CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Eleanor C. Addison

Project Number
J2101

Project Title
Sunprints, Sunscreens, and Sunburns: Testing UV Protection

Abstract

Objectives/Goals
The objective of this experiment is to find the sunscreen that best protects skin from sunburns for the lowest price, and to see if marketed SPF ratings are reliable.

Methods/Materials
12 types of sunblock, acrylic sheets, Sunprint (cyanotype) paper, thin-line tape, midday sunlight, Adobe Photoshop (to accurately measure exposed Sunprint paper) and a tub of water. A pre-test was performed to determine optimum exposure times. Multiple sunscreens were then applied to acrylic sheets and exposed for 3 time periods each on Sunprint paper in the sunlight to determine how much UV radiation each one blocked.

Results
Within the constraints of this experiment, sunscreen sticks blocked out the most UV radiation. Higher prices didn't equal better protection. In addition, marketed SPF ratings didn't always match the measured protection level.

Conclusions/Discussion
For the best sun protection, this experiment indicates that you should use sunscreen sticks, and avoid sunscreen sprays (which had the worst performance, but perhaps because they didn't stick well to the acrylic sheets). Don't rely too heavily on SPF ratings, as their measured performance often differed. Higher prices didn't mean higher measured UV protection; the low-cost lotions had the best price performance. Finally, the one organic sunscreen tested had the worst performance and was not worth the money spent on it.

Summary Statement
Using cyanotype paper to measure UV light, I found that sunscreen sticks provide the most UV protection, price isn't the most important factor, and SPF ratings are often unreliable.

Help Received
None: I performed the experiment, wrote up my results, and put together the board myself.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Julsie (Juliet) E. Anderson

Project Number
J2102

Project Title
Current State of Batteries

Abstract

Objectives/Goals
Buying a battery these days is very confusing. There are so many different brands and types of batteries and all seem to claim to be the best or the most economical. This experiement was performed to try to determine the longest lasting battery and the most cost effective battery. I wanted to provide usable information to clarify the process of buying batteries.

Methods/Materials
The AA batteries tested included: Energizer Ultimate Lithium, Energizer Max, Energizer Eco, Duracell, Duracell Rechargeable, Walmart Generica Alkaline, and Panasonic Heavy Duty. Each battery tested was placed in a battery holder, attached to a resistor, and the voltage was measured using a voltage meter. The time was measured to deplete each battery to 1 volt and 0.85 volts. This was done to simulate how long each battery may last in an acutal device. The current delivered was calculated using Ohm's law. Two different resistors were used to measure the mAmp hours under high and low load conditions. Finally, the mAmp hours per dollar were calculated to determine the most economical battery.

Results
OVERALL CAPACITY: Under both loads, the Energizer Ultimate Lithium battery had the most capacity at 2793 and 2129 mAh respectively.

LONGEST LASTING: The Energizer Ultimate Lithium gave over 6 hours at low load, and 3 hours at high load to total (0.85V) depletion and lasted the longest.

MOST ECONOMICAL: The Walmart Generic Alkaline battery gave 3671 and 1109 mAh/$ spent at low and high loads respectively and was the most economical.

Conclusions/Discussion
This experiment provided guidance to the confusing process of purchasing a battery. In situations where the longest lasting battery is needed, the Energizer Lithium was superior to the all the batteries tested. For the best overall value in AA batteries, however, I will by the Walmart Generic Alkaline batteries in the future.

Summary Statement
I tested commercial AA batteries to determine which one lasted the longest and was the most economical.

Help Received
My father, John Anderson, helped me with my experimental design and analysis.

Name(s)
Mahesh Arunachalam; Mihir Manchikatla

Project Number
J2103

Project Title
Seal That Mask: An Effective Solution to Improve Dust Masks

Abstract

Objectives/Goals
People use dust masks to reduce inhaling of air pollution in various parts of the world. Our objective was to measure the effectiveness of popular dust masks like N95, P95, and R95. Also our goal was to create an effective sealant for dust masks to reduce leaks.

Methods/Materials
For our test setup we put a mannequin head wearing different grade dust masks inside a closed enclosure. We used a hair dryer to blow baby powder inside the enclosure to simulate a human getting exposed to dust. Using GEARDON air quality monitor we measured the powder particle concentration that seeped through the masks. We did this by setting up a pipe behind the mask through the mouth of the mannequin's head that carried the seeped powder particles to the monitoring device placed in a sealed bag at the other end of the pipe. We measured PM2.5, PM1.0 and PM10 particle concentration that seeped through the masks. We performed each test safely by wearing mask ourselves. We ensured every test run was performed with the same conditions, by using the same amount of powder, taking readings at every 15-second mark and cleaning all materials thoroughly. We also created a simple sealant for the dust masks using a sponge. We then performed the same experiment with every mask with the seal. We also did the same experiment using a fake beard.

