CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Benjamin I. Antin

Project Number

J0501

Project Title

Wet Heat: Can You Cook with Chemical Reactions?

Abstract

Objectives/Goals

This experiment will document the way in which the starting temperature affects an exothermic reaction. The reaction to be tested is an instantaneous reaction between Calcium Oxide and Water. Calcium oxide is also referred to as Lime or Quicklime. This will help determine the different conditions in which the reactions could be used in commercial applications. The hypothesis was that, if the two chemicals are reacted at different starting temperatures, then colder temperature will invoke a higher temperature gain, because research shows that Calcium Oxide is more soluble in colder water, which should yield a greater surface area for the reaction.

Methods/Materials

The reaction was tested at three different temperatures, with the goal of covering a wide range. Each starting temperature was tested three different times, for a total of nine trials. The first set of trials was at five Degrees Celsius, the second set was at twenty Degrees Celsius, the third at 65 Degrees Celsius. The chemicals were reacted in a glass bowl, with a three to one ratio, by weight, of Quicklime to Water The temperature of the reaction was recorded every ten seconds.

Results

The results refuted the hypothesis. The gain in temperature increased progressively with a gain in starting temperature. It is important not to judge the reaction by the peak temperature that it reached, because the starting temperature would inherently change this value. The reaction with a starting temperature of 5 Degrees produced an average temperature gain of 65 Degrees. The reactions at 20 Degrees and at 65 Degrees produced an average temperature gain of 70 and 95 Degrees, respectively.

Conclusions/Discussion

One explanation for the data is Brownian Motion. Brownian Motion, the small, random movement of small particles, decreases as the temperature decreases. Brownian motions causes the Quicklime particles to remain suspended in the water, allowing the chemicals to more fully react. At higher temperatures, there is more Brownian Motion, and therefore a more violent reaction.

Summary Statement

Testing different starting temperatures of a chemical reaction between Quicklime and Water in order to find out how the starting temeprature would affect the reaction and its commercial uses.

Help Received

Father supervised with safety. Teacher gave format for report.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Ari P. Baranian

Project Number
J0502

Project Title
Fire Burning

Abstract

Objectives/Goals
In my experiment, I burned different kinds of wood with different densities and timed how long they burned. My hypothesis is that the denser the wood is the longer it will burn. My question is obviously "does the density of the wood affect how long it burns." With my results fire fighters and reporters will be able make very realistic guesses as too how long a forest fire will burn and the way that it will burn.

Methods/Materials
I used four different kinds of wood and I burned them four times each. Poplar, Red Oak, Pine, and Douglas Fur were the different species. I had one independent variable which was the density and two dependent variables, one primary and one secondary. The primary variable was the flame time and the secondary variable was the smoke time. The constants in my experiment were used to minimize the number of confounding variables. After all the densities were found, I soaked them in two fluid ounces of lighter fluid for three minutes as an igniter.

Results
In my results I found that there were two extremes in my project, one high and one low. My results proved to me that the densest wood, oak, burned the longest, an average of nineteen minutes and sixteen seconds, theoretically supporting my hypothesis. On the other hand Douglas Fur, the second extreme, burned the shortest with an average of three minutes thirty-four seconds and it was the second densest wood. So my hypothesis was neither supported or rejected. The densities for these and the other two woods are as follows:

Conclusions/Discussion
My hypothesis was that the denser wood would burn longer because there was more fuel on the inside and my sources convinced me of it. Well, my hypothesis wasn't exactly right. The densest wood burned the longest but the second densest wood burned extremely short. My findings did match my background information because I did find in my research that oak was believed to be the best burning wood. After doing this project I still have to find out about all the other kinds of wood to widen my range of knowledge.

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Summary Statement
My project is to determine how the density of wood affects how long the wood burns.

Help Received
Father helped supervise the experiment and he helped soak the wood in lighter fluid

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Trevor W. Beall

Project Number
J0503

Project Title
Hard Water! Can Electricity Affect the Hardness of Water?

