CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Kyle Alexander

Project Number

J0601

Project Title

Electrolysis of Water

Abstract

Objectives

The objective of this study is to determine if the amount of electrolytes affect the rate of production of hydrogen gas during the process of electrolysis.

Methods

Water
Salt (electrolyte)
9 volt battery
Push pins (electrodes)
Container
Test tubes
Timer

Results

Results were collected on five different tests. Each test was taken was with increased amount of electrolytes which produced more hydrogen as more electrolytes were added. This was not the case with oxygen.

Conclusions

After completing my tests, I determined my hypothesis was partially correct. Each test was taken with increased amount of salt. The salt increase created more amounts of hydrogen produced during the test. However, with two hydrogen atoms bonded with one oxygen atom to create a water molecule, it would reasonable to assume that the hydrogen produced would be twice the amount of the oxygen produced. However, this did not occur. As I reviewed the data chart and data table, I noticed that the test tube did not collect a lot of oxygen. The only large amount of oxygen readable was on one of my tests which still did not add up to two parts hydrogen and one part oxygen.

Summary Statement

By simply adding table salt and electricity to water, I will make hydrogen, which is a clean fuel source of renewable energy.

Help Received

My dad help me with the layout after I researched the techniques and topic on the Internet.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Lucile Allen

Project Number

J0602

Project Title

How to Build a Better Cupcake

Abstract

Objectives

I love to bake and enjoy sharing my baked creations with my friends and family. I especially like baking cupcakes and cakes and my friends love eating them. Unfortunately, cupcakes are high in saturated fats and sugar and contain little fiber or protein. This results in a food item that is not very good for you and can cause blood sugar highs and lows when you eat them. But what if cupcakes could be good for you? For my science fair project, I decided to investigate whether I could create a healthier cupcake that is still delicious. My plan was to try and make a recipe for a cupcake that was better for you, but that still tasted like a cupcake and not a vegetable. The question for my project was is it possible to create a healthy cupcake that still tasted good. My hypothesis was that by substituting healthier ingredients, I could create a cupcake that would be better for you but still tasted good.

Methods

After picking my project, I researched what was unhealthy in cupcakes using medical and nutritional web pages and journal articles (see background section for details) and then searched for substitutions for those ingredients. Based on what I learned I decided to focus on three areas to increase the nutritional value of cupcakes: reducing processed sugar, reducing saturated fat, and increasing fiber and protein. In my experiment I started by creating four recipes that had healthy substitutions for fat, sugar and provided added protein and fiber. That resulted in cupcakes that didn t rise and were inedible. In the next phase of my experiment, I tried recipes with gradual substitutions: standard recipe, standard recipe + healthy sugar, standard recipe + healthy sugar and added fiber and protein, standard recipe + healthy sugar, added fiber and protein + healthy fat. Once I had 3 modified recipes that tasted o.k. I taste tested them on 20 kids and 22 adults.

Results

The original recipe received the highest average ratings in all evaluations except for texture. All the recipes except recipe 7 got over a seven out of ten in the overall rating showing that the healthy recipes were still edible and considered by participants to taste good. Sweetness was the factor most negatively affected by my substitutions with the original recipe rating at a 7 and the healthier recipes rating at 5 to 5.5. Recipe 6, which had honey instead of sugar and almond flour, actually got a higher ranking in texture, and was a close second to the original in almost everything else. Over half of the participants chose the original recipe as their favorite while over a third of participants selected one of the healthier recipes as their favorite.

Conclusions

Summary Statement

In my project I studied what was unhealthy in cupcakes and tried to use substitutions to create a healthier, but still delicious cupcake.

Help Received

Kia Nesmith, Sue Sherwood, Christy Brigham (my mom), Mitch Allen (my dad)

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Raven Alvarez

Project Number

J0603

Project Title

Using Chemistry to Remove Carbon Dioxide from the Atmosphere

Abstract

Objectives

The purpose of this project is to find a chemical reaction that removes (scrubs) carbon dioxide gas from semi-fixed sources, without needing to store pure carbon dioxide as a gas, but instead creating a molecule, that is not harmful to the environment, to be stored as a solid. I hypothesised that if the equation H2O + CaCl2 + CO2 => CaCO3 + 2HCl is used to remove carbon dioxide from the atmosphere, then calcium carbonate would precipitate to the bottom of the solution and will be easily removed and stored, making it an effective and efficient way to remove carbon dioxide from the atmosphere.

Methods

To test my hypothesis I added 10g of calcium chloride to 227g of deionized water then pumped carbon dioxide through the solution. The vessel was on scale so I could record the change in mass over the course of 12 minutes. I bubbled carbon dioxide through the solution for the first 3 minutes, noting the change in mass every minute. I continued to monitor the amount of carbon dioxide in the solution or released out of it until the 12 minutes was over. After I did this I compared it to the amount of mass the solution hypothetically should have gained due to carbon dioxide sequestration to the mass it actually gained, discovering if calcium chloride is an efficient chemical to use.

Results

During my experiments no carbon dioxide was permanently removed from the atmosphere. Although the solution did gain an average of about 1.7g while the carbon dioxide was still being added, at the end of the 12 minutes the mass was always back to its original mass, making calcium chloride an inefficient way to remove carbon dioxide from the atmosphere.

Conclusions

Through doing my experiment I learned that calcium chloride is not an effective way to sequester carbon dioxide and store it as a solid. This is because once the chemicals bonded together, it created hydrochloric acid along with the calcium carbonate, and the calcium carbonate reacted to hydrochloric acid, creating an equilibrium and forcing it to the left side of the chemical equation. This means that I will need to use a new chemical to take carbon dioxide out of the atmosphere to help fight climate change. After I have found a chemical that I can use to efficiently remove carbon dioxide from the atmosphere and convert it to a non-hazardous solid, I would like to build a carbon scrubber that can be place in different areas to help reduce the effects of climate change.

Summary Statement

Through experimenting, I found that calcium chloride, when in a solution with deionized water, is not a chemical that can effectively take carbon dioxide out of the atmosphere and convert it into environmentally safe solid.

Help Received

I was loaned a scale to measure the different masses by the Hoopa Tribal Fisheries Dept. and I was provided calcium chloride by my science teacher, Nicholas Dedini. I also received advice from Chris Harmon, an Humboldt State University Chemistry professor.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Trevor Berry

Project Number

J0604

Project Title

Studying the Decomposition of Cotton and Polyester Fabric

Abstract

Objectives

The objective of my project was to determine if cotton and polyester would decompose naturally in a home composter.

Methods

My study was conducted using the following items:
One, white, 100% cotton t-shirt cut into 10 equal strips measuring 2"x13".
One, black, 100% polyester t-shirt cut into 10 equal strips measuring 2"x13".
One- FCMP Outdoor IM4000 Tumbling Composter, 37 gallon, dual chamber tumbling composter.
Seven gallons of organic compost.
My experiment was conducted by placing 3.5 gallons of compost into each side of the dual sided composter. I then placed the ten cotton strips into one side, and the ten polyester strips into the other side. I rotated the composter every other day. My experiment lasted 5 months. My experiment began October 1, 2018 and ended February 28, 2019. On the last day of each month, I would remove the fabric, rinse it in distilled water, let it dry, then weigh it.

