CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

So-Jung An

Project Number

J1301

Project Title

Playing With Pencils: Comparing the Quantity of Graphene Created by Different Types of Graphite

Abstract

Objectives/Goals

The objective of this experiment was to determine which type of graphite is best for making graphene.

Methods/Materials

I used the graphite 2B, 3B, 4B, 6B, 9B, and the magic green tape when creating the graphene. The pencil leads each have a different mix ratio of graphite to clay. The harder pencils have more clay, and the softer, darker pencils have more graphite. I then shaved each graphite stick. After I had a sufficient amount of powder for each type of graphite, I put a 2-inch piece of tape on the powder and made sure the sticky side of the tape was completely covered in graphite powder. Next, I used separate pieces of tape to peel away the layers of graphite. Finally, I tested the resistance of the graphene samples using a multimeter.

Results

The graphene sample created with the 9B graphite had the least resistivity. The more clay in the mix ratio of the graphite, the higher the resistivity level.

Conclusions/Discussion

When creating graphene, we should be using the 9B graphite.

Summary Statement

In my project, I seek to find the type of graphite people should use when creating graphene.

Help Received

No help received.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Ishaan S. Brar

Project Number

J1302

Project Title

Cooking Smart, Scientifically

Abstract

Objectives/Goals

The objective of this experiment is to compare the rates of heat conduction of commonly available metals. My hypothesis is that copper will conduct heat faster than iron, aluminum, brass, mild steel, and stainless steel.

Methods/Materials

To conduct my experiment, I used 12 inches long, 1/8 inch diameter metal rods of copper, iron, aluminum, brass, mild steel and stainless steel. I attached these rods to a holder by making holes in it. Then I melted wax and used it to attach colored push-pins along the length of the each metal rod at 1 inch intervals. I used different color push-pins for each metal to help differentiate them during my experiment. Once all the rods were ready with push-pins in place, I placed one end of the each rod on a hot skillet. I started the timer as soon as the rods touched the skillet. Then I recorded the time as each push-pin fell. The test was considered complete when no push-pin fell for 10 consecutive minutes. I repeated the experiment 3 times. I recorded my data for each experiment in logbook and converted the time to seconds.

Results

The results showed that copper was the fastest conductor, followed by aluminum, then brass, mild steel, iron. Stainless steel was the slowest conductor. I also observed that heat conduction was slower farther away from the heat source.

Conclusions/Discussion

The experimental results showed that copper was the best conductor. My hypothesis was correct. My experiment has applications that can be useful in our daily lives. Based on results, for faster time saving cooking and to save non-renewable heat energy, cooking utensils should be made of copper and aluminum. But since copper has some health issues, we should coat it the pan with teflon. The handles should be made of stainless steel since it takes longer to heat up. Also, as heat loss will be less in stainless steel, serving utensils should be made of this material to keep food warmer for longer periods. If I were to do this experiment again, I would use more metals and compare different diameters of the same metals, and different shapes of the metal rods.

Summary Statement

My project is testing heat conduction rates of different types of metals.

Help Received

My parents helped in getting the materials and supervised my experiment while I used hot materials.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Alexandria B. Hanzlik

Project Number
J1303

Project Title
Does 100% Wool, Rayon, or Polyester Shrink More than 100% Cotton?

Abstract

Objectives/Goals
To discover if 100% Wool Rayon or Polyester shrinks more than 100% Cotton.

Methods/Materials
Methods:
Step 1: Get 100% Wool, Rayon, Polyester, and Cotton. Cut each piece of fabric to 4 pieces measured 6" by 6", and label Wool cloth with the letter A, label Rayon cloth with the letter B, label Polyester cloth with the letter C, and label Cotton cloth with the letter D.
Step 2: Put three pieces of each type of cloth into washer and set it on rinse cycle.
Step 3: When done rinsing, put cloths into dryer and set it on medium heat.
Step 4: Set timer on dryer for ten minutes.
Step 5: When timer runs out, take the cloths out the dryer.
Step 6: Let the cloth cool on table in single layers for ten minutes then compare cloth to original fabric and record in logbook.
Step 7: Repeat this process three more times.
Materials:
1. 100% Cotton fabric
2. 100% Wool fabric
3. 100% Polyester fabric
4. 100% Rayon fabric
5. cloth measuring tape

Results
The original purpose of this experiment was to find out if 100% Wool, Rayon, or Polyester would shrink more than 100% Cotton. The results of the experiment show, the Rayon fabric shrank 2 1/2 inches after all three washes and drying. Polyester shrank 5/16 inches, Wool shrank 3/8 inches, and Cotton shrank 1 3/16 inches. Overall the results of the experiment were that, Rayon shrank the most and Wool shrank the least. In this case my hypothesis was considered false, Rayon shrank more than Cotton.