Abstract

Objectives/Goals
The objective of this project is to find a less expensive and healthier way to lower the hardness of water. The hypothesis is that electrical current surrounding a PVC water pipe will lower the amount of hardness (calcium) in water.

Methods/Materials
By placing a holding tank on one side and allowing the water to flow through a PVC pipe that is wrapped in electrical line to a holding vessel. Well water was put into the holding tank and held back by a valve. A 1.4 volt connection was plugged in and the switch turned to on. The water was released to flow into the other bottle while the electricity is supposed to alter the hardness of the water by changing the ions. Test was reset with fresh well water and a 6 volt electrical supply was used. Samples were taken: one set was sent to a lab for computer analysis; the other set of samples was put through a simple soap test.

Results
The results collected proved the hypothesis true. Hard water computer analysis testing showed: untreated well water had a 261 ppm of calcium and very cloudy water with no soap bubbles; the 1.4 volt had a 225 ppm of calcium and water that was slightly clearer that the untreated water; and the 6 volt had a 200 ppm of calcium and water that was just a little clearer then the 1.4v test. The water with the 1.4 volts was 14% lower than the untreated. The 6 volt was 23% lower.

Conclusions/Discussion
The hypothesis was proven; an electrical current surrounding a water pipe can alter the hardness of water. A healthier way of softening water can be accomplished by altering the ions in the water; therefore, the calcium and magnesium is attracted to itself and not the plumbing.

Summary Statement
Electrical current has the potential to lower the hardness, or calcium, level in water.

Help Received
Mother helped type report; Grandfather helped build stand for plumbing; Grandfather and father helped with electrical connections and supervision; Computer analysis lab was proved by All Season Pool & Spa, Inc.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Danielle M. Behrens

Project Number

J0504

Project Title

What Voltage Is Needed for Steel to be Protected by Impressed Current Cathodic Protection?

Abstract

Objectives/Goals

The objective of this experiment was to find which voltage would provide Impressed Current Cathodic Protection.

Methods/Materials

I designed and conducted a 134 sample corrosion experiment to find out what voltage is needed for steel to be protected by Impressed Current Cathodic Protection (ICCP). I hypothesized that there would be a certain voltage that would give ICCP to steel. Eleven series of seven different voltages were run in batches of six in open top cups containing 250 ml of 3% salt water with aerators bubbling air and one corrosion coupon of mild steel (C01010) which was dangled by a wire connected along with a carbon rod for an anode to a constant voltage DC power supply. Controls for my experiment were series run without impressed voltage, and blanks without coupons for procedure checking. The batches were left for 96 hours in a temperature monitored environment. Prior to disconnecting the wires at 96 hours, the voltages were measured between the coupon and the electrolyte and similarly between the carbon rod and the electrolyte with a Cu/CuSO(4) reference probe. The corrosion solute was filtered and rinsed before drying and weighing; similarly the coupon was weighed for weight loss.

Results

Using the molecular weight ratio of Fe(2)O(3) to Fe, the weight loss of the coupon was equated to the weight gain of the filter. These correlated well (R^2=0.84) except for a consistent 53 mg excess filter weight. Subtracting off 53 mg from the filter weights allowed for a random error calculation. Discarding the four data points outside three standard deviations, the standard deviation became 42 mg for Fe(2)O(3) or 30mg for Fe representing the typical sample error. The corrosion amounts varied from 0 to 300 mg.

Conclusions/Discussion

For my experimental setup, applying 1.8 volts or more across the entire system, good corrosion protection was seen with only 0.05 mm/yr; applying 1.7 volts or less there is no significant protection with 0.8 mm/yr. This was true whether or not a temperature correction for corrosion rate was applied. Measuring final voltages between the coupon and electrolyte with the Cu/CuSO(4) reference probe, the protected coupons had a potential of -0.8 V or less whereas the unprotected coupons had a potential of -0.7 V or greater.

