not taste well enough to function as a tooth cleanser, until I added stevia and significantly increased the amount of essential oils.

Conclusions/Discussion
I created three formulas that are able to absorb sweat and oil, clean teeth, kill bacteria, and have a pleasant taste/smell.

Summary Statement
I created an all-purpose tooth, hair and body cleansing powder to assist the homeless population

Help Received
I designed and performed the experiments myself, supervised by my mother and Caryn Asherson, my science teacher.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Caitlin M. Gorin

Project Number

J1410

Project Title

Developing a Prototype Case that Reduces Electromagnetic Fields Emitted from Cellular Devices

Abstract

Objectives/Goals

The objective of this engineering project is to develop a Prototype Case that reduces H-Field Radiation emitted from Cellular Devices by 10%. Cellular Device usage continues to increase, raising concerns about a possible link between Electromagnetic Field (EMF) Radiation and adverse effects to human health (cancer, sleep disorders, and development problems). It would be beneficial for Cellular Device users to have a protective cover that minimizes H-Fields.

Methods/Materials

This is a 3-Phase Engineering Project that evaluates Cellular Devices' H-Field levels and Materials for filtering Magnetic Radiation using an EMF Tester.
Test Run: Measure H-Field levels from all 6 sides of the Cellular Device, at 3 distances (Direct Contact, 8", and 24" Away) while playing a video or 3 Test Tone Frequencies (200 Hz, 350 Hz, and 500 Hz).
Phase-1: Measure H-Fields in the area. Phase-2A: Build a Faraday Cage out of aluminum mesh and wood.
Phase-2B: Conduct Test Run on multiple Cellular Devices (iPhone 6S, Samsung S3, Samsung S7, iTouch 4, iPad Mini 4, Tab E 8, Note 10.1, and iPad 1). Select the device with the highest Average H-Field.
Phase-2C: Make Screens from different Materials (Plastic, Conductive PLA, Carbon Powder, Iron Filings, Iron Oxide, and Aluminum) and repeat Test Run 3 times with the Selected Device by itself and with each Screen, to identify the Material with the lowest Average H-Field. Phase-3: Design and Fabricate Prototype Case based on Phase 2 Selections. Repeat Test Run 3 times with Selected Device by itself and with the Prototype Case. Analyze H-Field Averages to determine if Objective has been met.

Results

Phase-1: Store Entrances and Electronics Areas have high H-Fields. Phase-2: Highest H-Field - Samsung S7. Due to popularity, iPhone 6S was also tested. Conductive PLA had the lowest Average H-Field, followed by Iron Filings. Phase-3: 3D-Printed Prototype S7 Phone Case using Conductive PLA and then coated it with Iron Filings. Prototype reduced Average H-Fields levels by 15.8%.

Conclusions/Discussion

Prototype met the 10% Reduction Objective with a value of 15.8%. Only partial success can be declared since Direct Contact Front and Back H-Field values exceeded EMF Tester maximum levels (>20μT) for all Cellular Devices and were excluded. This project supports using conductive materials Carbon Black (found in Conductive PLA) and Iron Filings to manufacture a case that filters H-Field Radiation.

Summary Statement

Developing Prototype Case made from Materials that reduce potentially harmful Magnetic (H-Field) Radiation emitted by Cellular Devices.

Help Received

My father showed me how to use the tools to build the Faraday Cage and taught me how to use the CAD software so that I could design the Prototype Case.

Name(s)

Neve G. Greenwald

Project Number

J1411

Project Title

Harvesting Atmospheric Water

Abstract

Objectives/Goals

The objective of this project was to test various materials to determine which ones collect the most atmospheric water when exposed to the same environmental factors. I also observed the effect of weather conditions and a material's surface area and hydrophilicity on atmospheric water collection.

Methods/Materials

Equally sized tiles of glass, plastic, ribbed plastic, aluminum, ribbed aluminum, steel and wax paper, scale, thermometer, humidity meter, and a wind meter. The tiles were set outside next to each each night. Temperature, humidity and wind speed were recorded at the onset of each trial. The next morning, I calculated the amount of water collected by weighing each tile. I also recorded the weather conditions at the end of each trial. This experiment was repeated twelve times.