Results
Our results show that P95 mask was the best in blocking dust particles. For PM2.5 particles it was better by 34% compared to N95 mask, and 60% better compared to R95 mask. P95 was also better in blocking PM1.0 and PM10 particles. When we applied the seal to the masks N95 did the best. It reduced PM2.5 particle leaks by 72%. R95 mask with seal reduced leaks by 52% and P95 mask with the seal, reduced leaks by 22%. On an average sealing masks reduced leaks by 45%. Surprisingly having a beard actually helped to block leaks even without a sealant by an average of 67%.

Conclusions/Discussion
Based on our results we conclude that dust masks do reduce inhaling of air pollution particles. Our experiments did confirm that there are leaks when wearing dust masks. Our simple and inexpensive sponge sealant was able to effectively reduce dust particle leaks. Our solution will help people across the world by making dust masks more effective in fighting air pollution. We propose that dust mask manufacturers should create masks with different facial structure and features in mind to make them more effective.

Summary Statement
We reduced the leaks in the dust masks by creating a sealant there by reducing harmful pollutants from getting inhaled.

Help Received
Mrs. Christine Harada was our mentor. Our Science teacher Ms. Christina Haydt also helped us with this project. Our parents contributed to the cost of all the equipment and the masks.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Jillian T. Beer

Project Number
J2104

Project Title
Surface Temperatures of Turf Samples and Infills

Abstract

Objectives/Goals
The objective of this project was to determine what factor significantly causes turf to heat up. Finding the distinct factor will prevent turf installers from their turf reaching extreme temperatures. To further study this, the question of will the quality/type of turf or the type of infill affect how hot the turf gets, was raised. The questions helps clarify what exactly needed to get tested.

Methods/Materials
I placed pairs of 9X9 turf samples separately into two different wooden frames. The frames allowed the turf's infill to remain where it needed to be, and the wooden frames were built by a carpenter. After I placed each sample into its individual square, I evenly dispersed infill on top of them. One row of samples had one type of infill, while the second row of samples had another type of infill. Every half an hour, the surface temperatures of the turf samples wererecorded using an infrared laser thermometer.

Results
The brands didn't play a significant factor on the temperatures the brands reached. The highest difference between the hottest turf brand and the coolest turf brand was 6.755 degrees Fahrenheit. The most significant difference between the infills reached up to 6.5 degrees Fahrenheit. Although there were temperature differences, the turf brand or the type of infill did not play a significant roll. Even though the turf brand and infill type did not reveal discrepancies, the temperature of natural grass was recorded. At 83 degrees Fahrenheit outside, natural grass rose to 83 degrees Fahrenheit, while the turf rose up to 142 degrees Fahrenheit.

Conclusions/Discussion
Having all of the turf samples outside, with an equal amount of sun exposer, allowed each reading to be more accurate. Even though the samples were outside at the same time and location as each other, the infrared laser thermometer lacked accuracy. In order to receive results that were completely accurate, a more advanced infrared laser thermometer needed to be purchased.

Summary Statement
I determined that turf reaches extreme temperatures in comparision to natural grass, yet the brand of turf or the type of infill used in the turf does not play a significant factor on the temperature of the turf.

Help Received
My science teacher, Mrs. Armstrong, explained to me how to use the infrared laser thermometer. I also received assistance from my mom to understand how to analyze the data I collected the best way possible.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Heidi C. Bishop

Project Number
J2105

Project Title
Cool Tunes: The Effect of Temperature on Instrument Tuning

Abstract

Objectives/Goals
My objective was to discover if temperature affects instrument tuning.

Methods/Materials
The saxophone, bugle, orchestra bells, and flute were tuned using a tuner and the "warmed up" temperature of the instruments was determined. Each instrument was refrigerated for 60 minutes. The instrument was removed, its temperature measured, and it was played to determine if it was flat, sharp, or in tune. The instrument was then set down for another 10 minutes and its temperature measured and tonality checked. This repeated every 10 minutes until the instrument was in tune. Three trials of the experiment were done per instrument.

Results
Saxophone temperature ranged from 2.2°C to 25.1°C and tonality ranged from -45 flat to +10 sharp for G. Bugle temperature ranged from -0.3°C to 28.3°C and tonality ranged from -40 flat to 0 in tune for D. Orchestra bells temperature ranged from 0.1°C to 23.5°C and tonality ranged from -40 flat to +20 sharp for B flat. Flute temperature ranged from 2°C to 31.5°C and tonality ranged from -60 flat to 0 in tune for B flat.