Summary Statement

I designed and conducted a 134 sample corrosion experiment with Impressed Current Cathodic Protection (ICCP) and determined that cathodic protection occurred where voltage was -0.8 V or less.

Help Received

Dad prescreened some corrosion textbooks, procured equipment and consulted throughout. Mom or dad helped with each vacuum filtration.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Denny C. Biju

Project Number
J0505

Project Title
Boiling Point

Abstract

Objectives/Goals

If I boil water, sugar and salt solution which one will have the highest boiling point?

How does thermal energy break the molecular bonds?

Methods/Materials

A pan; Water - 1 liter (4 cups); Sugar solution- 1cup of sugar in 1 liter of water; Salt solution- 1 cup of salt in 1 liter of water; A thermometer; A stop watch; Stove.

1. Take one third of water in a pan. 2. Place a thermometer in the pan. 3. Place the pan on a stove. 4. Then turn on the stove and start the stop watch. 5. Check temperature of water every 30 seconds.

Continue till the water boils and temperature remains steady for some time. That temperature is the boiling point of water. Repeat the experiment with Sugar solution and Salt solution. Record the temperature every 30 seconds on the table. Thus we can find which liquid has the highest boiling point.

Results

In my data, at 1 minute the salt solution had the highest, it was 36 degree Celsius. Water was 30 degree Celsius, and sugar solution was 34 degree Celsius. At 6-10 minute all solution had reached its boiling point. For water it was 100 degree Celsius, for sugar solution it was 104 degree Celsius and with the highest boiling point salt solution had 106 degree Celsius

More heat energy was needed to break the ionic bond in salt solution than the covalent bond in sugar solution so the boiling point of salt solution was higher.

Conclusions/Discussion

My hypothesis was if I boil the water, sugar solution and salt solution, the sugar solution will have the highest boiling point, because sugar molecules are larger. But the salt solution has the highest boiling point.

Boiling point elevation states that a solution has a higher boiling point than the pure solvent. A solution has a higher boiling point because the intermolecular forces have been increased and increasing the boiling point. Hence, it takes more heat to raise the solution to 1 atom (normal boiling point) than would the pure solvent.

Salt is a very small molecule. In addition it splits into two particles when in water, the sodium atom and

Summary Statement

Ionic bond is much stronger than Covalent bond

Help Received

Mom helped in finiding the project and Dad helped setting up the display board.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Timothy S. Brown

Project Number
J0506

Project Title
The Power of Oxygen

Abstract

Objectives/Goals
This experiment is an extension of a previous experiment on electrolysis that had unexpected results. No oxygen gas was produced and a red substance dissolved into the water. This led to the hypothesis that the oxygen reacted with iron in the nail at the anode to produce iron oxide, or rust. The purpose of this experiment is to understand what happened to the oxygen by measuring the amount of hydrogen and the weight loss of the nail.

Methods/Materials
An electrical current is run through salt water to split it into hydrogen and oxygen. The oxygen dissolves the nail used as a conductor for the anode, while hydrogen constantly bubbles off the cathode. The hydrogen, and the weight loss of the nail at the anode are measured and compared to see if it supports the hypothesis. Materials include salt water, nails, bowl, plastic container, measuring cup, electrical tape, and a laptop power adapter.

Results
The experiment consisted of five electrolysis sessions, each with different amounts of time. Hydrogen bubbled off the nail of the cathode as the red and green substance dissolved into the water. The weight of the nail and the amount of hydrogen was measured before and after each session. As the increments of time increased, more iron disintegrated off the nail.

Conclusions/Discussion
The results confirmed the hypothesis that the weight loss of the nail would be proportional to the hydrogen produced. In this experiment there was an average of 462 ml of hydrogen/gram of iron. This is close to the predicted 660 ml/gram, especially considering the method of capturing and measuring hydrogen, and the fact that steel nails rather than pure iron was used.

