



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Nadya B. Al-Sharif	Project Number J0501
Project Title Color Match: Candy Chromatography	
Abstract Objectives/Goals To determine if the food dyes used in making similar colored chocolate candies made in two different countries are the same. Methods/Materials I used paper chromatography to find the retention factors of the food dyes used in green, blue and red M&Ms (made in the USA) and green, blue and red Smarties (made in the UK). Using distilled water, I extracted the dye from 20 pieces of each color of the M&Ms. I prepared and tested 5 paper chromatography strips for each color. Then I repeated the same procedure for the Smarties. Out of curiosity, I tested green, blue and red liquid food dyes to see if I can identify any of the dyes used in the candies by comparing the retention factors. Results My results showed that the retention factors for the food dyes used in M&Ms and Smarties were not the same. Conclusions/Discussion My conclusion is that the food dyes used in making M&Ms and Smarties are different. From my research, I found out that the food dyes used in M&Ms are artificial, while the food dyes used in Smarties are natural.	
Summary Statement The use of paper chromatography to compare the food dyes used in similar colored chocolate candies made in different countries, the USA and the UK.	
Help Received Mother helped with designing the display board; Father helped by showing me how to measure the retention factors.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Suevana Ayala	Project Number J0502
Project Title The Effect of Peanut Coating on Calorie Content	
Abstract Objectives/Goals The objective is to determine the difference in calorie content for peanuts with different coatings. Methods/Materials 45 plain peanuts were used as a control and compared to 45 sugar coated and 45 salted peanuts. A calorimeter was used for measuring the temperature change of the water and the peanuts mass change was recorded after burning was completed. Peanut energy in kcal was calculated by multiplying the change in water temperature by .2 L. Lastly, kcal per gram of nut burned was calculated by dividing the peanut energy by the mass change of the nut. Results The plain peanuts (control) had an average of 1.78 kcal/gram while the sugar coated peanuts had an average of 4.13 kcal/gram. The salted peanuts had an average of 2 kcal/gram. Conclusions/Discussion Using 10% confidence intervals, a significant difference can be found between the calories of sugar coated peanuts and that of plain or salted peanuts. However, there is no significant difference in the number of calories between plain or salted peanuts. This data suggests that those persons concerned about calories should avoid sugar coated peanuts in favor of salted or plain peanuts.	
Summary Statement This experiment determines the calorie content of peanuts with different coatings.	
Help Received My science teacher, Mrs. Harris, helped me build the calorimeter and showed me how to make the necessary calculations for peanut energy and kcal per gram of nut burned.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Alexis G. Baldwin	Project Number J0503
Project Title Color Me Blue!	
Abstract Objectives/Goals In this science fair project, I made an electronic device which functions as a colorimeter, that converts the concentration of dye in a solution into electrical resistance, which you can read off a multimeter. Then I made a set of standard solutions to convert between the data I have (resistance) and the data I want (Concentration). Then I determined the amount of dye in the samples with unknown concentrations (sport drinks, juices, and soda) and tracked the rate of color loss in a bleach-treated solution. Methods/Materials I used the Beer Lambert law and chemical kinetics for my science fair project. I did one test on my colorimeter to find out how much blue dye was in each cuvette from the diluted series, then to find out how much blue dye was in the various sports drinks, I measured the different sports drinks on the colorimeter. I then did a different test and took the cuvette with half water and half blue dye and placed different amounts of bleach inside each one and tracked the rate at which bleach affected the blue dye. Results In my test for the unknown amounts of blue dye, I found that Shasta soda had the most amount of blue dye #1. The following: Tropicana Twister Blue raspberry juice, All Star Berry Gatorade, Fierce Grape Gatorade, were all very close in the amounts of blue dye. They were separated by less than a 100th of an ohm. The G2 Gatorade had the least amount of blue dye. The last test I performed was with the bleach. The results were that the solution with the most drops of bleach (four) stopped at 0.611 ohms at 17 minutes when it became clear and colorless. The test with 2 drops of bleach went to 0.600 ohms at 15 minutes to become colorless. The third test involved one drop of bleach and took 19 minutes, stopping at 0.599 to become colorless. Conclusions/Discussion The interesting thing is that my hypothesis was based on my belief that the bluer the product, the more blue dye was in it, but actually only by a fraction of an ohm were the drinks apart. This was amazing because the color on these products ranged from a light purple to blue. The other testing with the bleach also produced an unexpected result because the 2 drops of bleach actually took 15 minutes to make the cuvette become colorless and yet the 4 drops took 17 minutes in the same amount of water with blue dye.	