Conclusions/Discussion
My hypothesis was that an instrument at colder temperature would be more out of tune than after it had been warmed up. Data showed all instruments were out of tune after being refrigerated for 60 minutes. This proved my hypothesis correct. The flute appeared to be the most affected by the temperature change followed by the saxophone and bugle. The orchestra bells were a little more sporadic with their pitch. In conclusion, temperature definitely affects the intonation of instruments. For eleven trials, instruments were all flat at colder temperature. For one trial with the orchestra bells the instrument was sharp. In all trials, instruments were not in tune for at least 20 minutes after being refrigerated.

Summary Statement
My project showed that cold temperature negatively affects instrument tuning.

Help Received
My parents provided the supplies needed for me to do my project.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Krina A. Ghadia

Project Number
J2106

Project Title
Counteracting Coffee Stains: Dentifrice Whitening Properties

Abstract

Objectives/Goals
The objective of my project is to determine which dentifrice is the most effective in coffee stain removal.

Methods/Materials
Ceramic tiles were stained using coffee for one day and then dried. The stain was then brushed and attempted to be removed using different forms and types of dentifrice. The tile was then compared with the shade guide for measurement.

Results
The Sodium Hypochlorite had the most whitening effect out of every type of dentifrice, although every type and form of dentifrice had some whitening effect.

Conclusions/Discussion
Each dentifrice had a varying amount and type of active ingredient that was used to eliminate the stain, however the Sodium Hypochlorite had the strongest stain removing ability and in the largest concentration. Therefore, Sodium Hypochlorite, or off-the-shelf bleach, removed the stain most effectively.

Summary Statement
I determined how effective dentifrice with varying active ingredients was in removing coffee stains.

Help Received
Dentist Vinay Govindji answered my questions about whitening toothpastes, however I created and executed the experiment without assistance.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Adrian Guo

Project Number
J2107

Project Title
Electrolytes in Gatorade

Abstract

Objectives/Goals
The objective was to determine if different flavors of Gatorade had different amounts of electrolytes.

Methods/Materials
3 different flavors of Gatorade were used. The flavors were; Orange, Cool Blue, and Fruit Punch. Three bowls of equal size were used to hold the liquids. A handmade conductance sensor and circuit was used to measure the conductance of the liquid by sending a electrical current through the liquid. I used the formula (G=I/V) to convert the results to millisiemens (a unit of measure for conductance) to show to the conductance of the liquid. Since electrolytes conduct electricity, so the more conductance, the more electrolytes.

Results
Gatorade Orange consistently had the most conductance. Gatorade Fruit Punch consistently had the the second most conductance.

Conclusions/Discussion
Gatorade is commonly drunk during intense workouts to replenish lost electrolytes. As shown in the experiment, specific flavors of Gatorade had different amounts of electrolytes. I noticed in the ingredients that all flavors had different dyes. I would like to do more research on dyes to see if it might have affected the results. Results suggest that Gatorade Orange flavor has more electrolytes compared to the other flavors, therefore being more effective.

Summary Statement
This experiment is about measuring and comparing the amounts of electrolytes in different flavors of Gatorade.

Help Received
The design for the conductance circuit was found on the internet. I also modified the procedure found on the same site. I performed the experiment without help.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Cornelius E. Harmon

Project Number
J2108

Project Title
Fact or Friction

Abstract

Objectives/Goals
The objective of this study is to measure the efficacy of various motor oils to reduce heat cause by friction.

Methods/Materials
Wooden test stand (2"x 2"x 8" post), copper caps,electric motor (drill), Wire drill bit brush, egg timer, eye dropper, thermocouples (type K), and multimeter. Measured the ability of various motor oils to reduce friction through measuring temperature increase.

Results
A controlled volume of various brands of motor oils were placed in cooper caps. The temperature increase of the cooper caps, when exposed to heat, was recorded. Repeated trials were run to calculate an average temperature increase. The difference between the temperatures was statistical significant.

Conclusions/Discussion
To within the accuracy of the measurements, the presence of motor oil significantly reduced friction. However, the difference between the brands of motor oils was not statistically significant. This study reveals that brand marketing has a substantial effect on consumer perception of scientific quality.

Summary Statement
As measured by the ability to control heat, I found that there is no significant different between generic and name brand motor oil.

Help Received
I designed and performed the experiments myself. I got help in constructing the test stand understanding the statistical comparison of data from my father.