Results

The results of my experiment show that cotton fabric strips will decompose and polyester fabric strips will not. On October 1, 2018, the cotton strips weighed 27.4 grams. On February 28, 2019, what was left of the cotton fabric weighed 2.1 grams. On October 1, 2018, the polyester fabric weighed 40.7 grams, and on February 28, 2019 the polyester fabric weighed 40.3 grams.

Conclusions

Based on my results, I can conclude that cotton fabrics will decompose naturally in land fills and a home composter. Therefore, instead of throwing away cotton fabrics in our regular garbage bins, we should be putting them in our green waste garbage bins since they will decompose naturally like leaves, twigs, branches, and grass clippings. My experiment also determined that man-made fabrics, such as polyester, will cause a problem for recyclers and land fills because these fabrics will not decompose naturally, and will continue to take up more and more space.

Summary Statement

I determined if cotton and polyester fabrics would decompose in a home composter.

Help Received

Mr. Gulbronson, my classroom teacher, taught me how to use a scale to accurately measure the weight of my fabrics.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Sabrina Bluml; Shruti Chand

Project Number

J0605

Project Title

How to Produce the Most Fizz with Bath Bombs

Abstract

Objectives

The objective of the experiment was to change the relative amounts of sodium bicarbonate (baking soda) and citric acid in bath bomb recipes to produce the optimum amount of fizz that is released once the bath bomb touches water. It was expected that a mixture of approximately 0.76 grams of citric acid for every gram of baking soda would produce the most fizz. This hypothesis was based on the chemical reaction formula.

Methods

There were six recipes that changed the relative amounts of sodium bicarbonate and citric acid, and all the other ingredients were kept constant. The fizz was measured using a jar filled with water and a cap with a balloon attached to the top. As the both bomb was dropped in the water, the cap would immediately be screwed on. A video was recorded for each experiment and then later reviewed to determine how much time it took for the balloon to fill. The shortest times showed the most carbon dioxide and fizz produced.

Results

The shortest time was observed for a mixture of 1:0.78 (by weight) citric acid to baking soda with an average time of 3.7 seconds. The longest time came from 0.22:1 (by weight) citric acid to baking soda with an average time of 6.7 seconds.

Conclusions

The result of the experiment is consistent with a chemical reaction where three baking soda (84 g/Mol) molecules react with one citric acid (192 g/Mol) molecule. The closer a mixture comes to this ratio, the more fizz and carbon dioxide is released.

Summary Statement

This experiment tested different recipes that changed the relative amounts of baking soda and citric acid in bath bombs to produce the most carbon dioxide.

Help Received

My partner and I completely developed the concept of the experiment and did the project on our own. However, we received help from from my dad on making sure our ratios for measurements were correct.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Brendan Byrne; Evelyn Schilling

Project Number

J0606

Project Title

Fueling the Future: Beyond the Limits of Water?

Abstract

Objectives

The objective of this experiment is to investigate which metal and pH of water would be most suitable and effective for the electrolysis of water.

Methods

equipment to fully complete a breadboard, different types of metals, various levels of water (pH wise), phosphate buffer solution, multi meter.

method:

set up the breadboard, buffer solution and other parts of the electrolytic cell. After the control is established, change the pH of the water and the metals used for the electrodes. Record the data.

Results

For our experiment, the water with a PH level of 7 and the use of tin for the apparatus produced the most electricity consistently. These results might not seem significant, but this was the amount of voltage produced in only a 500 ml container. If we enlarge the ratio for 10 liters then the outcome would be 80 volts at least. If we did this experiment again we would have tested this experiment on larger amounts of water so that we could eventually be used to generate a car or even a house.

Conclusions

Hydrogen fuel is the new source of energy that will power the future. Clean, renewable, easily accessible and plentiful, hydrogen is ideal for technological advancement. In this experiment, hydrogen was sourced from the electrolysis of water, which is simple and reliable. My partner and I yielded hydrogen, which, if the process were to be done by professionals, would later be used as fuel. My partner and I also tested if the pH of the water being electrolytic would affect its electrolysis, and if using different types of metals used in the experiment would affect it also. For example, the experiment this one is based on called for nickel metal strips, but we tested tin, brass, copper and nickel. We reached our conclusion based on the voltage readout of each of the metals whilst going through electrolysis. The metal with the highest voltage was tin, proving our hypothesis that brass would have the highest voltage wrong. With this information, scientists can source materials much quicker and more efficiently.

Summary Statement

Our project is about testing the components of an electrolytic cell; the water going through electrolysis and the electrodes.

Help Received

Steve Wait, a water scientist, helped us with our project when we needed help, and guided us a little bit.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Himmut Chatha

Project Number

J0607

Project Title

Testing Different Methods of Water Electrolysis: Lead Pencil Electrodes vs. Metal Thumbtack Electrodes

Abstract

Objectives

My goal is to determine the most effective method of water electrolysis. In particular, to determine the most effective method I measured which produced the most amount of gas. My hypothesis is the thumbtack method will produce more gas because metal has a higher conductive property than carbon due to the molecular structure.

Methods

Both methods have constants of water, salt, electric tape and, a 9-volt battery. Salt is an electrolyte which will make the water conductible. Both procedures for the electrolysis process are similar except on a molecular level. In addition, for electrolysis, both method designs are different, as well as when I tested with test tubes. The positions of the electrodes had to changed for each design. The thumbtack electrodes are on the side while the pencils are on top held by cardboard. I measured three types of data. First, with test tubes to collect and measure the gas produced, a voltage meter to record the voltage and pH paper to indicate the pH levels.

Results

My results were not surprising considering how metal electrodes have more conductivity than carbon. My test results are the following. The voltage for the thumbtack method was 8.37 volts while the pencil method was 3.28 volts. The pH levels were 8 pH for the Thumbtack method and 7 pH for the pencil method. The pencil method did not give off oxygen, however did make chlorine, because of a special byproduct reaction. The thumbtack method gave off 3 inches of hydrogen and 1 inch of oxygen. The pencil method gave off 3 inches of hydrogen and 3 inches of chlorine.

Conclusions

My results supported my hypothesis that the thumbtack method will produce more gas because metal has a higher conductive property and this could change the world because they can design cars to be water electrolysis powered which would work more efficiently with metal electrodes. If further testing was conducted nickel, as well as Zinc, might work well because they are cheaper and are not able to corrode. Metal electrodes are also used for water dialysis which makes seawater into freshwater and, also can make hydrogen fuel.

Summary Statement

My experiment is fundamentally about the comparison of two water electrolysis methods

Help Received

Some assistance was from Navneet Brar (MOM) with the completion of the board and Gurinder Chatha (DAD) with the cutting of speaker wire.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Eva Chen

Project Number

J0608

Project Title

Revisit to the Synthesis of 1-(2-fluorophenyl)-1H-imidazole

Abstract

Objectives

My objective is to get the correct building block for future medicinal compounds (which is 1-(2-fluorophenyl)-1H-imidazole) and get a high yield percentage.

Methods

I tested phenyldihalide variety, base variety, reaction time, and the reaction temperature. These reactions varieties were tried in hope to synthesize 1-(2-fluorophenyl)-1H-imidazole.