Results

Ribbed and flat plastic collected more water than any other material. Wax paper and glass both collected the second highest amount of water. The metal tiles harvested far less water than the other materials. More water was collected on colder nights with higher humidity levels and lower wind speeds.

Conclusions/Discussion

Repeated trials demonstrated that hydrophobic materials collect more water than hydrophilic materials. This may be because hydrophobic materials repel water, causing atmospheric water to bead up and condense in clusters. This allows more room for condensation and greater efficiency in water collection. Although increasing the surface area appeared to cause more water collection with the plastic materials, the ribbed aluminum collected less water on average than the flat aluminum. This was likely because the ribbed aluminum was thinner and more susceptible to movement caused by wind which may have led to water loss.

Summary Statement

I examined the efficiency of different materials in collecting atmospheric water through condensation.

Help Received

I designed and conducted the experiment myself. My mentor reviewed my work and offered helpful advice.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Andrew G. Johnston

Project Number

J1412

Project Title

The Identification Experimentation

Abstract

Objectives/Goals

Fingerprints are unique to each of us but obtaining a print isn't always 100%. This test was to determine which process would be most reliable of matching fingerprints to a set of test subject prints.

Methods/Materials

Baseline prints were taken from 3 test subjects and scanned into the computer. Three processes tested included standard black and fluorescent powders, and the third was a chemical reaction between heat and super glue. The black and fluorescent powders were applied to water glasses that each subject handled. Upon applying powder, clear tape was used to lift prints from the glass. Tape was then applied to a 3x5 note card and scanned into the computer for comparison. The chemical reaction process required a sealed environment. A glass with a subject's print was placed in a plastic container with a small bowl of water for humidity. A small aluminum boat with a quarter size of super glue was then placed on a hot plate and sealed in the plastic container. After a 10 minute chemical reaction process, the glass was removed, finger print lifted, then scanned into the computer.

Results

Results showed the fluorescent method to be the most reliable. Each subject was tested in each of the three tests. A defined set of numbers 0-2 was set to rate each fingerprint. A 0 was assigned to a print not having any distinguishable features. A 1 was assigned for prints having one distinguishable feature. A 2 was assigned to prints having 2 or more distinguishable features. Each test was added up. A higher the number meant a higher reliability.The fluorescent powder consistently had higher values compared to other methods. Out of a maximum value of 10 (two for each finger), the fluorescent power method had an average of 8/10.

Conclusions/Discussion

The conclusion was that the fluorescent powder method to be the most reliable. Reasons for inaccuracies were found in the techniques themselves. The black powder had issues lifting the prints using the tape. If air bubbles were present during lifting only a partial print would be lifted. It was found for the chemical reaction method the longer the glass was left to react with the super glue, the more smudged the print became. The fluorescent powder method had drawback when the print was lifted fingerprint was unable to be seen on the white cards. A different scanning method was adapted using a black light, photographing then transferring the image to the computer.

Summary Statement

I showed there to be a consistent method of obtaining and matching up latent fingerprints from household objects.

Help Received

My father assisted me in handling the hot plate and use of the super glue chemical. He also showed me how to build a spreadsheet in order to visualize and compare my data.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Ty R. Koebler

Project Number

J1413

Project Title

A Driver's Risk of UV Exposure

Abstract

Objectives/Goals

The purpose of this experiment is to determine how drivers are exposed to UV light, and whether any characteristics of the vehicles can predict how much UV light they will be exposed to.

Methods/Materials

UV Meter, level, access to 50 cars and an iPhone. I took UV readings inside and outside the front windshield and drivers' side windows of vehicles, and calculated the amount of UV light passing through each window. I tracked make, model, year, price, and whether a car was new or used.

Results

I found that a much greater percentage of UV light is passing through the drivers' side windows than the front windshield. I also found that the amount of UV light that passed through the car windows was not correlated with a car's make, model, price, year, or whether the car was new or used.

Conclusions/Discussion

Based on the cars I tested, drivers are at risk of UV exposure through their side windows. This project points out that drivers should protect themselves while driving, either by using broad spectrum sunscreen, wearing protective clothing, or installing coating that filters UV light on their side and back windows. In addition, the project highlighted the difficulty of predicting UV exposure based on a car's characteristics. One unique finding was that in the cars I studied, the percentage of UV light passing through side windows actually increased from 2015 models to 2017 models. This particular finding was not shown in literature I read. This finding is important because with the ozone layer being degraded due to chemical pollution, UV rays will pose greater threats of skin damage, so the percentage of UV light passing through the windows should be decreasing rather than increasing.