Summary Statement
This experiment studied oxidation of metals by correlating excess hydrogen produced by electrolysis of water with the dissolving of the metal anode.

Help Received
I thank my mom for helping me lay out the pages onto the poster board and my dad for giving me good feedback and advising the electrolysis sessions.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Morgan E. Case

Project Number
J0507

Project Title
Determining the Relationship between a Water Sample's Temperature and Its Turbidity Level

Abstract

Objectives/Goals
In my project I'm trying to figure out if the different temperatures of water have different turbidity levels. I'm concerned about how clear our drinking water is, and I want to find out if the temperature of the water is cleaner/clearer.

Methods/Materials
I will complete my testing by using a turbidimeter. This device is used by scientists to quickly, and easily find the turbidity level of a water sample.
Create 1 liter of 20NTU Standard tubidimeter test water solution by adding 5 ml of Formazin to 1 liter of deionized water in a sterilized stainless steel bowl. Both the Formazin and the water should be at room temperature (20 degrees C). This solution will be used for all of the (20 degree C) Control tests. Pour the test solution into a clean (triple cleaned, and rinsed) 100 ml beaker to create control sample. Place the test bottle into the turbidimeter, check the reading, and record the results. Repeat this for a total of 5tests. Create the remaining 4 test solutions using the formula from step 1. The two cooler temperatures can be cooled using a refrigerator/freezer, or an ice bath. The two warmer test solutions can be heated using a hot plate, or Bunsen burner. After completing the five 20 degree C (control) tests, complete 5 tests for the 1 degree C group, the 10 degree C group, the 30 degree C group, and the 40 degree C group.

Results
The results show that the 40 degree C had the lowest turbidity level. Tests 1 through 5 showed results with an average test reading of 21.34. In second place was the 10 degree C tests, with an average test reading of 21.65. The third place one was the 30 degree C tests with an average test reading of 21.72. In fourth place was the 20 degree C tests, also known as the Control tests with an average of 22.32. Finally in last place, the highest turbidity levels were the 1 degree C tests with an average test reading of 22.38.

Conclusions/Discussion
The results did not give conclusive evidence of any correlation between temperature of a water sample, and it#s turbidity level.

Summary Statement
Finding out if changing water temperature affects it's turbidity level

Help Received
Advisor and teacher helped me with the experiment

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Caroline I. Cox

Project Number
J0508

Project Title
Electricity You Can Eat

Abstract

Objectives/Goals
The objective of this investigation was to discover if a cell phone battery could be charged on the energy produced by fruit for an hour.

Methods/Materials
The fruits were all cut into smaller pieces (except the mandarins - they were too small) the apples were cut into fourths, and the limes, lemons, and bananas were cut into halves. The investigator measured the amps and volts in each piece of fruit by inserting a zinc nail and a copper nail into it and attaching the alligator clips of the galvanometer to them, recording the number of milliamps, converting them to amps, and repeating with the voltmeter. This was done to every piece of fruit.

Results
The results of the collected data and calculations showed that to charge a cell phone battery for an hour on fruit, twelve apples, eighteen lemons, twenty-three limes, thirty-six bananas, or 475 mandarins would be needed to accomplish the task. The investigator succeeded in reaching the goal of discovering if a cell phone battery could be charged on the energy produced by fruit for an hour.

Conclusions/Discussion
The investigator#s hypothesis was correct and the objective was attained. With this knowledge, cell phone batteries can be charged using fruit, which is potentially less expensive than using a wall socket.

Summary Statement
This investigation centers on the ability of fruit to charge a cell phone battery for an hour.

Help Received
The investigator borrowed a zinc nail, copper nail, a galvanometer, and a voltmeater from Mr. Noble, a science teacher at Pleasant Valley Elementary School.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Devin E. Helle

Project Number
J0509

Project Title
How to Increase the Speed of a Reaction

Abstract

Objectives/Goals
Reaction rate is what determines when bombs go off, and how we digest food. But can you change the speed it occurs? In order to find this out, I took two possible factors, particle size and temperature, and put them to the test. This project will look at the effects of both particle size and temperature on reaction rate.