Results

After many trials and errors, I was successfully able to synthesize 1-(2-fluorophenyl)-1H-imidazole with a high yield percentage.

Conclusions

Using 2-iodo-1-fluorobenzene as the phenyldihalide and potassium carbonate instead of cesium carbonate as base led to the synthesis of my desired product.

Summary Statement

After many trials and errors I was successfully able to synthesis 1-(2-fluorophenyl)-1H-imidazole.

Help Received

Qiao-hong Chen, California State University Fresno

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Maxwell Chen

Project Number

J0609

Project Title

How Can We Efficiently Generate Hydrogen from Water?

Abstract

Objectives

Hydrogen is a clean energy source. It can be generated from water by using electricity. In this project, I compare the rate of hydrogen production from water using solutions of different pH and find that the lower the pH the faster the production rate. I also compare the rate of hydrogen production by using different electrode materials, and find that copper wire works much better than pencil lead as the electrode.

Methods

Materials: pencil, solid copper wire, plastic centrifuge tube, power supply, connection cable, autopipette, timer (iPhone)

Method:

1. I prepared four solutions: 0.05 M H_2SO_4 (pH = 1), 0.005 M H_2SO_4 (pH = 2), 0.1 M KH_2PO_4 (pH = 6.8), and 0.1 M KOH (pH = 13)
2. I sharpened both ends of two pencils
3. I cut off the tip of the plastic centrifuge tube, inserted a pencil into the tube, and used waterproof tape to seal the gap. I calibrated the volume using an autopipette to transfer a known amount of water into the tube, and marked the volume with a permanent marker.
4. I used a beaker and put 100 mL of one of the solutions into it.
5. Then I took an autopipette and filled up the plastic tubes until it was almost overfilled.
6. I then took wax paper and carefully covered the opening with it, making sure not to let any bubbles inside.
7. Then I flipped the tubes over and submerged them into the beaker and removed the paper once they were in.
8. I then connected cables from the power supply to the electrodes and timed the amount of hydrogen and oxygen produced.
9. I repeated the study by replacing the pencil with a solid copper wire.

Results

I did two sets of experiments. In the first experiment, I used the most acidic solution, 0.5 M H_2SO_4. I observed that once the power supply (6 V) was connected to the outside pencil tips, bubbles started to form on the other pencil tips, and the amount of gas collected in the negative tube was almost twice as much that in the positive tube, because the amount of hydrogen in water is two times that of oxygen.

Summary Statement

Acidic solution and metal electrodes are preferred in efficient hydrogen production from water.

Help Received

Dr. Yi Peng, University of California Santa Cruz

Name(s)

Aralyn Connolly; Claire Tsai

Project Number

J0610

Project Title

The Effect of Temperature and Light Exposure on Pigments in Picked Leafy Greens

Abstract

Objectives

We aim to develop methods to detect the amount of leaf pigments. We will then use the methods to study the effect of temperature and light exposure to the pigments in picked leafy greens.

Methods

1. We built a device to measure chlorophyll concentration by measuring light absorption from leaf extract.
2. We used paper chromatography to separate and quantify leaf pigments.
3..We extracted and measured the amount of leaf pigments after different storage conditions for leafy greens (1 control group with 4 test groups).

Results

Extractions and Absorption Measurement:

1. Our home-made absorption meter is able to quantify the amount of chlorophyll in leaves
2. We could monitor the reduction of chlorophyll and compare different experimental groups.
3. The ideal condition for storing leafy greens is dark and cold. The temperature is a much stronger factor.
4. Extraction/absorption is a better method to measure leaf pigments.

Chromatography:

1. We successfully separated chlorophyll from other pigments on chromatography paper.
2. We noticed that chlorophyll band intensity decreased with storage time (especially for the room temperature samples).
3. The attempt to quantify chlorophyll from the chromatography paper yielded inconclusive results.

Conclusions

Through two methods, we found out that a cold and dark condition is better for preserving chlorophyll in leaves. We also concluded that absorbance is a better way for testing if the leaf maintained its chlorophyll.

Summary Statement

We found that light absorption is a better method than paper chromatography when quantifying chlorophyll and the best condition to preserve chlorophyll is in a cold and dark place.

Help Received

We built the device and performed the experiments ourselves. However, our parents helped us with heating the Isopropyl Alcohol in a water bath.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Noorah Fathima Dhamim

Project Number

J0611

Project Title

A Bio-Friendly Oil Spill Remover

Abstract

Objectives

There is one main problem that is tainting our oceans day by day, yet very few are taking action. Oil spills dump thousands of tons of oil into our precious oceans, damaging the environment. There are many solutions that people have come up with, but everyone always retreats to the most inexpensive and harmful solution: oil dispersants. However, there are many natural, abundant materials that can be used instead of these harmful chemicals. I wanted to find out which bio friendly substance would be the most effective in cleaning up oil spills.

Methods

I started by choosing 5 absorbents that are easily found and are known for their absorbing properties. The 5 absorbents I chose are: hair, oak bark, super-absorbent polymer, cheesecloth, and ferrofluid. First I hypothesized that Super Absorbent Polymer would absorb the most oil and be the best solution to clean up these spills because it can absorb from 50 to 500 times its size.

In the first test, I used the coffee-filter method to weigh and measure how much oil left the substance. This was done to discover how much weight each substance gained from absorbing the oil around it. Each material was tested 10 times to get accurate results. I performed a second experiment to use another method to discover how well each product absorbed the oil in the petri dish. When using the ferrofluid, I wanted to find out if the amount of drops placed in the oil tainted water would affect how well it absorbed the surrounding oil. Keeping the oil as the control variable in this procedure, the amount of oil remaining in the petri dish gradually increased as the amount of drops of ferrofluid increased. This means that the amount of drops doesn t drastically affect the absorption. I conducted another procedure by programming the robot to move a bottle in a wave motion, imitating the waves of the ocean. I conducted the same steps as procedure 1 to ensure that the absorbent would work in the real ocean, not only in my prototype.

Results

After conducting my entire experiment, my results showed that hair absorbed the most amount of oil, and the polymer did not in fact absorb as much predicted.

Conclusions

The polymer did not in fact absorb as predicted. Though it absorbed all the oil in the container, it also absorbed the water. This means that it would not be the ideal solution because it would drink up much of the salt water in our ocean. The substance with the most amount of weight gain was hair, mostly because it is an adsorbent to oil and doesn t soak up the oil.

Summary Statement

My project tests 5 absorbent materials to see which one would be the most effective in cleaning up oil spills.

Help Received

I would like to thank my coach for guiding me throughout the project, and my family for encouraging me.

Name(s)

Ingrid Feague

Project Number

J0612

Project Title

Taming Coulomb: How Solutes Affect the Reaction of Sodium Immersed in Water

Abstract

Objectives

I wanted to learn how the presence of various solutes (sugar, NaCl, KCl/NaCL mix) in an aqueous solution would affect the reaction of sodium submerged in the solution. My hypothesis was that all of the reactions will be slower than the control (pure water), with sugar solution slowest of all.

Methods

Sodium (0.05 oz samples); Water; Solutes: Salt (NaCl), Table Sugar, Lite Salt (KCl/NaCl mix); Video recorder

Place a sodium sample in each of three fully saturated aqueous solutions of salt (NaCl), table sugar, and Lite Salt (KCl/NaCl mix), plus pure water as a control, measuring reaction duration and qualitative observations.