Summary Statement

As measured by the percentage of light passing through the front windshields and drivers' side windows of 50 vehicles, I found that drivers are at risk of UV exposure mainly from their side windows.

Help Received

I designed and conducted my experiment myself. Managers from five car dealerships allowed me to test 10 cars each. My science teacher Amy Schwerdtfeger gave me feedback on my my procedure, graphs, and conclusion.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Seney M. Larson Moreno

Project Number
J1414

Project Title
When It Rains, It Drains: The Best Additive for Permeable Concrete

Abstract

Objectives/Goals
The objective of this study was to determine what additive would best increase the porosity of permeable concrete with the least decrease in compressive strength. Permeable concrete is an enhanced concrete formulation in which small aggregate is removed to produce a porous material that can filter water back into the ground.

Methods/Materials
As porosity is hard to measure, a flow rate testing system (WITS) was designed and used to measure maximum water flow rate through the samples. An industrial Instron machine was used to measure the compressive strength of the samples. There were 6 additives consisting of both metals and plastic materials. Standard concrete components and easily accessible construction materials were used to make the samples, molds, and the flow rate testing system.

Results
Additives always increased the flow rate through the samples and significantly dropped the compressive strength. Metal Mesh samples had the least drop on compressive strength measuring at 326N/cm2 (473PSI), while Steel Wool #00 had the highest flow rates at 2.04cm/sec (2892in/hr).

Conclusions/Discussion
The permeable concrete formula used resulted in extraordinary high flow rates that over compensate for realistic rain events. The recipe needs to be adjusted to increase the compressive strength of the permeable concrete. The permeable concrete samples did not have a typical "failure" fracture like the industrial standard, rather it continuously found a new load path. The inclusion of additives into permeable concrete results in drainage and increases local water reclamation, reducing runoff and pollution deposited into our oceans. Possible applications include its use in parks, pavements, patios, pavements, patios, court yards, and sidewalks. Selection of material additives would likely depend on the properties needed for the application.

Summary Statement
While the inclusion of additives does decrease the compressive strength of permeable concrete, it greatly improves the flow rate creating an eco-friendly material with lots of applications.

Help Received
I received help in cutting materials used for molds from my science fair advisor. Orbital ATK allowed me to use their Instron for compressive strength testing and provided instruction on using the equipment.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Naomi Licht

Project Number
J1415

Project Title
Keep Your Temper: Maintaining Beta Crystal Forms of Cocoa Butter in the Preparation of Molded Chocolates

Abstract

Objectives/Goals
My primary goal is to make tempered chocolate molded items so they won't melt in my hands. My primary hypothesis is that if tempered chocolate is melted and reformed at a temperature less than 95°F, it will retain its temper qualities.

Methods/Materials
Dove milk and dark chocolate pieces and Nestle semi-sweet chocolate chips, frog molds, microwave, thermometer, grater, scale, bowls, spoons.
The different chocolates were prepared as grated and ungrated samples, and were melted at low temperatures, poured into molds, allowed to cool, and tested for temper qualities.
The control was semi-sweet, ungrated, melted at a high temperature.
Each chocolate type and grated or ungrated preparation was repeated three times.

Results
I assigned point values to the observed temper qualities: meltiness, shininess, snapability. I averaged the sums of the temper points over the three samples in each category. Higher points mean better tempering. The low temperature samples showed higher temper points than the high temperature samples.

Chocolate Category	Average Temper Points
Semi-sweet (ungrated, high temp., control)	0.66
Semi-sweet (ungrated, low temp.)	4.33
Dove Dark (grated, low temp.)	5.33
Dove Milk (grated, low temp.)	5.00
Dove Dark (ungrated, low temp.)	5.00
Dove Milk (ungrated, low temp.)	6.00

Conclusions/Discussion
I achieved my primary goal of finding a quick way to make tempered chocolate molded items that would not melt in my hands. The results support my primary hypothesis that melting tempered chocolate below 95°F will retain its temper qualities.
Home chefs can benefit from these results by using tempered milk chocolate (best temper results), not grating the chocolate before melting (saves time), and keeping the chocolate below 95°F (retains temper qualities).