Conclusions/Discussion
Conclusion:
My hypothesis was that the 100% Cotton fabric would shrink more than the 100% Wool, Rayon, and Polyester. The results indicate that this hypothesis should be considered false. 100% Rayon shrank 1 5/16 more inches than the four fabrics because its thin texture is sensitive to heat. Also, the Rayon that I have is

Summary Statement
My project is about finding out how much fabric shrinks when you put it in the washer and dryer.

Help Received
My dad helped measure the fabric and my mom went to the store to buy materials.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Savannah D. Hebert

Project Number

J1304

Project Title

Ice Bubbles

Abstract

Objectives/Goals

To see if I could freeze a bubble using dry ice and if I could pick one up without it popping. I also wanted to see what other people thought.

Methods/Materials

I asked ten people if they thought it was possible to freeze a bubble and recorded their answers. I then placed dry ice in a variety of containers. Using different bubble solutions and different wands, bubbles were blown over the containers. I observed and recorded what happened.

Results

Bubbles blown over the containers would hover over the dry ice and then slowly fall into the containers. Many of the bubbles froze. As the bubbles aged, they would become more transparent. I also observed that the bubbles that stuck to the sides of the containers popped in half, always popping from the top side. The cardboard box worked best with the soccer bubble mix and the small wand.

Conclusions/Discussion

Nobody thought it would be possible to freeze a bubble, including myself. However, it is possible to freeze a bubble. I was not able to pick one up without it popping.

Dry ice is frozen carbon dioxide. The dry ice did not melt like an ice cube. It became a vapor. This process is called sublimation (a solid form turns directly into its gaseous state.) Dry ice is dangerous and must be handled with care.

Summary Statement

I wanted to see if I could freeze a bubble using dry ice.

Help Received

My mom helped blow bubbles over the containers and helped me organize my data. My dad provided the dry ice from his work, AirGas. He also put the dry ice in the containers.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Jennifer A. Hritz

Project Number

J1305

Project Title

The Impact of Materials and Rubbing Methods on Generating and Storing Static Electricity

Abstract

Objectives/Goals

The purpose of this experiment was to determine how much static electricity is generated when two materials are rubbed together and how quickly the static electricity is discharged. The experiment also explores the impact the rubbing method has on the amount of static electricity generated.

Methods/Materials

The experiment was conducted by rubbing together various combinations of rods and cloths in different ways. The rods were placed in front of an electrostatic voltmeter and their electrostatic voltage was measured over time.

Results

Static electricity was generated for certain combinations of materials. The High Density Polyethylene (HDP) rod produced the highest voltage when rubbed by the silk cloth and the cotton cloth produced the highest average voltage. The copper and wood rods produced no discernable amount of static electricity. The electricity discharge rate also was a function of the materials used. The HDP rod discharged the slowest and the glass rod discharged the quickest.

Conclusions/Discussion

The rubbing method used to generate the static electricity had an impact on the amount of static electricity generated. The up and down rubbing method produced more voltage than the circular rubbing method. The experiment could be expanded to provide insights into how static electricity could be harnessed. With the right materials and application it may be possible to create a generator that produces enough power to charge small devices. It may be possible to recharge your mobile phone when you walk across a carpet. Or, maybe you could charge a hearing aid by wearing a special kind of sweater.

Summary Statement

The goal of this experiment was to test how different materials and rubbing methods affected the generation and storage of static electricity.

Help Received

My parents helped with acquiring the materials and equipment that I used in my experiment.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Cameron C. Jones

Project Number

J1306

Project Title

Carbands: Flexible High-Strain Biometric Sensors from Carbon Infused Elastic Bands

Abstract

Objectives/Goals

My goal is to prove that infusing carbon black particles and graphene into common elastic natural rubber bands can create flexible, high sensitivity strain sensors useful for a variety of biometric applications. A secondary objective is to demonstrate that carbon black will work as effectively as graphene as a conductive medium. Finally, I hypothesize that it is possible to accurately measure a variety of biomedical metrics such as respiration, pulse, weight, or joint movement using such sensors. These sensors are cheap to manufacture and have properties that distinguish them from more traditional strain sensors including light weight, compliance and flexibility, high strain capability, and fast response times.