Summary Statement Measuring the amount of blue dye is in various liquids and tracking the rate at which bleach affects it.	
Help Received Dad supervised the building of the circuit; Mom with proofreading my report.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Danielle M. Behrens	Project Number J0504
Project Title Which Road Deicer Corrodes Steel the Most?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals I wanted to determine the least corrosive of commonly available road deicers. I hypothesized that sodium chloride would be more corrosive than other higher cost deicers.</p> <p>Methods/Materials I designed and conducted a 250 sample corrosion experiment on steel wool. Nine series of seven different deicers were run in 13 batches of open top sample cups each containing 90 ml of liquid and one piece of steel averaging two grams. Sample cups and steel wool were weighed with two milligram precision. Controls included a distilled water series and two blanks (individual samples without steel wool) for most series. The batches were left for five days in a temperature monitored environment, and were processed on the sixth day. The steel wool was rinsed according to procedure and the rinse water, along with the used deicer solution, was filtered in a vacuum flask. The sample cup, filter, and steel were all dried and measured with two milligram precision.</p> <p>Results I attempted to independently measure corrosion by the weight loss of the steel wool and by the weight gain of the cups and filters. However, some batches of the steel wool corroded in the oven while drying so I could not rely on it for a corrosion measurement except where there was consistent weight loss within the batch. The average steel wool weight loss (for the series that consistently lost weight) ranged from 20 to 100 mg. When analyzing the blanks I realized that the cups were gaining weight without corrosion (probably because some of the deicer solution dried on the side of the cups adding additional weight), hence I could only rely on the filter weights to measure corrosion. During my experiment some of my cups leaked, causing the corrosion to be much higher so I dealt with these samples by putting them into a different category. Certain series are being redone to get clean results without these errors prior to the California State Science Fair.</p> <p>Conclusions/Discussion Aside from the cups that leaked, the low cost deicers (potassium chloride and sodium chloride) caused the most corrosion while the high cost deicer (potassium acetate) caused the least corrosion. This was consistent with my hypothesis. The leaked cups caused the most corrosion because of the higher oxygen exposure.</p>	
Summary Statement A quantitative 250 sample corrosion experiment was conducted to discover which deicers corrode steel the most and least of the seven tested.	
Help Received Discussions with parents, lab & computer assistance from parents.	



CALIFORNIA STATE SCIENCE FAIR 2009 PROJECT SUMMARY

Name(s) John Berba	Project Number J0505
Project Title Which Grease Is Good for You?	
Objectives/Goals This project focuses on proving that vegetable oil will degrade in quality when fried five times, and if the addition of Vitamin E(antioxidant) will help in retaining the oil's quality.	
Abstract Methods/Materials Four types of vegetable oil -Extra Virgin olive, Extra Light Olive, Canola, and Extra Virgin Coconut, with and without Vitamin E were heated repeatedly in a 400ml glass beaker for five times at 178degC for 4 minutes and allowed to cool to 80degC before reheating. To measure the degree of oxidation and rancidity, the oil samples were then tested in the lab to measure the peroxide value using sodium thiosulfate(Na ₂ S ₂ O ₃) as a titration solution and the amount of free fatty acid using potassium hydroxide(KOH) as a titration solution. The viscosity of each sample were also measured at room temperature by dropping 10 plastic round beads into the oil in a 200ml graduated cylinder. These oil samples were also tested using triangle method to test the change in color, taste and odor.	
Results It was observed that there was an increase in peroxide value between the unheated and heated samples. An increase in free fatty acid was also observed although in most cases the delta were lower in the heated samples with Vitamin E. The results also showed that there was a significant difference in the sensory properties between the heated and the unheated samples. The differences were prevalent in color, but were more pronounced in taste and in odor.	
Conclusions/Discussion The hypothesis that the vegetable oil's properties degrade subsequent to being fried 5 times was proven to be correct. The experiment also met the hypothesis for adding vitamin E did decrease the degradation of the oil's quality. The healthiest oil would be extra light olive oil, because although the oil did not have the lowest peroxide value or free fatty acid level in the unheated state, the oil had remained stable despite the five fryings, and according to the results on peroxide, had almost no delta. The oil has a decent viscosity, medium low peroxide level, and medium free fatty acid level.	