Name(s)
Jibiana Z. Jakpor

Project Number
J2109

Project Title
Combatting Wildfire Smoke: A Comparison of the Efficacy of Various HVAC Filters

Abstract

Objectives/Goals
My science project is about reducing particulate air pollution from fires using HVAC filters. This is an important issue because 5,000-25,000 people in the U.S. die from particulate air pollution caused by wildfires each year. The recent Northern California wildfires produced as much particulate in 2 days as California's cars make yearly. Although there has been much success reducing emissions from cars, I am not aware of any efforts to address particulate pollution from house fires and wildfires. During a brainstorm, I imagined a fleet of drones carrying a large sheet of HVAC filters over a fire. As the first step towards my dream, I designed an experiment to test 2 hypotheses: 1. an HVAC filter suspended over a fire will capture a moderate amount of soot, and 2. filters with higher MERV ratings will be more effective than those with lower MERV ratings.

Methods/Materials
Three types of 3M filters were tested: the Basic Pleated Non-electrostatic filter (MERV:5), the Fiberglass Filter (MERV:6), and the Elite Allergen Extra Electrostatic Filter (MERV:12). I did 12 trials for each type of filter test, each with a simultaneous control. I made a test apparatus with 2 cake pans lined with white flannel, one of which was covered by a filter. I held the apparatus in the smoke from a wood fire. I used digital photography to get the Mean Gray Value (brightness) of white flannel fabric after exposure to soot with/without a filter.

Results
A paired Student's t-Test showed that all 3 filters suspended over a fire were effective at reducing the soot that lands on a piece of fabric on the other side of the filter ($p<0.01$). However, ANOVA testing showed all 3 filters performed the same.

Conclusions/Discussion
All 3 filters resulted in a statistically significant reduction in the amount of smoke that was able to pass through the filters. I have developed a new test method using digital photography to evaluate the effectiveness of filters. This experiment is the first step towards a broader goal of active measures to reduce particulate air pollution from fires. My dream is to create a filter apparatus with negative pressure to draw in smoke to be suspended by large drones over house fires and wildfires. Even capturing a small portion of the smoke could help save lives.

Summary Statement
My experiment revealed that three types of HVAC filters suspended over a wood fire are effective at capturing soot ($p<0.01$).

Help Received
I designed and conducted the experiment myself. My mother paid for supplies and kept a watchful eye on the fires. My sister guided me to the correct statistical tests. I taught myself how to do those tests by watching YouTube videos.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

Emogene G. Karas

Project Number

J2110

Project Title

Measuring the Attributes of Different Fabric Weaves

Abstract

Objectives/Goals

In this experiment, I wanted to find out if there was a relationship between the weave of a fabric (plain twill satin weave) and the strength stretch and fray of it. I tested by ripping the fabric for strength, putting weights on the fabric for stretch, and fraying the fabric with sandpaper. I tested each type of fabric 9 times, 3 along grain, 3 cross the grain, 3 diagonal grain. In the end, twill was strongest, plain frayed most, and plain stretched most.

Methods/Materials

I tested by ripping the fabric for strength, putting weights on the fabric for stretch, and fraying the fabric with sandpaper

materials~ 1 yard of twill cotton, 1 yard of satin cotton, 1 yard of plain cotton, fishing scale, 2 spring clamps, 1 2pound weight, drill, sandpaper.

Results

the tests show that twill was the strongest weave, plain frayed the most, and plain also stretched the most.

Conclusions/Discussion

patterns in the grain of the fabric show that there is probably a relationship in the grain of the fabric and the strength and stretch of it. One could possibly test this for further research.

Summary Statement

In this project i tested to see if the weave of a fabric affected it's strength, stretch, and fray.

Help Received

Although my parent's helped me come up with the project idea, I designed and performed the experiment by myself.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

Courtney L. Kelly

Project Number

J2111

Project Title

The Effects of Fabric Softener on the Flammability of Fabrics

Abstract

Objectives/Goals

The purpose of my experiment was to determine whether the use of liquid fabric softener increases the flammability of fabrics, and if the degree of flammability becomes greater with repeated use. I hypothesized that fabrics washed with fabric softeners would burn more rapidly than those not treated with fabric softener.

Methods/Materials

I tested the flammability of 4 different fabrics. My Independent Variable is the amount of washes of the fabrics and the Dependent Variable is the burn duration. I washed all of the fabrics with no fabric softener and tested and recorded the data to see how long it took to burn the whole piece of fabric. I then washed the fabric with liquid fabric softener one, and then five times. I tested and recorded both of these. There were three trials for every type of fabric being burned. Finally, I calculated the burn rate of each fabric using the equation R= 60cm^2/seconds.