Methods/Materials

My project of consisted of two phases: fabrication of the 'carbands' using solvents (Toluene) and solutions of NMP and either carbon black or graphene nanoparticles, and testing the properties of the carbands via experiments and demonstrations. I used an ultrasonic bath to mix my solutions thoroughly, and used a multimeter and Arduino based data collection system to capture my data.

Results

I was able produce both graphene and carbon black carbands which possessed the hypothesized capabilities. During the preparation of the bands, I tested a variety of recipes to optimize their uniformity and electrical characteristics. Changing the soak time by several hours could drastically alter the bands performance. Also, the bands were very sensitive to situations where they would stick together in the solution and prevent uptake of the carbon particles. After a few tests, it became evident that the graphene bands were much more variable in their characteristics than the carbon black bands. The graphene bands resistance was 13 to 20 times higher than the carbon black bands. When measuring strain, I observed that both bands resistance changed exponentially with high strains, but stayed mostly linear with small strains.

Conclusions/Discussion

Both bands demonstrated potential when testing biometric measurements such as muscle movement, respiration, weight, and pulse. These test prove that carbands are practical as sensitive biometric sensors with many potential applications. The next experiments I will perform could include testing pulse in other regions in the body, measuring vocal chord vibrations (speech), and logging complex movements of the hand in real time.

Summary Statement

My project is about developing lightweight, high strain biometric sensors by infusing carbon particles into natural rubber bands.

Help Received

Father bought materials and helped debug control program; Used high power sonication probe under the supervision of Dr. Jeffery Tok at Stanford

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Iliana Kleiner

Project Number

J1307

Project Title

Power of Shields: How Different Materials Affect Magnetic Fields

Abstract

Objectives/Goals

Magnetic shielding does not allow magnetic fields to interact. Magnetic shielding is used daily in televisions, microwaves, and cell phones. The better the magnetic shield the closer magnetic objects can be without any interference. Magnetic shields used to reroute magnetic forces are described by their permeability and saturation. Materials that have a high permeability are better magnetic shields. If a material is used to redirect a magnetic field, then the material with more iron in it will be a better shield.

Methods/Materials

Ferromagnetic, diamagnetic, and paramagnetic materials are used as the dependent variables to attempt to shield the magnetic force. Steel is the only ferromagnetic material. Copper is the diamagnetic material. Plywood, plastic, and aluminum are the paramagnetic materials used. Air, or no magnetic shield, is used as the control.

Results

The distance that the magnetic field is felt after shielding with each material is the dependent variable. This is measured in centimeters by the distance from the magnet that a paper clip can stay suspended in the air. The controlled variables are the neodymium earth magnet that emits the magnetic field, the distance of the shield from the magnet, the orientation of the shields, and the paper clip used to determine the magnetic force. The thickest steel sheet, 0.025 inches, reduced the magnetic field by 2.7 centimeters.

Conclusions/Discussion

Steel, a ferromagnetic material with a high iron content and high permeability, worked best as a magnetic shield.

Summary Statement

What material will shield a magnetic field the best?

Help Received

My dad helped be build the apparatus to measure the magnetic field.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Edward T. Mitchell

Project Number
J1308

Project Title
My New Friend

Abstract

Objectives/Goals
Determine if bioplastic made from vegetables and milk can resist higher temperatures like petroleum-based plastic then it would be a useful plastic material to make food containers, protective shields for tools, and it maybe use on 3D printers.

Methods/Materials
Starch from potatoes, yams, and parsnips was extracted. Bioplastic was made heating starch, water, vinegar, and glycerin at different concentrations (concentrated glycerin, 10% glycerin solution and 1% glycerin solution). Also casein plastic was obtained using milk heated at 95 degrees Celsius and using different amounts of vinegar (20mL, 10mL, and 2mL). The approximate melting point for each bioplastic and the time to dissolve the bioplastics on boiling water were determinate using plastic #4 and #5 like controls.