Results

Average reaction duration over three trials -
Control (water): 10 sec + Coulomb explosion
Sodium solution: 105 sec, NO explosion
Sugar solution: 64 sec, NO explosion
Lite Salt solution: 29 sec, NO explosion

Conclusions

The most interesting result was unexpected: sodium only exploded consistently in water. The presence of solutes inhibited the Coulomb Explosion. Sugar, salt, and Lite Salt solutions didn t explode, whereas the water exploded every time. The sugar caught lightly on fire, salt burned very little, and Lite Salt had an intense flame.

My hypothesis was partly correct in that sodium reacted more slowly in aqueous solutions than pure water. But I expected sugar to be slowest, when in fact salt was slowest. I thought the ionic solutions (salt and Lite Salt) would behave similarly because the Lite Salt is half salt, half KCl, so they are very similar substances. But the results were very different in both time and quality.

Nuclear plants sometimes use liquid sodium for cooling. If a tsunami hits a plant (like in Fukushima, Japan), it could be very useful to know that sodium won t explode in saltwater.

Summary Statement

I tested the effect of the presence of solutes on the reaction of sodium when submerged in various aqueous solutions vs. pure water and found that solutes slowed the reaction and consistently inhibited Coulomb explosion of the sodium.

Help Received

My father was my assistant throughout my project. He videoed my tests, helped me write and helped me prepare for judge's interviews. My science teacher helped me understand my experiment fully and answered all of my curious questions. My mother's cousin (a chemist) gave me ideas for follow-up

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Clarissa Gonzalez

Project Number

J0613

Project Title

The Chemical Reactions of a Lava Lamp

Abstract

Objectives

The objective of this study is to learn about the different chemical reactions that take place within a homemade Lava Lamp. More specifically: I wanted to understand, why water and oil do not mix with each other even though they are both liquids. I also wanted to understand what chemical reaction creates the bubbles in a Lava Lamp and what causes the bubbles to move up and down. And lastly, I wanted to understand which type of oil would create the best reaction.

Methods

Generic effervescent-antacid(or Alka-Seltzer), 3 types of oils, water, 3 clear containers, food coloring, stopwatch. I made 3 different homemade Lava Lamps using vegetable, grapeseed, and baby oil. Added the antacid tablets and observed and measured the reaction times.

Results

Antacid tablets were added to the three homemade lava lamps that contained the vegetable, grapeseed, and baby oil. The chemical reactions were observed and documented. The reaction times were also recorded. Repeated trials were run to determine which oil would create the best reaction. I found that the vegetable oil worked the best, the grapeseed oil worked second best, and the baby oil took the longest time to produce bubbles.

Conclusions

I discovered that oil and water don't mix for two reasons. Oil and water have different densities. And because of the polarity and nonpolarity of the water and oil molecules. The reaction of the acid and base chemicals that make up an antacid is what creates the bubbles in the Lava Lamp. And vegetable oil created the best Lava Lamp results.

Summary Statement

My research and experiments taught me about the different chemical reactions that take place within a homemade Lava Lamp. And about, of the three oils that I used in my experiment, the vegetable oil created the best Lava Lamp reaction.

Help Received

I received guidance from my Science teacher, Mrs. Yap, during our Science Club Meetings at Los Primeros School of Sciences and Art. She taught us the different steps that need to be taken when creating a science project. I chose the topic of my project and built and performed the experiments myself.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Hannah Hessler

Project Number

J0614

Project Title

Can Dry D-cell Batteries Oxidize Carbon Monoxide to Save Your Life in a Fire?

Abstract

Objectives

In the United States one person dies from fire every three hours, and of those 80% of all fire related deaths are from smoke inhalation. Carbon monoxide is the element in smoke that kills you by not allowing the oxygen onto the hemoglobin in your blood. Since fire risk has increased due to recent droughts, I set out to find a way to filter carbon monoxide from smoke using a household item, allowing a person more time to escape from a burning building.This project compares a store-bought emergency fire respirator to an alternative method of carbon monoxide filtration using manganese dioxide removed from dry D-cell batteries.

Methods

First, I extracted the manganese dioxide from one dry D-cell battery. I mixed water with the manganese dioxide to create a paste, and then spread it on a dust mask, creating a filter. I compared the magnesium dioxide filter to: 1) a store-bought emergency fire respirator and 2) a dust mask by itself as a constant for the manganese dioxide filter. I tested them using a device I developed to measure the carbon monoxide levels before and after filtration. The device drew smoke from a fire through tubing where the carbon monoxide level was measured. Then, the smoke was filtered and drawn farther into the tubing where it was measured once more for its carbon monoxide levels. This process was repeated seven times for each filter.

Results

My experimental results prove my hypothesis to be incorrect, as the manganese dioxide filter did not filter as much carbon monoxide from the smoke as the emergency fire respirator. It did however filter 82% of the carbon monoxide that the emergency fire respirator filtered.

Conclusions

In conclusion, Saver, the company that manufactures the emergency fire respirator, claims that their device is able to filter the carbon monoxide from smoke for 5 minutes. If my filter was able to filter 82% of the carbon monoxide that the Saver emergency fire respirator was able to filter, in theory it should allow a fire victim to survive carbon monoxide poisoning up to four minutes and six seconds more than with no filter at all.

Summary Statement

To help save fire victims from carbon monoxide poisoning, I attempted to develop a simple, homemade filter using the manganese dioxide found in dry D-cell batteries to oxidize the lethal carbon monoxide in smoke.

Help Received

I used the help of a qualified scientist named Monte Myers, Kern County fireman and HAZMAT Specialist. He assisted me because I used fire, which can be hazardous due to its nature and the carbon monoxide it produces. He also assisted in the handling of manganese dioxide which was removed from

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Hemani Kamarshi

Project Number

J0615

Project Title

Investigating Amounts of Vitamin C in Cut Fruits Left in Refrigerator over Time

Abstract

Objectives

I wanted to study how vitamin C content is affected by cutting fruits well ahead of consumption. I grouped the test fruit into two categories: fruit that visibly oxidizes and fruit that does not. I hypothesized that fruit that visibly oxidizes would losevitamin C at a faster rate than fruit that does not visibly oxidize.

Methods

To start my procedure, I made a reference sample using a known amount of vitamin C in water. Then I cut fruit into eighths and left the slices in containers in the refrigerator for varying numbers of days. (Uncut fruit were also placed in the fridge as a separate control.) On the testing day, I juiced this fruit and used a titration method that involved a reaction between iodine and cornstarch to find out the amount of vitamin C in the fruit. After this, I analyzed the data. I converted it to milligrams of vitamin C using the reference sample data, found the SEM for the values, graphed it, and conducted a T-test on it. I repeated this experiment by leaving fruit juice exposed in the fridge over time.

Results

I found that the vitamin C levels in all four fruits dropped over time. Of the oxidation-prone fruits I tested, Granny Smith apples lost 38% of their vitamin C content, while D Anjou pears lost 28% over the 8-day testing period. Of the fruits that do not visibly oxidize, strawberries and Navel orange showed a 19% and 24% reduction, respectively, in the amount of vitamin C over the test period. The vitamin C declining trend in all four fruits was statistically significant with P-values significantly less than 0.05. None of the whole fruits showed a reduction in vitamin C after 8 days in the fridge.