Methods/Materials
These factors will be tested with alka-seltzers inside a gas collecting apparatus (air tight bottle connected by tube into a graduated cylinder filled with water). For particle size, 3 trials were done for 4 different particle-sizes (Whole seltzer, Half, Quarters, Powder). Trials were done for particle size by dropping the tablet into the bottle and quickly shutting the cap. For testing temperature I did 3 trials for 3 different temperatures (Room Temperature, Cold, Boiling). Trials were done by pouring the water until the standardized level has been reached, and dropping a whole alka-seltzer into the bottle and quickly shutting the cap.

Results
For the Particle Size experiment, as the tablet was broken up into smaller pieces, the reaction grew to become faster. The tablet in its entirety proved to cause the slowest reaction, however as powder, the reaction was the fastest. In the Temperature experiment, as the temperature of the water grew to become higher, more carbon dioxide was produced at a faster rate. Cold water caused absolutely an extremely slow reaction to take place, while boiling water caused an extremely fast one, contrarily.

Conclusions/Discussion
My hypothesis was that if temperature and particle size was a factor, the reaction would speed up and more CO2 will be produced within a shorter amount of time. The results of the experiment supported my hypothesis and both boiling water, and powder tablets had great significance in speeding up the reaction. This experiment showed that scientists and chemists are able to speed up reactions by using powder instead of solids, and warmer or scalding substances and temperatures as opposed to lukewarm or cold. Increasing temperature, however, would result in the fastest reaction. An even faster reaction is set to take place if both powder and warmer temperature is used.

Summary Statement
This project was done in order to find a way to speed up a chemical reaction, and to find the way in which it is most effectively done.

Help Received
Mother bought materials.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Kamran M. Jamil

Project Number
J0510

Project Title
Steel and Acid Rain: Does Acid Make Steel Rust Faster?

Abstract

Objectives/Goals
We in 8th grade have just started studying acids and pH. I wanted to utilize my limited after-school time to do experiments involving acids and learn practical aspects of effect of acid in daily living. During my research, I came to know that acid rain has an enormous economic impact due to its effect on rusting of metals. The purpose of my science project was to use simple, inexpensive and non-hazardous household materials to study the relationship between acid and rust formation. My Hypothesis were: 1) Model of acid rain water will rust steel wool faster than model of normal rainwater. 2) The temperature will rise when steel wool is in contact with the acids due to the oxidation reaction.3) The rise in temperature will be higher when steel wool is subjected to more acidic rainwater as higher H+ ion availability will likely speed up the iron oxidation process and hence the rate of rusting. Independent variables were Time & pH; Dependent variables were Temperature, Mass & Length of rust formation.

Methods/Materials
I used lemon juice, vinegar and distilled water exposed to air as models for rainwater (acidic and normal rainwater) and used finest quality steel wool.

Results
There was a rise in temperature, it occurred faster in acid rainwater models compared to normal rainwater model and was maximal at 2 min. for each acid. Both the rate of rise of temperature and the steady state temperature was highest for vinegar, an unexpected finding as it is less acidic than lemon juice (pH 3.09 vs. 2.60 respectively). The greatest temperature difference between ending and starting temperatures was also highest in Vinegar rainwater model. The mass of steel wool changed when measured 15 min after it was exposed to more acidic rainwater models (vinegar and lemon juice), but did not change with distilled water. Rust formation on steel wool was also greatest for vinegar model.

Conclusions/Discussion
The results showed that the model of acid rainwater did cause rust formation, while model of normal rainwater did not. I observed a rapid rate of rise in temperature, a higher steady state temperature, a heavier mass and most rust formation with acid rainwater model (vinegar). The normal rainwater model (distilled water exposed to air) did not cause change in mass or rust formation. The more acidic liquid (lemon) did not cause more rapid rate of rise in temperature, so my 3rd hypothesis proved to be not true.