Summary Statement
My project is about finding an efficient method and the best materials to create tempered molded chocolates by melting and reforming the chocolate below 95°F.

Help Received
Alton Brown's "Good Eats" show about chocolate provided the initial idea for my hypothesis about melting chocolate below 95°F. Food Scientist Adina Licht (my mom) confirmed and expanded on Alton's science, and taught me how to make molded chocolate frogs using the high temperature procedure.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Nicholas Mandala; Theresa Prata

Project Number

J1416

Project Title

Thermochromic Energy Efficient Roofs: An Innovative Coating that is Solar Reflective when Hot and Solar Absorbent when C

Abstract

Objectives/Goals

To create an energy efficient roof which gives the benefits of a white roof during the hot summer months without compromising the benefits of a dark roof during the cold months

Methods/Materials

We created a roofing slurry by mixing black thermochromic crystals into a UV protective clear, waterproof, and durable paint base and then applied that mixture onto white roofing materials such as asphalt and metal. Our slurry has the ability to change to clear at the temperature of 90° F thus revealing the white substrate. We built 4 model homes, one with an untreated asphalt roof and one with a treated asphalt roof. We did the same for our metal roof models. We tested our product in a temperature-controlled box that contained two heat lamps, provided by Ryan Hickman. As the ambient temperature increased, we compared the interior attic space, the living space, as well as the roof surface temperatures between our models treated with our thermochromic slurry and those untreated. We ran each test for 30 minutes and repeated it multiple times.

Results

After running a series of tests our data consistently concluded with zero deviation that our color changing roofing material would reduce the interior attic temperature up to 30°F and the interior space below the attic an average 6°F cooler. The surface temperature difference for the asphalt treated and untreated roofs were up to 41ºF and the metal roofs were a huge 81ºF temperature difference.

Conclusions/Discussion

The performance of our thermochromic-slurry treated roofs proved to be significantly more energy efficient than the traditional asphalt and metal roofs thus lowering energy cost and carbon emissions from A/C use. Because of this, we believe that our slurry is a smart solution to help reduce global warming and the rising concern of Urban Heat Island Effect.

Summary Statement

We engineered a roofing slurry that has color changing capabilities to provide the benefits of a white roof when it is hot and a dark roof when it is cold.

Help Received

We had Ryan Hickman build a temperature control box to our specifications. Ryan Hickman is the Uncle to Theresa Prata

Name(s)

Veronica D. McKinney

Project Number

J1417

Project Title

A Dielectric's Effect on Capacitance

Abstract

Objectives/Goals

The objective is testing the effects of different dielectric materials on capacitance by building capacitors with different materials and physical dimensions. Tests were done by charging the capacitors in a basic resistor-capacitor circuit.

Methods/Materials

Five home-made capacitors (aluminum foil, a dielectric or insulating layer, and wire); voltage-current multimeter; 100 megohm resistor; 6-V battery; timer. Measured the time required to charge each capacitor and then applied fundamental physics theories to calculate the dielectric constant of each insulating material used in the capacitors.

Results

Repeated trials (20 per capacitor), in which I measured the current, allowed me to determine the time constant of the resistor-capacitor circuit. Following calculations found the capacitance of each capacitor, the electric permittivity of the dielectric, and finally the dielectric constant of each material.

Conclusions/Discussion

Because the capacitors were home-made, there was a significant leakage current through the capacitors. Inaccuracies in the current measurement led to some dielectric constants being apparently less than 1 (below the theoretical limit!). Despite this problem, I could measure the dielectric constant of the materials relative to each other.

Summary Statement

I showed that I could determine the relative dielectric constant of an insulator in a resistor-capacitor circuit.

Help Received

My father, whose background is electrical engineering, helped me with the construction of the capacitors.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Alexandra B. Olivar

Project Number

J1418

Project Title

Do You Hear What I Hear? Testing the Soundproofing Ability of Different Materials

Abstract

Objectives/Goals

The objective of this study is to find out which material out of cotton balls, rubber mats, foam, plastic bags, shredded paper, and plaster of Paris will be the most effective in soundproofing.