Summary Statement This project tested if vegetable oil will degrade in quality after frying 5 times and if adding Vitamin E(antioxidant) will help preserve the quality of oil.	
Help Received Teacher - Mrs. Erin Schumacher, Scientific adviser - Danilo Lambino (Formulae 8), Performed lab testing at Miramar College Science Lab with supervision from Tien Nguyen (Lab Technician) and Vuong Nguyen (Lab supervisor). The researcher's parents.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Alexander W. Bissell	Project Number J0506
Project Title Coke Blast	
Abstract Objectives/Goals The purpose of my experiment was to discover if the type of soda used with Mentos would affect the height of the geyser. My hypothesis was, "I believe that the type of soda will affect the height of the geyser, and I believe that the Diet Coke will make a higher geyser because I think that there are ingredients in the diet soda that will affect the Mentos strongly that could have the potential to cause a higher geyser". Methods/Materials Mentos, runs of 9 types of sodas (Cherry Coke, Diet Coke, Shasta Cola, Coke Zero, Diet Dr. Pepper, Coca Cola Classic, Diet Shasta and Club Soda as a control, all in 2 liter plastic bottles of similar shapes), measuring tape, empty bottle, camera and stand, stop watch, notebook and microscope. I controlled the variables as much as I could, with the only variable being the type of soda used in my experiment. I measured the height of each geyser and also photographed it to study later. Results There were a total of 18 valid geysers. The highest geyser, Diet Shasta, was 52" at its highest which was almost twice as high as Diet Coke's geyser, and 26 times higher than the lowest which was Shasta Club Soda. Therefore, because I thought that Diet Coke would be highest, my hypothesis was wrong. Conclusions/Discussion I think that the experiment concluded the way it did because there is something in the diet soda that makes the explosions go higher. It's probably because of the sweetener. Shasta uses Splenda and Diet Coke uses Aspartane. Coke Zero used a combination of artificial sweeteners and had a poor geyser. Companies keep the ingredients secret but I think Diet Shasta's success had something to do with Splenda as nearly all of the sodas had otherwise similar ingredients. I would like to study nucleation and artificial sweeteners further. I'm really interested in how nucleation affects ice-cream floats.	
Summary Statement My project is about how the type of soda used with Mentos affects the height of the geyser.	
Help Received Dad took photos, and Mom bought my supplies and proofread my project. She helped me organize this application. Ms. Woolford encouraged me to have a good time. Pat Lemle taught me how to do a science fair project.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Shyamal Buch	Project Number J0507
Project Title Half-Life! Spectroscopic Study of the Kinetics of Decontamination Reactions using New Programmable Colorimeter	
Abstract Objectives/Goals This project analyzes chemical reactions of decontamination using spectroscopy to determine kinetic parameters. Synthetic organic dyes are the model contaminants, as they are widely used, often toxic, and resist biodegradation. Objectives: (1) Build a programmable Colorimeter to measure change in concentration, (2) Determine the rate law, reaction order and half-life of the reaction of dyes with hypochlorite. It is hypothesized that the reaction is 1st order in dye and in hypochlorite. Methods/Materials Solutions of known concentration of synthetic dyes in distilled water are prepared using a 200g x 0.01g balance, 1mL/3mL/10mL pipettes, 10mL/25mL/100mL graduated cylinders, and test tubes. A Colorimeter is designed and programmed to take measurements near the dye's wavelength of maximum absorbance. Calibration curves are obtained. The reaction of dye and hypochlorite is begun and temperature noted. The control is a dye solution alone. The method of isolation and method of initial rates are used to find reaction orders for dye and hypochlorite, respectively. Data is mathematically analyzed to find the rate law and half-life. Results Dye solutions were found to follow the Beer-Lambert Law within certain ranges (e.g. Methylene Blue (MB) range extended up to about 7.82×10^{-5} mol/L). Reaction rates were quite slow for some dyes (e.g. for MB, the half-life was 1777 sec. at 24C). Analysis showed a 1st order dependence on concentration of both MB and hypochlorite, which supported the hypothesis. Results for other dyes & reactions are also tabulated. Conclusions/Discussion The Colorimeter was successfully built and tested; it is programmable and extensible. The hypothesis was partially supported; Eosin-Y (EY) data showed interesting anomalies. After further research into its spectroscopic properties, an explanation is proposed. Kinetics is important for industrial productivity and the environment. Applications of decontamination range from wastewater remediation to toxic chemical agent neutralization.	