Results

After one wash with fabric softener, each of the four fabrics had an increase in burn rate. Cotton flannel burned 7.69% faster than the control, and 100% cotton and flame resistant poly came in close with 7.67% and 7.29% increases in burn rate. After 5 washes with fabric softener, the flame resistant and poly blend fabrics showed dramatic increases in burn rate, burning 35.97% and 32.2% more quickly than the control. The 100% cotton and cotton flannel also burned faster, with 12.45% and 8.63% increases in burn rate.

Conclusions/Discussion

My results confirm my hypothesis that the use of liquid fabric softener does indeed increase the flammability of fabrics, and the increase is cumulative. While all fabrics tested increased in flammability after both 1 and 5 washes, it was surprising that the flame resistant child's nightgown had the greatest increase in burn rate after multiple washes with fabric softener.

Summary Statement

I showed that the use of liquid fabric softener increases the flammability of fabrics, and that the increase in flammability is cumulative with repeated use.

Help Received

I designed and conducted my experiment myself at home. I consulted Mikayla Barry, a Graduate Student in Materials Science at UCSB, via email for advice and guidance about experimental design and the science behind what makes fabrics more flammable.

Name(s)
Dhwani M. Kharidia

Project Number
J2112

Project Title
Best Shock Absorbing Shoe Sole Material

Abstract

Objectives/Goals

Many athletes and even casual runners develop leg joint, hip, and spine problems due to high impact stress on the foot and leg muscles. Shoe soles play an important role in absorbing ground reaction force (GRF) exerted by the ground on the body. Every person has his or her own capacity for absorbing GRF and current market forces do not allow consumers to make shoe choices based on their individual GRF needs. To help consumers make informed choices, this project defines Absorption Index and measures it for varying shoe sole types such as polyurethane, Ethylene Vinyl Acetate foam (EVA), leather, and thermoplastic rubber using a specifically designed test apparatus. Polyurethane will absorb the most shock because it is flexible, can compress and decompress, and has a high load bearing capacity.

Methods/Materials

The GRF acts on the outer shoe sole when the shoe comes in contact with the ground. To mimic GRF acting on shoe soles, the test apparatus with a mobile ground board and steady shoe sole were built. The ground board was pulled using different weights emulating different GRF values. When the ground board hit the outer shoe sole, a ball put on the inner sole was displaced depending upon the energy not absorbed by the shoe sole. The vertical displacement of the ball is proportional to the energy not absorbed, or transmitted, by the shoe sole. The Absorption Index (AI) is computed by normalizing the difference between flight height with and without the shoe sole. The Absorption index of varying sole types is computed and compared.

Results

The result shows that AI for shoe sole material made from polyurethane is the highest, at above 70% which is more than twice the AI of leather and thermoplastic rubber. The AI of EVA foam is between 65% to 70%. The low-density polyurethane is an excellent shock absorber and is used in midsole due to its sponge-like properties of compression and decompression.

Conclusions/Discussion

The AI information available to consumers can help them make informed decisions in selecting their soles. It will also be helpful to find AI during Impact Force (IF) and combine absorption indices of both IF and GRF to tabulate the total absorption characteristics of a shoe.

Summary Statement

This project has defined and measured shock absorption index for different shoe sole materials and concluded that polyurethane absorbed the most Ground Reaction Force.

Help Received

Received help from my dad to build testing apparatus and lift heavy weights.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Jenna Kim; Akemi Zollinger

Project Number
J2113

Project Title
The Effect of Hydrogels on Stain Removal

Abstract

Objectives/Goals
Our objective for this project is to conduct an experiment to determine whether polyacrylamide hydrogels are able to act as a stain removing vehicle when tested against different types of stain-causing agents.

Methods/Materials
150 polyacrylamide hydrogels, pomegranate juice, soy sauce, coffee, marinara sauce, and olive oil, 100% cotton t-shirts, distilled water, Oxi-Clean Stain Remover, wax paper, plastic wrap, baking sheets, beakers, paper towel roll, pipettes, plastic spoons. Our experiment was divided into two phases: 1) release of the loaded solution onto stain and 2) release and absorption of solution through the stain. In each phase, there were 10 trials per stain.

Results
As shown in our results, hydrogels were capable of removing stains. Both phases showed that pomegranate stains were the easiest to remove and olive oil stains were the hardest, as they showed no signs of stain removal throughout the experiment. In Phase 1, the water and Oxi-Clean loaded hydrogels worked the best with the pomegranate stains and the worst with the olive oil stains. However, in Phase 2, the dry hydrogel crystals taped on the back in addition to the loaded ones on top were able to let the absorbed substances pass through the stain, allowing the dry hydrogels to help the water-loaded hydrogel, but have little effect on the Oxi-Clean loaded hydrogel.