Methods/Materials

Sound level meter, alarm clock for sound source, boxes, and several different materials to use for soundproofing, namely cotton balls, rubber mats, foam, plastic bags, shredded paper, and plaster of Paris. Tested the volume coming from the alarm clock inside each box lined with a soundproofing material.

Results

According to my data, cotton balls were the most effective sound proofer, followed by plastic bags, then the plaster of Paris, with foam in fourth, then shredded paper, and finally, the rubber mats, with the loudest tested volume, and thus the worst soundproofing qualities.

Conclusions/Discussion

Out of all the materials tested, cotton was the most effective in soundproofing, as it had the lowest volume in all four trials. According to my research, cotton's effectiveness is due to it being soft and porous, therefore, it can absorb and soak up the sound. Repeated trials of testing my soundproofing materials revealed that using a material to soundproof really does make a noticeable difference, as my control, with no soundproofing materials, had a much louder volume. Hopefully, my project can help others reduce unnecessary or unwanted noise.

Summary Statement

I discovered that cotton is the most effective material in soundproofing when compared to rubber mats, foam, plastic bags, shredded paper, and plaster of Paris.

Help Received

None. I designed, built, and performed the experiments myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
John D.M. Olson

Project Number
J1419

Project Title
Comfort vs. Wall Thickness

Abstract

Objectives/Goals
This original project idea was conceived when I visited a beautiful glass building that used shades insides to cover the glass walls during the midday. I learned that although those glass walls gave a clear view of the city, it did not help with the heat. Therefore those shades were used. Afterward I was curious to know which wall type provides the most comfort. My hypothesis was that the thicker the wall is, the better the comfort level is. I performed 15 experiments twice a day over 12 days and measured inside temperatures while heat passed through glass, stucco and wood siding walls. The tests were also performed with and without the roof with R-30 insulation to determine the effect of using the insulation in the inside temperature of the room. During the tests, the temperature rose much more quickly inside glass walls as compared to stucco and wood siding walls. The conclusion is that wood siding walls with R19 insulation provide the most comfort.

Methods/Materials
3 pieces of 1/8" thick, glass pieces, plywood, R19 fiberglass insulation, stucco, screws and nails.

Results
Wood siding walls with R19 insulation provide the most comfort.

Conclusions/Discussion
The thicker and the less transparent the wall is, the more comfortable the inside is.

Summary Statement
This project explores how wall thickness contributes to the human comfort level inside a building.

Help Received
Wall designs were reviewed by the architect, Richard Gould. Everything else was solely researched, built and tested by me.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Elina I. Omran, Jr.

Project Number

J1420

Project Title

Types of Threads

Abstract

Objectives/Goals

This project is meant for fixing shirts and other things that need sewing by saying what would be the best thread and stitch that they should use if they want it to hold the best. Also my clothes always rip and they keep on ripping after that even though I stitched it good

Methods/Materials

first I have to sew 2 of fabrics together, and then make holes to put strings threw and tie one side to a high thing and the other side to a bucket then put the weights in. Then keep the weights for 10 seconds each until it snaps.

Results

The hypothesis was partly correct. The polyester is the strongest and the weakest is the silk, though the polyester was the cheapest and the silk was the strongest. The thing that was wrong is that the color wouldn#t be a factor in how strong it is but it was, the black was stronger than the white

Conclusions/Discussion

In conclusion, my hypothesis was partially correct. Color was indeed a factor in the strength; the black was stronger than the white. The polyester proved to be the strongest and silk the weakest.

Summary Statement

this project is to test the strength of different threads and to see if the color matters

Help Received

mrs. Najwan for checking my slides

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Anika Pandey

Project Number
J1421

Project Title
The Effect of Nano Paint on Different Surfaces

Abstract

Objectives/Goals
Nanotechnology is the science when an element or particle behaves differently when at the nanoscale. One such application is the ability to create nano-paint (spray paints with nanoparticles). Surfaces when painted with nano paints modify surface tension and surface energy by making liquid drops roll off from the surface and consequently making the surface extremely durable, corrosion-resistant, reusable and energy efficient. My goal was to create a superhydrophobic nano coating on multiple surfaces and create a nanoscopic surface layer that repels water and viscous liquids like honey off the surface leaving the surface almost "untouched".