Summary Statement The rate law and half-life of decontamination reactions are determined using spectroscopic analysis by a colorimeter which I designed and programmed.	
Help Received Thanks to my teacher Mr. Doe for clarifying concepts. Mr. Reinking introduced me to robotics & programming. Dad supervised my experiments & helped with soldering. Mom & Sister took pictures and gave suggestions for board layout.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Grace K. Cabri	Project Number J0508
Project Title Starch Production in Fruit Ripening	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective was to see if storing a fresh pear with a ripe banana affects the ripening process of the pear.</p> <p>Methods/Materials One fresh pear was stored in one gallon sized Ziploc bag (repeated for numerous trials) and both a fresh pear and a ripe banana were stored in a separate bag (also repeated for numerous trials). After nine days the fruit in each bag was stained with Lugol's iodine, which is a starch indicator. The fruit was cut in half and the cut surface was dipped into the iodine solution. The tested surface of each fruit changed color based on the amount of starch. The color of the stained surface was then compared to a starch color scale (which indicated the amount of starch in the fruit).</p> <p>Results The solitary pears had a slightly higher average color scale value than the average color scale value of the pears stored with the bananas.(color scale value refers to the amount of starch)</p> <p>Conclusions/Discussion The effects of the hormone ethylene cannot be accurately tested after fruit experiences nine days of exposure to the gas with the use of Lugol's iodine.</p>	
Summary Statement This project shows the lack of change in starch production and lack of change in the ripening rate of fruit exposed to ethylene over a period of nine days.	
Help Received Parents supplied all the needed materials and oversaw the experiemnt; Mr. Hagelsieb and Mrs. Perrino offered suggestions for revisions that they thought necessary	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Shannon H. Chee	Project Number J0509
Project Title Time in a Bottle: Will Water in a Plastic Bottle Become Unsafe to Drink over Time?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The goal of my project is to test the safety of bottled water when exposed to extreme temperature over time. My objectives are: 1. To examine the media reports concerning the harmful effects of phthalates 2. To evaluate the public's drinking and water storage habits.</p> <p>Methods/Materials Method 525.2 providing procedures for determining organic compounds in drinking water was used. Materials used included water samples, chemicals, safety equipment, glass vials, high performance extraction disks, equipment apparatus and miscellaneous items essential for the process.</p> <p>Results At the Reportable Detection Limit, no phthalates were detected in any of the five samples of bottled water.</p> <p>Conclusions/Discussion My study showed that bottled water when exposed to extreme temperatures is generally free from phthalates and therefore, is safe to drink for up to a period of at least fifteen weeks. Phthalates have frequently been the subject of misinformation and misleading media reports. That is why science is such a powerful tool. It gives us a chance to objectively test ideas and information we hear in the news against the evidence we observe. It allows us to base our decisions about what is safe to eat or drink on facts instead of media hype and mass hysteria. My experiment had some limitations including small sample size that affected the design of my experiment, limiting exposure times, length of study and one brand of bottled water.</p>	
Summary Statement My project is about determining the safety of water in a plastic bottle under extreme temperature over time.	
Help Received Babcock Lab and staff for donating sample runs and supervising me while conducting experimental procedures, family friend for helping with electronic display, family members for encouragement and support throughout the project.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Audrey B. Crom	Project Number J0510
Project Title Sticky Surfaces: What Affects the Surface Tension of Water the Most?	