Summary Statement
My project studied the effect of different acids on the rate of rusting.

Help Received
Lab equipment (thermometer, pH meter) and space was provided by Science Department at The Bishop's school. Ms Erika Hunt (my 8th grade science teacher) supervised me while I did my experiments, my mom taught me how to use excel spread sheet to make graphs from my raw data.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Meghan E. McKenzie

Project Number
J0511

Project Title
Manipulating the Electrical Conductivity of Different Solutions: Agent Sodium Chloride Strikes Again!

Abstract

Objectives/Goals
This project focuses on manipulating the electrical conductivity of different solutions via electrolysis. There were three types of water tested: hard, soft, and R.O.(water purified through reverse osmosis). After testing these three types of water, I added approximately 58.443 grams of sodium chloride to each in hopes of increasing their electrical conductivity. My hypothesis was that if I sent an electric current through the previously mentioned solutions, then soft water with sodium chloride added would produce the most hydrogen and oxygen/chlorine gas.

Methods/Materials
To set up this experiment, I plugged the beaker with the rubber plugs with pencils inserted, propped the beaker on three wood blocks, and filled it with one liter of water. If I was running a test with sodium chloride, I would measure out 58.443 grams of it (to create a 1 mole solution) and mix it with the water in a separate bowl, then pour the solution into the beaker. Next, I connected a volt meter between the nine-volt battery and the electrodes in order to measure the amount of current flowing through the circuit. Next, I set the timer for one hour and connected the clips to the tips of the pencils that were protruding from the bottom of the beaker. For the sodium chloride tests, however, I was only able to run each test for fifteen minutes because each test tube had filled half-way with gas at that mark, so they would have overflowed by the time even a half-hour had passed. I took the results from those tests and multiplied them by four in order to figure how much gas would have been produced in an hour. I cleaned the beakers out and changed out the electrodes after each test.

Results
As for my results, hard water with sodium chloride added produced the most hydrogen and chlorine gas of all of the solutions, followed by soft water with sodium chloride added, then R.O. water with sodium chloride added, plain soft water, plain hard water, and finally, plain R.O. water with the least amount of gases produced.

Conclusions/Discussion
Hard water with sodium chloride added produced more hydrogen and chlorine gas than soft water with sodium chloride added because though soft water contains a high concentration of sodium; it lacks the metals and minerals that hard water contain This may have affected the level of conductivity because hard water has both minerals and sodium for conductivity while soft water has just sodium.

Summary Statement
This project focuses on manipulating the electrical conductivity of different solutions via electrolysis.

Help Received
Parents helped assemble board; Michael "Tio" Stewart and Father provided equipment and suggestions; Mother helped edit typed documents; Ms. Chelsea McQuade helped guide and advise project; Grandfather gave suggestions.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Peter J. McLeod

Project Number
J0512

Project Title
How Does Seawater Affect the Corrosion of Iron?

Abstract

Objectives/Goals
Many iron items are exposed to water. Though they are often protected by being alloyed to make steel or coated in zinc (galvanized), they all eventually rust. The purpose of my experiment is to determine whether or not iron exposed to ocean water needs to be protected more than that exposed to rainwater.

Methods/Materials
90 baby food jars; 90 iron bar ties; 1 digital camera; 1 electronic balance; 1 fork; 1 roll masking tape; 1 measuring cup, mL; 4 plastic milk jugs, gallon; 1 plastic pouring cup; 1 plastic squirt bottle; 1 Sharpy marker; 4 gallons seawater 4 gallons tap water

Label 30 baby food jars "T 1" through "T 30" and fill with 50 mL of tap water. Label 30 baby food jars "S 1" through "S 30" and fill with 50 mL of seawater. Label 30 baby food jars "1" through "30" and leave empty. Using the electronic balance, find the mass of each bar tie and record. Place one bar tie in each jar. Record observations. Photograph wires at the start of the experiment and whenever you notice an interesting change. At the end of the experiment, drain solutions allow to dry, and find the mass of each bar tie.