Fruit juice showed an even bigger reduction in vitamin C content over the 4-day testing period.

Conclusions

It shows how vitamin C changes in pre-cut fruits, and helps people decide which fruits would be best not to store after cutting to maximize the vitamin C content.

Summary Statement

My project is investigating what happens to the levels of vitamin C in fruit when cut and left in the fridge over time, and I found interesting results showing how long we should leave cut fruit before consumption.

Help Received

I would like to thank Vivek Kamarshi for helping me refine and edit my content, especially my conclusion and result slides, and my mentor, Mrs. Corinna Chung (teacher at John F. Kennedy Middle School), for helping me with the scientific method I used and helping me revise my content, and for her valuable

Name(s)

Aditi Kiran

Project Number

J0616

Project Title

Effect of the Amount of Glycerin on the Strength of Starch-Based Bioplastics

Abstract

Objectives

Bioplastics address some of the environmental and health concerns of synthetic plastics. A plasticizer makes bioplastics flexible and strong. The objective of this project was to test the effect of different amounts of glycerin, a plasticizer, on the weight-bearing capacity of starch-based bioplastics used to produce shopping bags. My hypothesis was, the bioplastic made with 15ml of glycerin would have the highest weight-bearing capacity followed by the bioplastics made with 10ml, 20ml and 25ml of glycerin.

Methods

To create bioplastic sheets, a mixture of 15ml of glycerin, cornstarch, water, and vinegar was heated until the mixture turned transparent. Then the mixture was transferred to a mold comprised of two metal sheets lined with parchment paper and secured by binder clips. Once cooled, five strips were cut from the bioplastic sheet. To measure the weight bearing capacity, a single strip was looped around the handle of a bucket and lifted. Water was poured into the bucket until the strip broke. The weight of the bucket with water was measured using a spring scale. The steps to measure weight bearing capacity were repeated for the other four strips. The steps to create and measure the weight bearing capacity of bioplastic were repeated for 10ml, 20ml and 25ml of glycerin.

Results

The results showed that the average weight bearing capacity of the bioplastic strip decreased as the amount of glycerin increased.

Conclusions

My hypothesis was partially supported. The strips made with 25ml of glycerin had the least weight bearing capacity followed by 20ml and 15ml strips. Surprisingly, the strips with 10ml of glycerin had the highest weight-bearing capacity. Increase in the amount of glycerin made the strips become increasingly gel-like causing it to break easily. Even though the bioplastic made with 10ml glycerin was the strongest, given that it was brittle and hard, it is not best for creating shopping bags. Hence, the bioplastic most likely to be used for making plastic shopping bags would be the bioplastic made with 15ml of glycerin, which was both flexible and firm.

Summary Statement

I tested the effect of the amount of glycerin on the weight bearing capacity of starch-based bioplastics, thus determining the ideal amount of glycerin for making shopping bags.

Help Received

Ms. Sampath provided valuable advice and support. My mother helped in getting supplies and supervised safety procedures in the kitchen.

Name(s)

Malvyn Lai

Project Number

J0617

Project Title

Catalyst Efficiency for Producing Energy Fuels by Water Splitting

Abstract

Objectives

Renewable energies, such as solar and wind, are intermittent sources of energy. For renewable energy to become practical, we need a cost-effective method for storing energy so it can be supplied at all times. One way to transform and store solar energy is by water splitting.

The objective of this study is to find the effect of temperature and different types of electrodes on the efficiency of water splitting.

Methods

Different types of electrodes, Iron, Nickel, Graphite, and Copper, were tested with and without a cobalt catalyst. The electrodes were put in a sodium phosphate buffer solution and connected to a voltmeter, which read the voltage required to split water into oxygen and hydrogen. I recorded this data and calculated the overall efficiency for each electrode. The effect of temperature was also tested by heating the buffer up to 75 degrees Celsius, and the overall voltage was taken at 5 degree increments.

Results

The test results show that heated solution was more efficient, saving 700 millivolts than the energy cost at 9° C. The graphite electrode performed the best, outperforming another three electrodes I tested: copper, nickel, and iron. The graphite electrode had the highest net efficiency gain after the catalyst had been added, with an overall improved efficiency by 18 percent relative to the baseline efficiency. The final voltage with the cobalt catalyst for each electrode is as follows:

Graphite about 1.238v

Copper about 1.495v

Nickel about 1.565v

Iron about 1.836v

Conclusions

The original hypothesis was that the nickel electrode would perform the best out of the four electrodes tested. My hypothesis was rejected by the data. The graphite electrode performed the best,

Summary Statement

A carbon-based electrode with nano structures that creates large surface area has high water splitting potential when paired with a cobalt-based catalyst.

Help Received

The circuit was made by myself. Professor Chun-Ta Lai of the Biology Department from San Diego State University assisted in the conducting of the experiment.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Grace Lin

Project Number

J0618

Project Title

Keep the Ice Warm: Measuring How Initial Temperature Affects Sodium Acetate Hand Warmers

Abstract

Objectives

The objective was to determine what initial temperature for a hand warmer would create the most effective hand warmer in terms of warmth, crystallization rate, and voltage from its heat. It was expected that the hand warmer with an initial temperature of 30 degrees Celsius would last longest due to its closeness to room temperature (which helps increase the crystallization rate and how long the hand warmer stays warm). Its warmth would create more voltage than lower temperatures, and its other factors would make it more efficient than any other variation.

Methods

Two digital thermometers, a thermoelectric cooler, and a hand warmer were mainly used. The amount of voltage produced as shown by the digital thermometer and thermoelectric cooler was measured when the timer reached one minute, and the temperature s change over time was measured until the hand warmer returned to its initial temperature. Meanwhile, the rate of crystallization was recorded.

Results

The hand warmer with an initial temperature of 19 degrees Celsius was most efficient based on the factors I tested, while the hand warmer with an initial temperature of 50 degrees Celsius was least efficient. The 19 degrees Celsius variation had the longest warmth time, shortest crystallization rate, and most consistent voltage out of all the variations.

Conclusions

The 19 degrees Celsius initial temperature hand warmer, which was most effective, produced a decent amount of heat and an average of about 0.4 volts of electricity at the one-minute mark and had a consistent range of 0.3 volts to 0.5 volts. The hand warmer crystallized much faster than other variations. It also lasted extremely long every trial (up to 145 minutes). Thus, the closer the initial temperature is to the room temperature, the more efficient the hand warmer is overall.

Summary Statement

I found that the lower the initial temperature of the reusable sodium acetate hand warmer, the more efficient it is based on its crystallization rate, voltage from its heat, and amount of time it was above its initial temperature.

Help Received

I conducted and recorded the results of the experiment myself. My physical science teacher helped me understand how a sodium acetate hand warmer worked and reviewed my results.

Name(s)

Alexis MacAvoy

Project Number

J0619

Project Title

Designing Efficient, Low-Cost, Eco-Friendly Activated Carbon for Removal of Heavy Metals from Water

Abstract

Objectives

Heavy metal contamination continues to threaten the SF Bay & cleanup of mercury & copper from watersheds is costly & time-consuming. Designing a cheap & effective activated carbon (AC) for filtration of industrial waste is an unmet need for heavy metal adsorption from water.