Methods/Materials
For the experiments nano paint was applied to three kinds of surfaces - metal, wood, and sponge. Once the multiple surfaces were nano coated, water and honey was dropped on the surfaces that were coated and on similar surfaces that were not coated. Contact angle (which is the angle formed by the drop#s edge and the surface it hits as measured through the liquid), diameter of the drop and the roll-off distance of the drops was measured for both nano-coated and not coated surfaces.

Results
The superhydrophobic coating caused the contact angle to increase. The nano sized particles in the nano paint minimized the water#s adhesion to its surface and that's why spherical shaped water droplets were formed on the nano coated surfaces. The water on the nano painted surfaces, had a high contact angle(which meant that it was a spherical drop), had a small diameter (it's not flat), and rolled off the tilted surfaces completely (which meant that it wasn't adhesive).
Hydrophobic nano paint was also quite effective with honey, and managed to reduce adhesive forces between honey and all three surfaces, and caused the surface tension to become prominent and form drops of honey that rolled off the surface.

Conclusions/Discussion
In conclusion, hydrophobic nano paint reduced the adhesive forces between all of the surfaces and water, and cohesive forces took prominence causing a perfect water/honey droplet to form, which rolled off the surfaces like a marble.Since the water and honey drops rolled off all the surfaces, the liquid did not stick to the material surface. This would eventually make the material more reusable, energy efficient and durable in a corrosive and harsh environment. As a result, materials can last longer against long term stress, increasing their use.

Summary Statement
I nano painted multiple surfaces and dropped water and other viscous liquids like honey to test the hydrophobicity of the nano paint on three separate surfaces.

Help Received
I didn't receive any help from mentors, institutions, professional scientists, and engineers.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Theodore F. Pierce

Project Number

J1422

Project Title

Carbon Composite or Steel: Which Resists Strain Better?

Abstract

Objectives/Goals

Due to their light weight and high strength attributes, carbon composite materials are being used more frequently in airplanes, cars, and sports equipment. However, I want to explore whether they are as resistant to strain (plastic deformation) as traditional metallic materials such as steel.

Methods/Materials

3 carbon composite golf club shafts (regular stiffness rating), 3 steel golf club shafts (regular stiffness rating), 2 19 liter buckets, 1 #S# hook, 1 hose clamp, Drill, 15.875 mm drill bit, 1 piece of straight wood, Metric ruler, Metric tape measure, Scale, Safety glasses, Framed doorway, Clamps, Paper clips, Pen, 1 metric measuring cup, Tap water for weight

Results

Carbon composite shafts perform much better than the steel shafts. While all three steel shafts suffered plastic deformation and eventually failed, there was no plastic deformation in the carbon composite ones, and they did not fail. I was not able to permanently bend or break the carbon composite shafts even with almost 19 kg of water in the bucket.

Conclusions/Discussion

Based on my research, data, and calculated results, I believe that carbon composite is better resistant to strain when compared to traditional metals like steel. My testing definitely supported this hypothesis. The steel shafts deformed at an average weight of 8,842 grams. The average deflection in which the steel shafts deformed was 23.9 centimeters. The average weight that the steel shafts fractured at was 13,776 grams with a deflection of 34.3 centimeters. The carbon composite shafts never actually deformed or fractured, clearly supporting my hypothesis.

Summary Statement

I showed that carbon composites resist plastic deformation far better than steel.

Help Received

Dr. George Youssef, Professor of Mechanical Engineering at San Diego State University helped me develop my procedures and project. Mrs. Reed, my Science teacher helped me organize my project.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Brant W. Sirles

Project Number

J1423

Project Title

What Material Affects a WiFi Signal the Most?

Abstract

Objectives/Goals

The objective of this study was to determine what material attenuates a WiFi signal the most.

Methods/Materials

Connect NETGEAR wireless router, check settings. Connect Android tablet to internet. Download WiFi Analyzer Application. Use tape measure to place tablet 10 feet from router. Path between Android tablet and router is to be clear and void of signal interference. Perform control read using WiFi Analyzer. Place aluminum foil 1/2 inch in front of router, using the tape measure. Take three readings and mathematically average the results, subtract the average result from the controlled average, to obtain the attenuation. Remove material and place next material in front of router. Repeat steps to obtain results for these materials: human body, steel, glass, cardboard, plastic and water. Enter information into data table, graph and logbook.