Objectives/Goals Abstract This project is entitled #Sticky Surface: What Affects the Surface Tension of Water the Most? Liquid Dish Soap, Salt, or Rubbing Alcohol?# The purpose of this project is to observe which solution(s) reduce water's surface tension, or the ability of water to stick together, the most effectively. The hypothesis stated that if liquid dish soap is added to water, then the surface tension of water will be reduced because the hydrophobic ends of soap will stick out of the water and separate the water molecules from each other, causing the attraction between water molecules to weaken, thus reducing the surface tension. Water, a liquid dish soap solution, a salt water solution, and a rubbing alcohol solution will each be dripped on ten pennies until the penny overflows and the surface tension breaks. Each of the forty trials will be recorded and observations will be taken as needed. The results of these procedures were that the pennies dripped with water were able to hold an average of 1.26 mL of liquid, the pennies dripped with the liquid dish soap solution were able to hold an average of 0.60 mL of liquid, the pennies dripped with the salt water solution were able to hold an average of 1.12 mL of liquid, and the pennies dripped with the rubbing alcohol solution were able to hold an average of 0.61 mL of liquid. In this particular experiment, the liquid dish soap solution caused the most reduction of water's surface tension, which supports the hypothesis	
Summary Statement This project will be investigating which of the following solutions of water, liquid dish soap, salt water, and rubbing alcohol, will have the greatest effect on reducing the surface tension of water.	
Help Received Mrs. White helped me with my questions and my conclusion, and my mom helped me gather the materials.	



CALIFORNIA STATE SCIENCE FAIR 2009 PROJECT SUMMARY

Name(s) Cormac Z. Crowley	Project Number J0511
Project Title Boiling Hot	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective is to determine if salt, sugar, pepper and baking soda have an effect on the boiling point temperature of water.</p> <p>Methods/Materials The experiment was performed at 1000 ft. above sea level. The boiling point of tap water was 111 degrees F. due to high altitude and less atmospheric pressure. Boiling tap water served as the control. A digital thermopen 5 thermometer was used to measure temperature. Salt, sugar, baking soda and pepper were added to separate pots of boiling water in teaspoon increments (up to 5 tsp.). After each teaspoon addition, the maximum boiling temp. was recorded. This process was repeated 3 times to achieve more accurate results. The boiling point temperatures were compared and graphed.</p> <p>Results After each teaspoon of substance was added the water boiled vigorously for a second and then stopped for varying lengths of time. Salt raised boiling point temp. steadily to a high temp of 218 degrees F. after 5 tsp. were added. Sugar similarly raised the boiling point temperature but not to as great a degree. Baking soda had little effect and pepper the least effect on boiling point temperature.</p> <p>Conclusions/Discussion Salt raised boiling point temperature the most because when salt is dissolved in water it forms strong ion-dipole bonds which are stronger than the hydrogen bonds in plain tap water. It took more energy to break these bonds and release the water molecules from the saltwater solution. Sugar had a similar effect on boiling point temperature. Sugar did not raise boiling point temp. as much as salt because sugar molecules are 6 times larger than salt molecules and therefore there are many more salt molecules in 1 tsp than sugar molecules. This results in more salt water bonds than sugar water bonds. Baking soda raises boiling temperature only slightly because only a small amt. dissolved in the water and pepper had the least effect because it did not dissolve in water. These results are important for cooking and kitchen safety. Food will cook faster in salt and sugar water because it will boil at a higher temperature. Care must be taken when first adding solutes to water because of the vigorous boiling that immediately happens.</p>	
Summary Statement The effect of salt, sugar, baking soda and pepper on the boiling point temperature of water.	