Methods

Biowaste materials (coconut & walnut shells, sawdust, ash) were used as precursors because of high lignin & cellulose content. Precursors were treated with dilute sulfuric acid to increase lignin & cellulose content. Adsorbents were activated using 85% phosphoric acid (288 C x 6h). For Phase 2, repeated 8% NaHCO(3) rinses were performed to raise pH. Adsorbents were treated with 15% NaF or NaCl halogen solution to increase mercury (Hg) s affinity to the carbons. These activated carbons were designed for Hg adsorption but given Hg s toxicity, copper (Cu) was used as a test contaminant. All ACs were packed in burettes & 10mL 0.02 g Cu/L solution introduced as a contaminant. To test effluents from AC columns, 3 quantitative spectrophotometric assays & 1 qualitative assay were performed.

Results

3 spectrophotometric assays were attempted to determine Cu concentration in effluents & the Cu-ammonium-cuprizone assay was most accurate & reproducible. During Phase 1, the most efficient ACs were the sawdust & coconut controls. Cu levels in effluents were reduced to levels of Cu remaining in commercially produced AC, but control carbons achieved similar results to treated carbons. In Phase 2 synthesis, the objective was to rinse the carbons to neutralize pH. Testing of effluents from Phase 2 chemically treated carbons demonstrated a marked drop in Cu concentrations compared to Phase 1 syntheses, concluding that high pH increased Cu removal.

Conclusions

Low-cost, AC syntheses removed the same amount of Cu as the commercially available AC for the Phase 1 synthesis, & up to 30 times more for the Phase 2. About 90% of the test Cu(II) on average was removed on the first pass through the test carbon column in Phase 1 & up to 99.67% of test Cu(II) was removed in Phase 2 to levels below the allowable EPA Cu concentration for drinking water. Home design & synthesis of effective AC using low-cost materials is a usable option for heavy metal adsorption, especially in high-risk environments with few resources.

Summary Statement

I synthesized and tested cheaper, effective, eco-friendly activated carbon that removed 99.67% of copper from a standard copper solution.

Help Received

My parents helped me wash dishes and let me use the garage to conduct experiments.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Justin Magugat

Project Number

J0620

Project Title

Boiling under Pressure

Abstract

Objectives

The objective of this project is to determine if the boiling point of water can be lowered by lowering the surrounding pressure.

Methods

Filtration flask, hand vacuum pump, rubber stopper, propane burner, and water. First, the pressure in the flask was lowered to the pressures at which I planned to record the boiling points. Next, I heated the water until I saw boiling occurred. Then I recorded the temperature at which the water boiled.

Results

The temperature at which the water boiled was recorded after reaching the desired pressure. The water's boiling point decreased when the surrounding pressure was lowered. Three sets of trials were conducted, each under the same conditions, excluding pressure. Each set had three different tests and each test was conducted three times each.

Conclusions

The boiling point of the water was lower when the pressure surrounding it was lower. My results supported my hypothesis that the boiling point of water is directly connected to atmospheric pressure. When graphed, the relationship between pressure and boiling point resembled a logarithmic curve. In future experiments, I plan to test different liquids as well to find out if this relationship is purely unique to water. I also plan to use a more capable vacuum pump in order to reach lower pressures. This concept can be applied in oil and natural gas drilling to prevent overheating of parts and save money.

Summary Statement

I showed that the boiling point of water can be decreased if the pressure surrounding the liquid is lowered.

Help Received

I designed and assembled the apparatus by myself. I performed my experiments and operated the propane burner with the supervision of my father.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Taryn Manns

Project Number

J0621

Project Title

Fe-ueling Iron Absorption

Abstract

Objectives

The objective of my experiment is to determine if iron absorbs faster on an empty stomach or a full stomach.

Methods

Iron detector tablets, iron color chart, test tubes, distilled water, white distilled vinegar, almond flour. Measured the rate of absorption of iron in solutions representing a full stomach and an empty stomach.

Results

The rate of absorption of iron was significantly faster for the solution representing an empty stomach than the solution representing a full stomach. The solution representing an empty stomach also reached a higher level of absorption on the color chart reaching 5ppm (parts per million). The solution representing a full stomach only reached 1 ppm on the iron color chart.

Conclusions

Based on my experiment, iron absorption occurs faster on an empty stomach. This information is important for people who take iron supplements.

Summary Statement

I showed that iron absorption occurs faster on an empty stomach.

Help Received

I prepared all of the solutions and compared the solutions to the color chart by myself. I had help with the timing at the beginning of each trial from my mom.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Ryan Menefee

Project Number

J0622

Project Title

Does the pH of Water Exposed to Hydrogen and Oxygen Change after Separation by Electrolysis?

Abstract

Objectives

My project involved creating electrolysis of water using a battery to examine the pH of the water after it was affected by electrolysis. My hypothesis was that if we separate the atoms of hydrogen and oxygen in water then the remaining water pH will be lowered.

Methods

I used baking soda and Sodium Hydroxide as agents and selected a model that would allow me to collect and test water touched exclusively my Hydrogen and Oxygen. I conducted the 6 evolutions of my experiment by building out and slightly modifying YouTuber Thomas Kim s model (Kim, 2015) In this model, metal rods are attached to the base of a container. The lid is modified to cover aluminum rods with tubes to allow gases to flow to feed the gases into smaller containers filled with tap water and a separate tube leading to a balloon to capture the gases. I recorded the pH of the water before and after, the voltage, time and other notes.

Results

Ultimately, I found that while there was no difference in the pH levels of water touched by hydrogen versus the water touched by oxygen the pH levels of water actually increased after electrolysis which makes the water better for the environment.

Conclusions

My hypothesis was that if we separate the atoms of hydrogen and oxygen in water then the remaining water pH will be lowered. I suspected that this reduction of the pH levels then would render the water harmful to the environment.

I conducted electrolysis of water in 6 evolutions of my experiment. My findings disproved my hypothesis and illustrates that the pH did change but it did not decrease, it increased which is actually better for the environment as pH values increased making the water less acidic consistently in all evolutions.

Hydrolysis of water is used in many fields and is the solution to many different problems. The knowledge I ve acquired through this experiment means large scale hydrolysis can be used without much risk to the environment s surrounding water. Therefore Hydrolysis could be a viable renewable energy source of the future.

Summary Statement

I took a look at the aftermath of the separation of hydrogen and oxygen in water by examining the pH balance of the remaining water touched exclusively by hydrogen and oxygen.

Help Received

Mr. Mitchell assisted me with using the power tools and equipment to build out my project device and helped verify that it worked properly. Mr. Mitchell and my mother proofed and gave feedback on my report.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Anthony Perez

Project Number

J0623

Project Title

Salt, Salt, Salt!

Abstract

Objectives

The objective for this project is to see if there is an alternative to the road salt that they use to thaw the snow on mountains that will melt ice/salt faster.

Methods

Tablespoon to measure the salt, 6 different salts, stopwatch, camera. Used stopwatch and camera to record the times of my experiments into my journal.

Results

The results that I got was that table salt melted the ice the fastest in 29 minutes and 12 seconds. While I thought that rock salt would melt the ice the fastest with the time of 36 minutes and 43 seconds.