Conclusions/Discussion
Overall, fruit stains and water-based, hydrophilic stains could be best removed by either of the hydrogels. Hydrophobic and oil-based stains were not able to be removed because the level of pH at which the hydrogel is triggered to absorb and release was at a neutral pH of 7, or water. The special characteristics of these hydrogels that allowed it to remove the stain could not be functional with pHs lower than 7 (bases), meaning that the mainara and olive oil stains could not be removed. In conclusion, hydrogels are capable of removing stains because of their abilities or absorb and release liquids, and most effectively remove hydrophilic stains as opposed to hydrophobic stains.

Summary Statement
In our project we took advantage of the unique properties of hydrogels to absorb and release liquid substances and tested them to see if they can remove different types of stains.

Help Received
We designed the experiment ourselves and our science teacher reviewed our project.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Kael K. Mai

Project Number
J2114

Project Title
What's Your UV Defense?

Abstract

Objectives/Goals
The objective of this experiment was to test the effectiveness of three different types of sunscreen active ingedients, which were oxybenzone, titanium dioxide, and a combination of zinc oxide and titanium dioxide.

Methods/Materials
Three different sunscreens, a UVC/UVB meter, saran wrap, paint stirrers, and embroidery hoops. Spread saranwrap over the embridery hoops, and spread suncreen over the saran wrap. Measured the UV energy going through the sunscreen.

Results
The sunscreen with a mixture of zinc oxide and titanium dioxide blocked the most UV energy and was the most effective in all 3 trials.

Conclusions/Discussion
In all 3 trials, oxybenzone was the least effective active ingredient while the combination of zinc oxide and titanium dioxide was the most effective. This suggests that sunscreens with a combination of zinc oxide and titanium dioxide are more effective than sunscreens with either oxybenzone or only titanium dioxide.

Summary Statement
I measured the effectiveness of three different active ingredients in suncreens and found that a combination of titanium dioxide and zinc oxide is the most effective.

Help Received
My mom helped take measurements for the experiment when I was gone.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

Nathan Poggemeyer; Justin Wang

Project Number

J2115

Project Title

AA Showdown

Abstract

Objectives/Goals

This project is intended to produce a battery among a chosen set of Duracell and Energizer batteries which will save you time and money in various situations such as emergency preparedness, as knowing the better choice is crucial for surviving natural and man-made disasters, camping and hiking preparations, business or work readiness, and obtaining maximum performance in battery-powered devices.

Methods/Materials

We found an Arduino-based battery tester to collect data and display it on a program called CoolTerm. The software was slightly modified with guidance from Hans Poggemeyer. We used two resistors to run the battery down and used a Mosfet, an electronic switch, to control when the Arduino UNO took measurements and when it ran the battery down. The data was then transferred to KaleidaGraph, where we plotted our graphs.

Results

The Energizer Ultimate Lithium lasted the longest, at 49.33 hours with an exceedingly low discharge rate at a price of $0.40 per hour and $0.26 per mA. We also found that the Energizer MAX had similar performance while costing less, $0.02 per hour and $0.19 per mAh, even though it pulled in at 41.1 hours. Therefore, the Energizer MAX provided the best cost to performance rate in this experiment.

Conclusions/Discussion

In conclusion, the Ultimate Lithium should be used in devices that require a large, constant current, like digital cameras and RC vehicles, as it boasts a high current with an exceedingly slow discharge rate. Rechargeables should be used in toys which require constant replacement of batteries as they can be recharged multiple times. Alkalines like the Energizer MAX can supply good performance for any situation like emergencies, recreation, entertainment, or work efficiency if you cannot afford the more expensive lithiums and rechargeables.

Summary Statement

We built our own tester to monitor the performance of a chosen set of batteries to find which one had the best cost to performance rate, and discovered that the Energizer MAX was the most cost efficient.

Help Received

The circuit was created and programmed with guidance from Hans Poggemeyer.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Tyler Lee Simerson

Project Number
J2116

Project Title
Heavy Metal for Breakfast: How Much Non-heme Iron Is in My Breakfast Cereal?

Abstract

Objectives/Goals
The objective of this project is to extract non-heme iron from breakfast cereal, and to determine if more iron can be extracted from cereals with a higher iron content.