Results
The "Seawater" bar ties average mass increased by 0.025 grams. The "Tap Water" bar ties average mass increased by 0.009 grams. The average mass of the "No Water" bar ties increased by 0.004 grams.

Conclusions/Discussion
Since the "Seawater" bar ties had the greater average mass increase, they must have rusted more than the tap water. These results are supported by visual observations, as well. This data proves the hypothesis correct that iron rusts faster when exposed to seawater than when exposed to tap water.

Summary Statement
To determine whether or not iron exposed to ocean water will corrode more than when exposed to rainwater.

Help Received
Mom helped me practice my speech. Dad helped with collecting materials, using an electronic balance and creating the data table & graph. John and Mark from Home Depot, Escondido helped me find some non-galvanized iron items.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Rachael M. Metzger

Project Number
J0513

Project Title
The Magic of Metal Corrosion

Abstract

Objectives/Goals
Analyze the corrosive behavior between metal fully submerged in liquid versus metal partially submerged and determine whether corrosion reacts similarly when using three types of liquid: An acetic acid, a sodium bicarbonate solution, and salt water. I hypothesized that metals fully submerged will have more corrosion and that the metals will react similarly when tested in different liquid solutions, whether partially or fully submerged.

Methods/Materials
Six-inch strips of aluminum, brass, copper, and iron were cut into two-inch pieces and placed in three different types of liquid: An acetic acid consisting of one cup of full strength white vinegar; a sodium bicarbonate solution consisting of two teaspoons of baking soda dissolved in one cup of distilled water; and salt water produced by dissolving one cup of distilled water with 8 grams of sea salt. Each strip was divided into a 3x5mm hand drawn grid to track and measure the rate of corrosion. Two sets of twelve 18-ounce cups were filled with one cup of solution and labeled. One metal strip was suspended from the top of each cup and submerged; 12 fully and 12 half way. Photographs were taken regularly and observations were logged every two days for 35 days.

Results
The fully submerged samples showed corrosion on 100% of the surface area. The brass and copper were completely covered with tarnish caused by the sodium bicarbonate. The iron sample in sodium bicarbonate showed no reaction, and the aluminum sample in vinegar had minimal corrosion.

The partially submerged samples had over 65% surface corrosion on all samples except for iron in sodium bicarbonate, which had no reaction. The brass and iron in vinegar were completely corroded above the water line and displayed different chemical reactions than those fully submerged. The results also showed that the partial samples rusted faster, however the parts above the water line rusted more slowly.

Conclusions/Discussion
The hypothesis stated that metals, when fully submerged in liquid, will have more corrosion than those partially submerged. While the hypothesis proved to be true, the metal strips that were partially submerged did corrode faster and their corrosion surface area averaged 65.6%, except for the iron submerged in sodium bicarbonate. While the hypothesis was supported, the partially submerged metals proved to have interesting and in some cases magical results.

Summary Statement
Analyzed the corrosive behavior of four types of metals fully and partially submerged in three types of liquid solutions and compared the results.

Help Received
Mother proof read and bound report, re-typed the log, made the graphs, and took the pictures.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Sara E. Murphy

Project Number
J0514

Project Title
The Metronome of a Chemical Reaction

Abstract

Objectives/Goals
The objective of this project was to test the effect of temperature on the rate of a chemical reaction. I thought that reaction rates would increase with increasing temperature.

Methods/Materials
Sodium Thiosulfate, Potassium Iodide, Potassium Bromate, Hydrochloric Acid, distilled water, and 2-3 drops of soluble starch were mixed to start the chemical reaction. When the reaction reached a certain point, the solution would turn blue. To compare the speed of the reaction at different temperatures, the time taken to reach the color change was measured with a stopwatch (in seconds). All of the reactants were cooled or heated to the appropriate temperature before they were mixed to ensure accuracy. The experiment was conducted at three temperatures: room temperature (19.5 degrees Celsius), in an ice bath (4.5 degrees Celsius), and in a heat bath (30.5 degrees Celsius).