Conclusions

My hypothesis was incorrect because I thought that rock salt was going to melt ice the fastest while table salt melted ice the fastest. Rock salt had a time of 43.08 and 36.43 minutes while table salt had a time of 29.12 and 30.30 minutes. I got these results because I thought that because rock salt doesn t have all the added chemicals that table salt has but it helped table salt melt the ice faster. A variable that could have affected my results was putting not enough or more than enough salt onto the measuring spoon. An improvement that I can make next time I do this experiment is not holding the ice when I put it into the cup so that the heat of my hands doesn t make the ice start to melt before I put it into the cup.

Summary Statement

My project is about testing different salts on ice to see if they would melt ice faster than the road salts that they are currently using.

Help Received

My parents helped me set up the board but I worked alone during the entirety of this project.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Daniel Puga

Project Number

J0624

Project Title

Metal Corrosion: How Oxygen Affects the Rate of Corrosion in a Wet/ Dry Case

Abstract

Objectives

The objective of this project is to measure the rate of corrosion in a wet/dry case in which the wet area of a given metal remains constant while the dry area exposed to air/oxygen varies.

Methods

Multiple iron and zinc nails of different sizes were partially submerged in an acid solution (white vinegar at 5% acidity) keeping the wet area constant and systematically varying the area exposed to air/oxygen. Once measurable amounts of rust were formed, the nails were removed from the solution and the rust was weighed using a precision scale. Multiple trials were performed to establish validity.

Results

Several nails of iron and zinc were tested for corrosion in white vinegar at a constant wet area and with the area exposed to oxygen varying. In a wet/dry metal corrosion case, the amount of rust formed in the area exposed to air/oxygen varies directly with the total dry area.

Conclusions

Repeated trials with multiple nails revealed that in a wet/dry metal corrosion case, the total area of a metal exposed to air/oxygen (dry area) varies directly with the corrosion rate.

Summary Statement

I discovered that in a wet/dry metal corrosion case, the rate of corrosion is directly proportional to the total area exposed to air/oxygen.

Help Received

My project supervisor explained the details of corrosion, I performed the experiments myself.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Alana Reyes

Project Number

J0625

Project Title

Which Element Produces the Greatest Amount of Hydrogen in the Electrolysis of a Water and Sodium Hydroxide Solution?

Abstract

Objectives

I have investigated the production of hydrogen gas using multiple elements by running an electric current through water and sodium hydroxide.

Methods

I made an apparatus with two various electrodes and measured the amount of hydrogen created from a solution of water and sodium hydroxide.

Results

I found that aluminum created the most hydrogen due to the addition of a reaction without the input energy.

Conclusions

Contrary to my hypothesis that carbon would produce the greatest amount of hydrogen, the use of aluminum as a cathode produced the most hydrogen gas as both endothermic and exothermic reactions occurred. Other metals produced great amounts of hydrogen but not as significant as aluminum. This process can be important information toward the development of hydrogen-powered cars or electrical devices in the future.

Summary Statement

I determined that aluminum was the most efficient electrode in producing hydrogen from electrolysis especially in a water and sodium hydroxide solution.

Help Received

My science teacher and parents advised and guided me through my project. No other help was involved.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Uzair Sajid

Project Number

J0626

Project Title

The Emergence of a New Fuel Cell

Abstract

Objectives

The purpose of this project is to see how water can be used as a renewable energy source by testing how efficient a cobalt-based catalyst will be in producing molecular oxygen from water splitting reaction.

Methods

This was done by creating a galvanostatic chemical cell using 9-volt batteries and breadboard. A constant current of 3mAmps was passed through the nickel electrodes through the phosphate buffer solution to run it at a constant rate. After the voltage was stabilized, the catalyst was formed on the anode side of the plates, and the procedure was repeated with fresh phosphate buffer solution.

Results

The efficiency of the created galvanostatic electrochemical cell was observed by the voltage measured across while keeping the constant current of 3mAmps. The average stabilized voltage reading after the three trials was 2.09 volts for the pure phosphate buffer solution. The voltage was lessened to 1.85 volts after the cobalt based catalyst formed on the electrode plate was placed in the fresh phosphate buffer solution. This shows a difference of 240 millivolts, which shows the extra savings of energy we are getting by splitting water into Hydrogen and Oxygen. These voltage difference was used to determine the efficiency rate of water splitting with growing the cobalt based catalyst. The growing of catalyst took about 20 minutes to give a stabilized voltage reading. The efficiency of the reaction was 59% before growing the catalyst. After adding the catalyst, the water efficiency was increased to 66%. This 6% increase in efficiency proves how we can use a cobalt based catalyst to obtain the tough task of separating the Oxygen molecules from water with lesser voltage at a constant rate.

Conclusions

What was found that adding the catalyst indeed lowered the voltage needed to split water molecules into Hydrogen and Oxygen? Hence, this made the reaction more efficient and required less energy. Once the hydrogen and oxygen combust, they will produce water and the cycle can be repeated. This addition of new fuel cell will give us a healthier environment without emission of pollutants and more options to use solar panels at night.

Summary Statement

The invention of a new fuel cell by using a cobalt based catalyst to split water efficiently.

Help Received

My mom and dad supervised me while I connected the circuits on the breadboard.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Summerlyn Stys

Project Number

J0627

Project Title

Sugar and a Drink: How Hot Can It Get?

Abstract

Objectives

The purpose of this experiment was to determine if sugar affected the temperature of a drink after five minutes on a stove. It was hypothesized that the higher the sugar content in the drink, the higher the temperature of the drink at the end of the five minutes.

Methods

To conduct this experiment, eight ounces of either water, coconut water, Gatorade, Sprite, or Redbull were measured in a measuring cup, then heated on a stove for five minutes. At the end of the timed five minutes, the temperature was recorded and the process was repeated until each drink had been tested ten times. The resulting temperatures were then averaged and made into a graph.

Results

It was found that my hypothesis was supported because Redbull and Sprite, the two drinks with the highest sugar content, had the highest recorded temperatures compared to the other drinks. The results indicate that the more sugar the drink contains, the quicker it can heat up and that it will be hotter at the end of a timed period than other drinks with a lower sugar content.

Conclusions

My hypothesis was supported by this experiment because Redbull and sprite had the highest recorded temperatures and the highest sugar content. For each test, the temperatures of these two liquids stayed close to their average and had higher temperatures compared to water, coconut water, and Gatorade. Also, and water and coconut water had the lowest recorded temperatures and they had the lowest sugar content.

Summary Statement

this experiment was done to discover if sugar made a drink hotter at the end of a timed period, and the more sugar in a drink, the hotter it will be at the end of a timed period.

Help Received

Mrs. Humkey, Mrs. McCarthy, and Mrs. Ringstad all helped me through editing and revising my project. My mom and dad bought me the supplies I needed and I tested and recorded the data in my home.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Sofia Truong

Project Number

J0628

Project Title

Corrosion in Motion

Abstract

Objectives

A recent study showed the global cost of corrosion is estimated at $2.5 trillion annually. Corrosion affects our lives directly include safety (collapsed bridges), health (contaminated water) and indirectly when producers and suppliers of goods incur corrosion costs which they pass onto consumers. This project tests which metal is the most resistant to corrosion.