Results
The bioplastic with the highest melting point was the bioplastic made from potato starch and 1% glycerin solution at 90 degrees Celsius. The bioplastics made with potato starch and yam starch using concentrated glycerin had the lowest melting point at 52 degrees Celsius for both. The melting point for controls were higher than the bioplastics with plastic #4 at 120 degrees Celsius and plastic #5 at 160 degrees Celsius. The bioplastic made from yam starch using concentrated glycerin dissolved fastest than the other bioplastics at 0.40 minutes. The controls didn't dissolve.

Conclusions/Discussion
The bioplastic that I obtained didn't resist high temperature to use for whatever I wanted like 3D printers, food containers, and protective shields for tools. Even though I didn't get the results I was expecting, I'm still thinking that bioplastics have a brilliant future because they are made from renewable sources. With the approximate technology it will produce bioplastic that would substitute almost all the petroleum-based plastics.

Summary Statement
The comparison of the resistance to high temperature between bioplastic and petroleum-based plastic.

Help Received
My mother supervised me not to be burned with the hot boiling water and took the pictures.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Sasha R. Parker

Project Number

J1309

Project Title

What Fabric Will Hold the Most Dye?

Abstract

Objectives/Goals

The objective of my science project was to determine which type of fabric would have the greatest saturation of dye (brightest) and which one would have the lowest saturation (dullest) of dye.

Methods/Materials

Six different fabrics were cut into the same size. Four different colors of dyes were acquired for the experiment. All sample swatches were placed in buckets, then the different color dyes were added into separate buckets (based on their color), then allowing the dye set into the fabric, remove fabric from buckets, rinse then wash each swatch, and finally let all swatches air dry.

Results

For the red, purple and blue dye tests, the order of saturation was the same. The rayon spandex blend had the greatest saturation, followed by the Linen, then cotton, the poly-cotton blend followed by nylon, lastly, polyester. An anomaly occurred with the green dye. For some reason, the green dye did not follow the pattern. The nylon and polyester swatches turned #BLUE# with the green dye test.

Conclusions/Discussion

The three dyes (Red, purple, blue) along with the six sample swatches, followed a pattern, however, the green dye test did NOT follow this pattern. This anomaly has great potential in the medical/biological field as well as the military and energy communities.

Summary Statement

What fabric would hold the most dye, and what fabric would hold the least amount of dye?

Help Received

My Father purchased all of the materials used, and helped me with my experiment. My mother helped me with my board, putting my notebook together and revising my research.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Isha Pati

Project Number
J1310

Project Title
Twitter Killer

Abstract

Objectives/Goals
The objective of this experiment was to find out which commonly used building materials are best at blocking WiFi signals. This information could be used for security purposes, such as securing your personal network from other people or eliminating blocking materials in the path of a router to get a better WiFi signal.

Methods/Materials
In this experiment a WiFi signal meter, WiFi router, 2x4s, steel, plywood, cloth, concrete blocks, bricks, and drywall were used to test which material blocked WiFi the best. First, a frame was built for the various building materials to go on. Then a WiFi router was placed 14 feet away from the signal meter, and average measurements of signal strength were taken for 2.4GHz and 5GHz bands, the two most common frequency bands used by the public. Next materials were placed surrounding the router, and the measurements were repeated.

Results
The results of the experiment varied for the 2.4GHz and 5GHz bands. On the 2.4GHz band concrete blocks blocked WiFi the best. The average received signal strength when concrete was placed in front of the router was -50dBm compared to signal strength of -27dBm without the concrete. At the 5GHz band, surprisingly, 2x4s blocked the best, with an average received signal strength of -57 dBm compared to a starting signal strength of -40dBm. Steel remained consistently the second best blocker for both the 2.4GHz and 5GHz bands.

Conclusions/Discussion
In conclusion, the best commonly used building material to consistently block WiFi is steel, because on both commonly used WiFi frequency bands it was consistently a good blocker. Concrete, which was the best at 2.4GHz was only third best at 5GHz, while 2x4s, which was the best blocker at 5GHz was only fourth best at 2.4GHz.

Summary Statement
In this project it was found that out of all the common building materials tested, steel was the best to consistently block WiFi signals for both 2.4GHz and 5GHz frequency bands.

Help Received
I would like to acknowledge my dad for assisting in the construction of the frame and materials to block the WiFi signals.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Nicholas A. Perez

Project Number

J1311

Project Title

Saving the Lives of Wildland Firefighters with a Hydrated Polyacrylate Fire Shelter

Abstract

Objectives/Goals

The objective of my project is to develop a shelter that will address both the radiant and convection heat that is generated in wildfires. My goal is that this improved fire shelter will save the lives of wildland firefighters.