Help Received My mom helped me locate research and corrected my spelling and grammar; My teacher helped me with my graphs and research.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) D. Marel Dugan	Project Number J0512
Project Title Chemically Altering Hair Could Make It Tear	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of my project was to test if dying hair effects its strength. Thousands of people dye their hair each day and have no idea what damage that they are causing by altering the color of their hair using chemicals. By dying your hair many risks follow. You can damage your hair, and recently there have been tests done to find if dying your hair can give you blood cancer. This shows how important it is that the public is aware of these dangers.</p> <p>Methods/Materials I tested this by hooking a plastic bag with a paper clip to the hair while the hair is connected to a piece of wood using duck tape, then placing mass in the bag until the hair broke. I completed 50 trials for the dyed hair and 50 trials for the un-dyed hair.</p> <p>Results After completing 100 trials, I came to the conclusion that dying hair effects its strength. It causes the hair to become weaker. The average weight held by the dyed hair was 39.7 grams, and 44.4 grams for the un-dyed hair.</p> <p>Conclusions/Discussion After concluding my test I proved my hypothesis to be correct. There was a total of one outlier out of all the data. The project was very controlled and had an obvious conclusion.</p>	
Summary Statement My project tested if dying hair effects its strength	
Help Received My teacher helped me create my project design.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Ryan A. Fish	Project Number J0513
Project Title Freezer Fun, It's Supercool! Investigating the Supercooled State of Water	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective was to discover if different types of water (salt, carbonated, tap) can be supercooled, or cooled in a liquid state below the normal freezing temperature, in the same way that purified water can. Hypothesis: Salt water and carbonated water cannot be supercooled because the bubbles and salt crystals will act as seed crystals, starting the freezing reaction at 0 degrees Celsius. Tap water lacks a crystal nucleation site and will be able to be supercooled.</p> <p>Methods/Materials Four identical bottles were filled with salt water, tap water, carbonated water, and spring water. All four bottles were placed in the freezer for either a 90 minute or 120 minute trial. Each sample was observed to see if it was still in a completely liquid state or had started to crystallize. Each sample's temperature was measured and recorded. Each sample was agitated to see if instant crystallization would occur.</p> <p>Results The majority of the bottled water samples were in liquid state when removed from the freezer. The temperatures were below water's freezing point with an average of -2 degrees Celsius after 90 minutes. Average temperature for 120 minute trials was -3 degrees. All of the carbonated water samples were in partially frozen state when observed. Temperatures were 0 degrees. All of the salt water samples were in liquid state at 90 minutes. Average temperature was -2 degrees. All of the salt water tests at 120 minutes were in partially frozen state at 0 degrees. Tap water samples were the most inconsistent. At 90 minutes half of the samples were in liquid state and half were partially frozen. All of the 120 minute samples were partially frozen at 0 degrees.</p> <p>Conclusions/Discussion My hypothesis was partially supported by the results. The carbonated water did not become supercooled. The salt water supercooled during the 90 minute tests but froze during the 120 minute tests. The tap water did not supercool. I think that the tap water reacted the way that it did because particles or impurities that did not get filtered out acted as seed crystals or catalysts for the crystallization process. I can't explain why the salt water supercooled at 90 minutes and not at 120 minutes. If the samples at 90 minutes did not instantly freeze when agitated, I would think that freezing point depression might have taken place. This is when the addition of salt lowers the standard freezing point. This is not the same as supercooling.</p>	
Summary Statement My project is about the supercooled state of water and discovering if different types of water can be supercooled in the same way the purified water can.	
Help Received My mother proofread my documents and helped my use Power Point for my graph. My dad introduced me to supercooling as something to investigate. My parents helped me research terms and scientific concepts.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Caroline R. Fontes	Project Number J0514
Project Title The Effects of Heat on Vitamin C in Tomatoes	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Vitamin C is an important vitamin, and tomatoes are a good source of Vitamin C. Most tomato products we consume have been processed by heat, and I wanted to discover if cooking altered the level of Vitamin C. My goal was to determine if heating the tomatoes to three different temperatures affects the level of Vitamin C. My hypothesis is that the Vitamin C content of tomatoes will decrease when heated because Vitamin C is water soluble and is affected by heat.</p> <p>Methods/Materials I used titration to test my hypothesis. The Vitamin C in the tomatoes is the titrant, and iodine is the titrating solution. I made a tomato solution by blending store-bought red tomatoes with 200mL of distilled water. I filtered the solution to remove seeds. A 10mL sample was removed and set aside as the control. The Vitamin C from this sample is the dependent variable. The remaining tomato solution was heated on a gas stove, and three 10mL samples were taken at three different temperatures, 50C, 75C, and 98C (independent variable). While the samples cooled to a standard temperature of 17C, I prepared a starch solution (1T cornstarch and 200mL distilled water). Ten drops of the starch solution were added to each of the four samples. I then added the titrating solution, iodine (Iodine Tincture USP) one drop at a time to the samples and recorded the number of drops necessary to change the pink colored tomato/starch solution to a blue/black color. The results were charted, and compared on a graph. I repeated this procedure a total of three times.</p> <p>Results The presence of Vitamin C in a fresh tomato solution declined after it was heated. In the first trial, my uncooked sample needed five drops of iodine to change color, while the other three samples needed 20% less solution (four drops). Trial Two started with six drops for the Control and concluded with four drops for the 98C sample. The final trial gave the clearest results--the Control required seven iodine drops to change to blue/black and the 98C sample only required four drops (43% less).</p> <p>Conclusions/Discussion This experiment showed that Vitamin C in a tomato can decrease due to heat. Heat causes the Vitamin C content in tomatoes to decrease by decomposing the water-soluble vitamin. Tomatoes that are cooked will have less Vitamin C than raw tomatoes. If you want the most Vitamin C from a tomato--EAT FRESH!</p>	
Summary Statement This project showed that Vitamin C in raw red tomatoes is reduced by heat.	