Methods/Materials
Used a triple-beam balance and magnets to extract non-heme iron from cereal by weighing each magnet on a triple beam balance to get its starting weight, then stirred it into the cereal solution, removed it and re-weighed it to measure the amount of iron extracted from each cereal.

Results
Non-heme iron was extracted from each cereal tested. The cereals with the highest percentage of daily values of iron on their nutrition label were the ones with the most iron extracted during this project.

Conclusions/Discussion
I was able to extract iron from all of the cereals I tested. Iron is used in the body to build platelets and hemoglobin to carry oxygen to the cells. It is a very important nutrient to your body. I learned that there are two types of iron, both are magnetic. They are heme and non-heme. The difference is heme iron is found only in animals and non-heme can be found in plants and animals. It is easier for your body to use heme iron. The cereals use non-heme iron to fortify the amount of iron in the cereal. So even though some of the cereals I used have lots of iron my body might not be able to use it all. I accepted my hypothesis because I found more iron in the cereals with the higher daily value.

Summary Statement
Extracted and compared the amount of non-heme iron in five breakfast cereals to see if there is a correlation between how much the iron that is extracted compares to the percentage of iron listed on the Nutritional Label on the cereal.

Help Received
My science teacher taught me how to use, and loaned me, a triple- beam balance to use for this project.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Monica Soberon

Project Number
J2117

Project Title
Testing What Fraction of a Sample of Kids Can Open a Child-Proof Container

Abstract

Objectives/Goals
Medicine cures diseases that without its use would be fatal. Medicine is a very important part of our society. However, medicine also takes part in ending lives.
Overdosing on medicine can be very harmful to humans. According to www.poison.org "children younger than six years compromise nearly half of poison exposures." In the year 2015, these poison exposures among children younger than 6 years old amounted to more than 1,015,000 deaths in the United States.
I chose to base my science project on childproof medicine caps because they are a great answer to combat this incredibly high amount of deaths that occur in small children because of medicine overdoses each year. My goal was to see how many containers 34 children ages 4 through 7 could open in less than 10 seconds.

Methods/Materials
I am going test what fraction of a sample of 34 kids including twelve four-year-olds, ten five-year-olds, nine six-year-olds, and three seven-year-olds. I will be doing so by testing children from grades Pre-kindergarten, Kindergarten, and First grade. I will give each child 10 seconds to open each of the five, different and completely empty medicine containers. Then, I will record which containers the children were able to open in my logbook.

Results
After 34 children were tested, on average, each child was able to open a bottle of 74.34% of the time. My results showed that on average each child was able to open a "child-proof" medicine bottle in under 10 seconds 74.3% of the time. The results I obtained are worrying because, according to my data, many of these children could easily open a "child-proof" medicine bottle in less than 10 seconds, which could pose a threat to their lives. I learnt that people should take higher precautions while designing medicine bottles.

Conclusions/Discussion
My hypothesis, "If I were to test what fraction of a sample of kids at ages under 8 can open a "childproof" container, then my results would be that they are able to open the containers because small children are very creative and could easily open the medicine bottles." was both correct and incorrect. The 34 children who participated in my experiment could open most of the bottles but couldn't open all.This concluded that we must make safer medicine caps.

Summary Statement
As I tested what fraction of a sample of kids could open five different "child-proof" containers, I found that the children were able to open each container 74.34% of the time, revealing that the containers were not completely safe.

Help Received
None. I performed my experiment and recorded the results myself.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Margaret J. Spencer

Project Number
J2118

Project Title
Baking Soda vs. Baking Powder

Abstract

Objectives/Goals
The goal of this project was to prove scientifically which leavener should be used in baking projects for best results. Baking soda and baking powder make baked goods rise due to their reactions and the ingredients within them. Baking soda (sodium bicarbonate) needs an acid to react and produce carbon dioxide so the baked good can rise. Baking powder contains sodium bicarbonate, but it also has a powdered acid (usually cream of tartar) and dry starch.

Methods/Materials
For this project I made standard blueberry muffins with baking soda and baking powder. I used standard baking equipment to make the muffins and a digital scale to divide the batter in to four groups: baking soda only, baking powder only, both leaveners and a control group with neither. All four batches were baked together in each trial.

Results
The result of my testing was that baking soda provides a slightly better rise, but without the help of a flavored acid it gives off a bitter taste.

Conclusions/Discussion
For a properly risen, neutral tasting treat no matter what the ingredients are, baking powder is the most reliable choice. The study could be improved if I had a more scientific method than my skewer method. I would like to run the experiments again with another baked good.

Summary Statement
For the most effective results, the majority of recipes use both leaveners: Baking soda for height and baking powder for taste, to produce an airy, risen baked good.