Methods/Materials

For my experiment, I built small scale fire shelters to replicate the actual fire shelters. I placed an egg in each shelter because an egg is made of protein and changes structure when exposed to heat. Then, I used different combinations of reflective shields and sodium polyacrylate and placed them in a 550 degree oven. After thirty minutes, I examined the egg to see the effects. My independent variable was the different elements: aluminum foil, sodium polyacrylate, air gap, and U.S. Forestry fire shelter. My dependent variable was the amount of heat that was reflected and amount of heat that passed through. My controlled variables (constants) included: standard oven, 550 degree Fahrenheit heat, propane torch, raw eggs, measurement tools (laser digital thermometer and Oneida digital internal thermometer), construction materials, time in the oven and time exposed to open flame.

Results

The best fire shelters need a combination of three elements. After thirty minutes, the fire shelter that withstood the heat best was the hydrated polyacrylate fire shelter with a reflective shield and an air gap. There was only an increase of 11 degrees inside the fire shelter after thirty minutes.

Conclusions/Discussion

In conclusion, I learned the best fire shelter had to have a combination of a reflective shield, a hydrated polyacrylate insulator, and an air gap. This performed better than the hydrated polyacrylate with no reflective shield, the dry polyacrylate with a reflective shield, or the standard issued Department of United States Forestry fire shelter. I also learned that it is essential to have an air gap in the shelter otherwise convective heat will come in contact with the firefighter thus killing him/her. I proved my hypothesis that a combination of hydrated sodium polyacrylate, reflective barrier, along with air gap, is the best way to improve the insulation.

Summary Statement

The best fire shelter needs a hydrated polyacrylate insulator with a reflective shield and an air gap.

Help Received

Mother proofread report; uncle helped to remove polyacrylate and buy materials; fire captain provided fire shelter.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Johnathan A.M. Polucha

Project Number

J1312

Project Title

Cosmic Shielding

Abstract

Objectives/Goals

My objective was to learn how well different materials block cosmic rays. My hypothesis is that the denser the material, the more cosmic rays it will block. Based on that, aluminum will block the most, followed by PVC plastic, then plywood.

Methods/Materials

MATERIALS: glass aquarium, isopropyl alcohol, wool felt, duct tape, aluminum sheeting, 1/8 inch thick plywood, 1/8 inch thick PVC, dry ice, cardboard box, metal sheet

SET UP: 1) Create covers out of wood, plastic, and aluminum to go over the detector. 2) Put dry ice in cardboard box. 3) Attach felt inside top of aquarium and soak with alcohol. 4) Attach metal sheet to open side of aquarium and seal with tape. 5) Place aquarium metal side down, on top of the dry ice. 6) Wait for cloud to form in chamber.

EXPERIMENT: 1) Place detector on a flat indoor surface. 2) Shine light into detector. 3) Set up camera to film entire inside of the detector. 4) Film for 1 minute and use video to count number of cosmic rays, writing the number on a record sheet. 5) Place aluminum cover around detector and repeat step 4. 6) Place wood cover around detector and repeat step 4. 7) Place plastic cover around detector and repeat step 4

Results

Cosmic rays per trial:
Aluminum: 1 - 32, 2 - 24, 3- 25, 4 - 37, 5 - 33, Total - 151, Avg - 30.2
Wood: 1 - 28, 2 - 26, 3- 23, 4 - 25, 5 - 22, Total - 121, Avg - 24.2
Plastic: 1 - 32, 2 - 24, 3- 30, 4 - 31, 5 - 28, Total - 145, Avg - 29
No Shield: 1 - 46, 2 - 31, 3- 17, 4 - 27, 5 - 26, Total - 147, Avg - 29.4

Conclusions/Discussion

The wood material blocked the most cosmic rays and the other two blocked almost none. This tells me that my hypothesis was wrong. I believe that the materials were not able to block the particles very well, but the wood was slightly thicker so the results showed a bigger change. Cosmic rays come from large space events which are not always consistent, so that may have played a part in the variations between each trial. My counting may have been inconsistent. I learned next time I should have a more consistent counting method and cosmic rays are hard to stop. I learned a lot of things about cosmic rays. I believe scientists working on future manned deep space missions could use these results in future research, because in deep space cosmic rays come in much greater numbers and can act as a form of harmful radiation. They could use this research to help figure out how to block the rays.