Results

The material that caused the most attenuation to the WiFi signal strength was the aluminum foil, at the attenuation of 14.7 decibel-milliwatts (dBm).

Conclusions/Discussion

My hypothesis was that a plastic container would affect the strength of the WiFi signal the most. The data results indicate that this hypothesis is considered false. The attenuation of the aluminum foil was the highest decibel-milliwatt interference of the materials tested in this experiment.

Summary Statement

I tested what common household materials affect a WiFi signal the most.

Help Received

I analyzed the strength of the WiFi signal; my grandfather, for assisting me in holding the test materials; my grandmother, for providing materials needed for this experiment; Mrs. Contreras, for checking and correcting my data, and providing encouragment; and www.sciencebuddies.com, for information.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Isabel M.H. Thornell

Project Number

J1424

Project Title

Flammable Fabrics

Abstract

Objectives/Goals

The objective of this study is to determine what fabric is the most flammable, and what fabric is the least flammable; and therefor, should be use for children's clothing or house hold items.

Methods/Materials

The materials of the study consisted of an Aim and Flame lighter, assorted natural and synthetic fabrics, stopwatch and adult supervision. the method was to ignite the fabric and record two different burn rates of each fabric and record how fast or slow it burned.

Results

The results showed that the most flammable fabric was made of natural fibers. Natural fabrics tended to ignite more quickly, burn more rapidly and inconsistently than the synthetic fabrics. Some synthetic fabrics ignited quickly but burned at a steady slower pace. While most synthetic fabrics resisted ignition and just melted from the heat of the flame.

Conclusions/Discussion

The results supported the hypothesis in that natural fabrics would ignite quickly and that synthetic fabrics would resist ignition. The natural fabrics ignited quicker because they did not have any dyes or blends. The synthetic fabrics resisted ignition because they have chemicals and blends of things that are not natural. The results from this study helped me to understand how fire reacts to certain fabrics and what materials to use in everyday life.

Summary Statement

If you have a child, you should purchase clothing made of synthetic fibers, because based on my research and findings synthetic fabrics ignite and burn slower than natural fabrics.

Help Received

I created the objective and hypothesis on my own. My mother oversaw the fabric being ignited and my father assisted in helping me attain the average degree of the heat source, the Aim and Flame.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Pilar R. Vanheusden

Project Number

J1425

Project Title

Artificial Turf: The Heat Is On!

Abstract

Objectives/Goals

The objective of my experiment was to figure out why turf is usually hotter than grass. On hot days when my soccer team had to play games on turf, we always complained that it got so much hotter than the grass. Why is this? What causes the turf to be hotter than grass? Is it the blades of the turf or does it have to do with the sand and infill? The fibers that make up the blades of turf are made up of thermoplastics. The infill between the blades is most commonly sand and rubber or other plastic materials. My hypothesis is that the synthetic turf will always be hotter than grass because of the tendency of the synthetic materials that make up turf to absorb heat.

Methods/Materials

The turf sample with no infill and the infill materials were laid out in an area that is open to the sun at the school next to the the turf field, grass field, and concrete basketball court. A digital and infra red thermometer was used to measure and record the temperature (in °F) of the ambient, each surface, and infill material before and after six hours of sun exposure. This process was repeated for two more days.

Results

My hypothesis was correct, the turf always got hotter than the grass. The turf got approximately 10 degrees hotter than the grass. This is because the sand and the infill in turf reached the highest temperature in comparison to the rest of the materials measured.

Conclusions/Discussion

In conclusion, the turf#s temperature will always be hotter than grass due to the infill materials that absorb more heat. The grass doesn#t get as hot because it absorbs and retains more water and so it takes more heat to evaporate the water. This experiment would have been much more controlled and accurate if the experiment took place in a controlled heat chamber so each day the the temperature would be the same. Turfs offer a lot of advantages like low maintenance and low water usage and are commonly used and so although they tend to get hotter than grass there are ways to avoid playing on a hot turf field.

Summary Statement

I showed that turf gets hotter than grass due to the synthetic materials that make up turf.

Help Received

I would like to thank the school for providing me the materials for my experiment.