Help Received
None

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Nicholas A. Toscano

Project Number
J2119

Project Title
Childproof Lids. Do They Work?

Abstract

Objectives/Goals

Childproof medicine bottles are bottles meant to keep children from eating medicine. Experiments were performed to determine what bottles were the least childproof. The hypothesis was that the screw top bottle and the "push and twist" would be the least childproof, while the "align the arrows" and "squeeze the sides" bottle would be the most childproof.

Seventy-one test subjects were observed and recorded. Each subject was given four different types of bottles. The first bottle, A, was an average bottle with a screw top lid. The second bottle, B, had a "push down and twist" lid, the third bottle, C, was an "align the arrows" bottles, and the fourth bottle, D, was a "squeeze the sides" bottle. The data was recorded as successes and fails.

The results showed that bottle A had the highest opening rate with 100%. Bottle B had the second highest opening rate with a 63.4%. Bottle C had the lowest opening rate with 12.7%. Bottle D had the third highest opening rate with 15.5%. The children who were tested had difficulties opening bottles C and D rather than bottles A and B.

In conclusion the hypothesis was proven correct and bottles A and B have a higher opening rate than C and D.

Methods/Materials

I tested three different types of childproof lids and one regular screw top lid. Handed them to children of the ages 3-7 and observed if they could open each bottle.

Results

During this experiment the bottles A, the bottle with the screw top, and B, the bottle with the "push and twist" lid, were opened the most by the children. The control, bottle A, had the highest opening rate which was 100%. Bottle C, the bottle with the "align the arrows" lids, had the lowest opening rate from all bottles. It had an opening rate of 12.7%. Bottle B had an opening rate of 63.4% and was the second most opened bottle. Bottle D, the bottles with "squeeze the sides" lid, had the third most opened bottle, with an opening rate of 15.5%.

Conclusions/Discussion

Through a series of multiple tests, it was concluded that my hypothesis was proven correct. Bottles A and B were not childproof but bottles C and D mainly were.

Summary Statement

Through tests I showed regular lids and "push down and twist' lids are not childproof, while "align the arrows" and "squeeze the sides" lids are.

Help Received

My science teacher corrected my binder.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Korbyn M.J. Turney

Project Number
J2120

Project Title
Energy Efficiency of Differentiated Roofing Materials

Abstract

Objectives/Goals
The objective of this project was to determine the efficiency of different roofing materials, including a composite shingle roof, a wood shake shingle roof, and a living roof, to maintain moderate internal temperatures and humidity in varying seasonal weather.

Methods/Materials
4 pieces of Plywood, fasteners, thermometers, humidity gauges, roofing materials: wood shake, composite shingle, and construct a living roof of sod and weeds.
Build 4 plywood doghouses with 3 different roofs and leave one bare for a control. Measure the temperature and humidity inside each doghouse and outside. Evaluate the efficiency of each roof by calculating the deviation from the outside temperature and humidity. Observe from June through February to assess efficiency in a variety of weather conditions.

Results
In hot months, the living roof maintained cooler temperatures than wood shake or composite shingle roofs. The wood shake shingle maintained a cooler internal temperature than the composite shingle roof. The humidity with the living roof was consistently but not significantly higher in the summer than wood shake shingle. Composite shingle held significantly higher temperatures in the summer.
In the cooler months, the deviation in temperature and humidity was insignificant between all roof types and did not support that one roofing material was measurably more energy efficient than another.

Conclusions/Discussion
A possibility for why all roof types had little effect on internal temperatures in the winter could be due to the sun's angle in the sky, or the smaller difference between daytime and nighttime temperatures during the winter than during the summer. While the living roof did maintain cooler temperatures in the hot summer months, the humidity within the doghouse was measurably, but not significantly higher than the wood shake shingle house. This indicates that both a wood shake shingle roof and a living roof better maintain moderate internal temperatures and humidity. The living roof provides a number of environmental benefits that the wood shake and composite shingle roofs do not. The living roof provides habitat for insects and small birds, supports honey bees, aids in combating carbon dioxide emissions, and can potentially prevent hot spots in big cities. Furthermore, a living roof can be used to grow shallow root food, especially in urban areas where space is limited.

Summary Statement
Through observing doghouses with a wood shake shingle roof, a living roof, and a composite shingle roof, I determined that living roofs and wood shake shingle roofs are more energy efficient in the summer than composite shingle roofs.

Help Received
With adult supervision, I used a free, online blueprint to construct all four doghouses. My science teacher helped me to determine how to break down my data into manageable sets.