Summary Statement

My project is about finding out how well different materials block cosmic rays.

Help Received

My father helped handle dry ice, cut the metal sheeting, add silicone sealant for a few holes, and process videos of time trials. My grandfather built the shields after I gave him the dimensions and the materials.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Nicholas C. Sercel

Project Number

J1313

Project Title

Splat: A Ballistic Pendulum Study of How Clothing Fabric Properties Affect Momentum and Energy Transfer of Paintballs

Abstract

Objectives/Goals

The purpose of this work was to determine the best materials to use for protective clothing against paintballs. This project involved three separate experiments. In Experiment 1, I measured the momentum transferred by the impact of regulation paintballs fired from a paintball marker into various protective fabrics. In Experiment 2, I measured how much damage a regulation paintball would cause to simulated flesh through various fabrics. Experiment 3 was a repeat of Experiment 2 using frozen paintballs.

Methods/Materials

Paintball velocity was measured using an optical ballistic chronograph. I simulated human flesh with a carefully controlled ballistic clay. This allowed me to simulate impact welts or #target lesions# in the clay. Momentum transfer was measured using a ballistic pendulum.

Results

My results for Experiment 1 are: i) both canvas and leather when used in combination with padding produce the greatest momentum transfer to the pendulum, ii) terrycloth and t-shirt material provide the same momentum transfer as the control (bare flesh), and iii) thick single materials like leather and canvas provide the least momentum transfer corresponding to the shortest pendulum swing. My results for Experiment 2 are: i) that bare flesh (the control) and the lightweight fabrics provide about the same flesh damage and little overall protection, while ii) the heavy materials, either in single or double layers provide significant protection (less flesh damage). My results for Experiment 3 are: i) frozen paintballs don#t seem to provide significantly more flesh damage in the simulated flesh than regulation balls when traveling at the same speed, but ii) the frozen paintballs travel faster and broke my ballistic pendulum.

Conclusions/Discussion

From these results I conclude that double layer materials do not provide a significant benefit relative to heavy weight single layer fabrics such as canvas and leather, but lightweight materials such as terrycloth or t-shirt provide virtually no additional protection relative to bare flesh. Frozen paintballs should be outlawed primary because they travel 20 m/s faster than regulation paintballs and given that they broke my plywood apparatus are likely to be very dangerous to people.

Summary Statement

The purpose of this work was to determine the best materials to use for protective clothing against paintballs.

Help Received

My family helped me conduct my experiment.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Joshua M. von Damm

Project Number

J1314

Project Title

Heat It Up! Insulators in the Building Industry

Abstract

Objectives/Goals

The purpose of this project was to learn how insulation works and to determine which type of insulation performs best in a building environment.

Methods/Materials

I built three boxes with each type of insulation(all with 1 in. thick walls: foam board, pine wood, and drywall.I built a fourth box to use as a CONTROL which is made of thin, 1/16 inch hard cardboard.I drilled a large hole into each box to insert the soldering iron, and sealed around the soldering iron with caulking.I drilled a hole in each lid where the thermometer was placed.I tested the set of four boxes 20 times. The thermometers were the same brand, and likewise with the soldering irons. Each time, I started my test by turning on the soldering irons simultaneously. The soldering irons provided a good heat source to mimic a space heater and heated the air quickly. Every ten minutes, I recorded the temperature of each box. At one hour, I ended my test and recorded the final temperature of each box.

Results

The foam board insulated better than all others from the beginning of testing, with the greatest difference in temperature being observed after about 30 minutes over the course of 20 tests. From 30 minutes to 60 minutes, the foam board consistently maintained a higher temperature of at least 25 degrees Fahrenheit. Standard Deviation of the final temperature of the 20 tests was calculated for each material: 1.9, 1.8, 2.8, and 4.8 degrees Fahrenheit for Cardboard, Drywall, Wood, and Foam board, respectively. I also ran some tests to determine the maximum temperature each box could reach after seven hours. The maximum temperatures reached for each box were 105, 110, 120, and 470 degrees Fahrenheit for Cardboard, Drywall, Wood, and Foam board, respectively.