Results
The results of the experiment showed a distinct relationship between temperature and the rate of a chemical reaction. There was at least a 20-30 second difference between the averages of times at each temperature. Times recorded at the higher temperatures were significanty lower (faster rates) than those recorded at lower temperatures.

Conclusions/Discussion
The results proved my hypothesis correct. I thought that the rate of a chemical reaction would increase with increasing temperature, and this is what my results demonstrated. This occured because as temperature increases, so does the speed of the consantly moving molecules. This is associated with an increase in their kinetic energy, therefore leading to an increase in the energy of their collisions. A higher percentage of these collisions then have the minimum amount of energy needed to break chemical bonds, thus initiating the reaction and increasing it's speed.

Summary Statement
My project tested the relationship between chemical reaction rates and temperature.

Help Received
My father, James Murphy, provided me with the materials needed (from Santa Monica College).

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Jamin Sangster; Emily Stewart

Project Number

J0515

Project Title

The Effects of Dry Ice on Diverse Liquids

Abstract

Objectives/Goals

The goal of this experiment was to observe the amount of carbon dioxide vapor released through sublimation by submersing dry ice in diverse liquids.

Methods/Materials

After obtaining materials, 12 grams of dry ice was removed from a cooler and submersed in a liquid. The carbon dioxide vapor was then measured in inches. This was repeated three times for each liquid. Data was calculated subsequently.

Results

Milk was found to have the highest vapor output, followed by water. Although this did not prove our hypothesis that water would produce the most vapor, it did prove our conjecture that #pure# liquids would produce the most vapor.

Conclusions/Discussion

It can be concluded that #pure# liquids produce more carbon dioxide vapor than mixed liquids. This may be because mixed liquids sometimes contain solid ingredients that will not react with dry ice. Our findings show that it is better to use milk as a reactant in a dry ice reaction than water (a more commonly used reactant) to obtain a larger reaction.

Summary Statement

It is about putting Dry Ice in a few different liquids to find out which one produces the most vapor.

Help Received

Friends helped find information

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Benjamin J.W. Too

Project Number
J0516

Project Title
Better Power

Abstract

Objectives/Goals
The title of my Science Fair project is called "Better Power." The recent earthquake in Haiti gave me the inspiration for my project. I saw on television that the Haitians were without power supply after the earthquake and they were thrown into total darkness when the sun set. This made me wonder if there is a way to create alternative power supply during a disaster using materials I can find in my home.

Methods/Materials
In my study, I found various household materials that could create enough energy power to power a radio or a LED light. I chose to use galvanized iron nails and copper wires as my electrodes and bleach as my electrolytes to create a battery. I measured the voltage and the current generated, it was 0.6 Volts and 0.1milliamps. I found the amount of watts for a radio battery by multiplying the voltage by the current which gave me the amount of watts used which was 51 milliwatts. I then found my homemade batteries power capability which was 0.3 milliwatts. In order to figure out how many batteries I would need I divided the radio requirement by the capability of my homemade battery and found it to be 170. I then rounded it to be 200 nails. To account for my batteries efficiency loss during the assembling, I doubled the amount of homemade batteries to 400.

Results
I was able to power a radio and LED light using the battery that I created. I discovered some interesting things. If I wired my batteries in a series they would produce more volts but would last a shorter time. When I wired them in parallel they produced fewer volts but lasted a lot longer.

Conclusions/Discussion
I have learned that organic materials such as vinegar don#t produce much voltage. Solutions such as bleach and soda produce lots of voltage.

Summary Statement
My project is about providing alternative power in the event of an emergency using everyday household materials.

Help Received
My father let me use his materials and helped me with nailing and wiring.