Methods

Aluminum, brass and copper wires , each 12cm in length were soaked in water, saltwater and vinegar. The metals were chosen because they are commonly use and liquids were chosen to get different pH levels. The wires were weighed before and on the last day of the experiment. The wires were observed, photographed and documented for color and general appearance for 21 days.

Results

My experiment showed that aluminum corroded on average of 8-10 days. Meanwhile, brass showed signs of corrosion on average of 1-3 days and copper on average of 2-5 days. After 21 days , the aluminum wire soaked in vinegar showed the most increase in weight of average of 4.40% increase from original weight. The least amount of increase in weight is copper in vinegar with an average increase of 3.64%.

Conclusions

My experimental result proved that my hypothesis that aluminum would be the most resistant to corrosion compared to brass and copper was true. Corrosion is the deterioration of a metal and when it happens , an oxide will form on the surface and increase its weight initially. Sometimes, the oxide does not stay on the metal. Patina on copper wire exhibited this when the liquids turned into light greenish color. If I were to expand this project , I would filter the liquids to get more accurate weight measurement.

Summary Statement

My project showed that aluminum when exposed to different pH of liquids is the most resistant to corrosion compared to brass and copper.

Help Received

My mother supervised the experiment and help me put together my board. My father helped me fill up this form

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Shreya Vogety

Project Number

J0629

Project Title

Factors Affecting Crime Scene Investigations

Abstract

Objectives

In crime scene investigations, it is easy to miss evidence of blood stains without careful application of Luminol, a chemiluminescent substance. My objective is to study the impact of various factors affecting the glow of Luminol.

Methods

Luminol, Perborate Mixture, Copper Sulfate Crystals, three cups, two small table spoons, Precision Thermometer, pH strips, Google Science Journal App.

Each experiment involves three trials in a dark room. A vial of water with four Copper Sulfate crystals, either crushed up or dissolved, is poured into a different cup of water with Luminol and Perborate Mixture mixed into it. The variables being tested are temperature, acidity, larger amounts of Luminol, and crushed up Copper Sulfate vs crystals. The light and duration is measured in the Google Science Journal App, which measures the glow, and charts it on a data point graph and can be exported as a .CSV file.

Results

I observed that the larger amount of Luminol had the longest duration of luminescence. With changing the temperature, I observed that the Luminol mixture at 145 F had the brightest glow and was only five seconds long, while the Luminol mixture at 85 F was dimmer and slightly longer. A more acidic mixture showed absolutely no light in the graph, and the crushed up Copper Sulfate graph was fluctuating and inconsistent.

Conclusions

The results showed that between a higher temperature of water and a colder temperature of water, a colder temperature mixture of Luminol would be better, because it glows for a longer duration. Even though a hot mixture would be much brighter, it would only last a few seconds, so it becomes harder to capture as evidence. The results also showed that any trace of acidity would make the Luminol mixture not glow, and this shows that high levels of acidity should be avoided.

Summary Statement

When finding how independant variables affect the brightness and the duration of the glow of Luminol, I established that a cold mixture with generous amounts of Luminol produces brighter and more sustained results.

Help Received

My dad and my sister helped brainstorm ideas and potential variable. Mrs. Patel, the Windemere Ranch Middle School science fair advisor, also guided me through the scientific method.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Sophia Watson

Project Number

J0630

Project Title

Bang! The Chemistry of Black Powder

Abstract

Objectives

The science procedure that I will be testing is does size and distribution of reactants affect efficiency of a combustion reaction? The hypothesis I have created to go with this science experiment is, if I test six different samples of black powder, then the sample that is ground finest (has smallest surface area) and has the most even distribution of ingredients will burn most efficiently.

Methods

After preparing appropriate amounts, size, and distribution of potassium nitrate, charcoal, and sulfur, each reactant was placed in aluminum foil dishes. A Bunsen burner was used in a chemical hood to light the reactants on fire. The times it took to start burning, how long they burned, and the beginning and final weights of the experiments are recorded. There were six different experiments ran: coarsely ground reactants that are poorly mixed and well mixed, medium coarsely ground reactants that are poorly mixed and well mixed, and finely ground reactants that are poorly mixed and well mixed.

Results

The results showed that the coarsely ground reactants that were well mixed burned slower and more efficiently, and had less left over product.

For each of the six experiments, the well mixed solutions burned most efficiently. Course reactants burned better with left over product 20% less when well mixed versus poorly mixed. Medium course reactants burned better with left over product 5% less when well mixed versus poorly mixed. Finely ground reactants burned better with left over product 12% less when well mixed versus poorly mixed.

Conclusions

The results, which only partially supported my hypothesis, showed that there is direct correlation between size and distribution of reactants. Although my results are not perfectly in line with the results of published studies, most likely due to the inferior grade of charcoal used in my experiment, it was very instructive for me and allowed me to answer my questions that arose from watching a fire works show.

The more efficient a combustion reaction is, the less left over material will be introduced into the environment. The better the understanding we have of the chemicals used to launch fireworks, such as black powder, the less environmental impact incurred.

Summary Statement

This is a study of the efficiency of burn during a combustion reaction of black powder that analyzes the effect of the size and distribution of reactants.

Help Received

My mother, Professor Devlin at CSUSB assisted me in my project by igniting my combustion reaction in a chemical hood at the University.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Jason Yang

Project Number

J0631

Project Title

Solving the Global Water Crisis

Abstract

Objectives

The purpose of my experiment is to test what the most effective way to purify water is. I compared Photocatalysis, Reverse Osmosis, Graphene, and Activated Carbon water treatment methods.

Methods

A Reverse Osmosis system, graphene, activated carbon, and titanium dioxide. I performed the experiment by running water through the filters and measuring the TDS (Total Dissolved Solids) using an electrical conductivity meter.

Results

The change in TDS (Total Dissolved Solids) levels were compared after passing through each filter. The performance of the Reverse Osmosis was shown to be the most effective at a 22.52% decrease in TDS (Total Dissolved Solids).

Conclusions

Repeated trials with multiple filters revealed that Reverse Osmosis is the best at filtering contaminants from water. It is concluded that Reverse Osmosis is the most effective filter out of Photocatalysis, Graphene, Reverse Osmosis, and Activated Carbon.

Summary Statement

I tested various filters and found that Reverse Osmosis is the most effective.

Help Received

None. I designed and carried out the experiment and built the filters myself.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

Lily Yang

Project Number

J0632

Project Title

Electrolyte Challenge

Abstract

Objectives

The objective of this project was to determine which liquid contains the most electrolytes.

Methods

Multi meter, 9-volt battery, straw, 24-gauge copper wire, alligator clips, and various liquids. Test and measure current of various liquids five times.

Results

Several liquids were tested using a multi meter to find the conductance. Repeated trials were performed to ensure the accuracy. Coconut Water was found to contain the highest amount of electrolytes in all five trials.

Conclusions

Repeated trials performed showed a consistent result. It is concluded that Orange Juice is not the best choice as an electrolyte replenisher. The results show that Coconut Water would be a better choice than Orange Juice.

Summary Statement

As tested for conductance, I found that Coconut Water contains the most electrolytes.

Help Received

None. I researched and performed the experiments myself.