Conclusions/Discussion

I chose the foam board because the foam consists of many small air pockets, which acts as an excellent form of insulation, inhibiting heat transfer through conduction. The final results clearly proved that the foam board box far outperformed the other boxes by more than 20 degrees Fahrenheit. In descending order, the other three materials performed in the following order: wood, drywall, and cardboard (Control). If I were to expand on this project, I would want to test different types of foam insulation because the foam performed really well in the tests. I could experiment with foam board, foam rolls, loose fill foam, and others.

Summary Statement

My project determined that among common building materials, foam board insulates best.

Help Received

I received guidance from Mr. Paul Pakus, my parents, and Zach Beavis. My father also assisted with construction of the boxes by cutting the box materials.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Wesley N. Weisenberger

Project Number

J1315

Project Title

I Need to See through Walls

Abstract

Objectives/Goals

My Project was to determine how electromagnetic waves were attenuated through various materials and figure out how to make the WiFi in our house faster.

Methods/Materials

A wireless router was placed in the bottom of an open top wooden box with material coating the sides to absorb reflected waves. Samples with different thicknesses of materials were placed on top of the box. A WiFi receiver was placed on a frame at a constant distance from the source and the signal was read from a computer in dBm and compared on a chart.

Results

My actual results are plotted in my science fair display.
Metal attenuated the signal.
Paper, wood and glass had significant attenuation in the range of 35%.
Water had high attenuation that amounted to about 80% as did the human body.

Conclusions/Discussion

The attenuation of the human body is probably due to the high water content. I was surprised at the amount of attenuation of wood and paper. Library shelves and walls could give unexpected attenuation. I expected water to have significant attenuation, but it was far higher. It almost blocks WiFi. Water attenuates visible light, but you can still see 20 feet into the water. Water goes through our walls for radiant heat and should be avoided.

Summary Statement

It is about the variable nature of Electromagnetic absorption with different materials.

Help Received

Dad bought materials and also was my assistant for measurements. We also discussed the nature of light. Dad read over project and made comments.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Eve C. Wharton

Project Number

J1316

Project Title

Oobleck: More Than Just Goo

Abstract

Objectives/Goals

What happens to the non-Newtonian fluid, oobleck, when it is exposed to extreme temperatures? The inspiration for this project came from finding out that there are many different uses for oobleck. Oobleck can be used to fill potholes, and the army is experimenting with putting it in their Kevlar vests. Oobleck can be used for so many things because of its many different properties. The experiment that was conducted, to see what happens to oobleck when it is put in extreme temperatures.

Methods/Materials

Oven set to 204.444º Celsius; Freezer set to -17.7778º Celsius; Dry Ice; Pyrex glass container; Corn starch; Water

Results

The first one was the freezer, and it resulted in an only slightly thicker product than the original. It only dropped by 7º, which is not a big change in temperature. There was no change in color either. Next was the dry ice. It had very similar results to the sample from the freezer. It was slightly thicker than the control, and it had no change in color. However, it did have 13º Fahrenheit difference in temperature. Next was the oven sample, it showed a 51º difference in temperature. It showed a difference in color. Instead of it being one solid color, it separated into two different layers, a cornstarch layer, and a layer of "gel"(for lack of a better word). The gel was a cloudy, off white color, and the inner layer was opaque, chalky, and also white. Last was the microwave sample, it was by far the only sample that had a major temperature difference. It increased in temperature by 146.5º, and showed the same color qualities as the oven sample. However the density and overall structure of this sample was very different from all the rest. It was similar to the oven sample in the way that it separated into two layers. Only in this sample, the harder layer was on the outside, and the gel like layer was on the inside.

Conclusions/Discussion

The sample that was put into the microwave could be sliced and made into an easy-to-make, non-toxic, decomposable plate. Some other ideas are maybe using the gel from the oven sample as a moisturizer. The microwave sample could be used as a new crash test dummy for testing cars. The gel from the microwave sample could also be used as temporary glue. The reason why is, the gel from the microwave sample was a lot stronger than the gel from the oven samples. These are some ideas that were thought up for the three, useable, varieties of oobleck.

Summary Statement

Exploring what the effects of four different temperatures are on oobleck.

Help Received

My Grandparents - Peter and Denise DeBono for letting me experiment at at their house and giving me a lot of support during my experiment. My Parents - Ken and Alicia Doolittle for encouraging me to try really hard at everything I do. Ms. Vanessa Weske for being such a great help when it came time to