Help Received My science teacher, Mr. Jeff Fox, loaned me laboratory equipment. My mom was my laboratory assistant.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Benjamin L. Francis	Project Number J0515
Project Title What's in Your Exhaust?	
Objectives/Goals The objective of this project is to see which octane grade of gasoline releases the most carbon dioxide.	
Abstract Methods/Materials I used 3 different cars with 3 different grades of octane (regular, medium, and premium), bromothymol blue solution, distilled water/ammonia solution, and 18 balloons. I got balloons placed behind the exhaust of 3 different cars. The balloons collected the exhaust from 3 different octane grades of gasoline after the cars were on for 15 minutes. Each balloon was detached and tied to keep as much exhaust from escaping as possible. I slipped a funnel straw into the neck of the balloon and placed the other end in a test tube containing bromothymol blue solution. I counted how many drops of distilled water/ammonia solution it took to change the color from yellow back to blue.	
Results The grades of gas that takes the most amount of drops to neutralize the solution released the most carbon dioxide. The highest amount of drops to neutralize the carbonic acid was 13 which the premium grade gas in trial 2 and 5, and the lowest was 2 which was medium grade gas in trial 2; the average amounts of drops was 10.7 for premium, 3.0 medium, and 4.3 regular.	
Conclusions/Discussion My hypothesis was supported because premium gas did the most carbon dioxide in the air. One important factor I would try to change is to use the same model and year of car. I also would take a "field trip" to a smog shop to talk to an expert and see their equipment.	
Summary Statement Looking at the amount of carbon dioxide released based off of the gasoline octane.	
Help Received Dad helped collect exhaust, Mom helped type reports	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Daniel Gay	Project Number J0516
Project Title Effects of Voltage and Concentration on the Fractal Dimension of Electrodeposited Copper Aggregates	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals For this project, I set out to determine the effects of voltage and concentration of copper sulfate solutions on the fractal dimension of copper aggregates created through a form of electrodeposition called diffusion-limited aggregation. A fractal is anything that is self-similar, meaning the only structural differential between an object and its components is scale. Fractal dimension is a measure of the complexity or self-similarity of an object.</p> <p>Methods/Materials The way that I formed copper aggregates for this experiment was through a process called electrodeposition; a process that uses a weak electric field and Brownian motion to form aggregates from a copper sulfate solution. By using copper wires as electrodes on the rim and center of a Petri dish, an electromagnetic field was created. That field pushed the copper ions in the solution towards the center electrode. This field, combined with Brownian motion, (the random walk a particle takes when it is suspended in a liquid,) creates the fractal through a mechanism called diffusion-limited aggregation.</p> <p>Results For this project, I used three voltages: 5V, 12V, and 19V. I also used two copper sulfate concentrations: 0.1 Molar and 1.0 Molar. The copper aggregates were then photographed and analyzed with FracLac for ImageJ software from the National Institute of Health. All of the formed copper aggregates had fractal dimensions between 1.5 and 1.9.</p> <p>Conclusions/Discussion My hypothesis on the effect of copper sulfate concentration was not supported; contrary to my expectations the 0.1M tests had higher fractal dimensions than the 1.0M trials. For my hypothesis regarding the effects of voltage, it was partially supported. In the 1.0M tests greater voltage translated to greater fractal dimension. However, in the 0.1M trials, the hypothesis was not supported.</p>	
Summary Statement The purpose of this experiment was to determine what impacts voltage and concentration have on the formation of electrodeposited copper aggregates which are created through diffusion-limited aggregation.	
Help Received Father helped me to acquire project materials and set-up experiment. Mother helped paste components on presentation board. Mrs. Miller, a science teacher at my school, explained complex concepts involving the calculation of fractal dimension.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) James F. Iannone, III	Project Number J0517
Project Title Feel the Burn: Energy Content in Food	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The original hypothesis had stated that 5% more fat would lead to a higher caloric content. The researcher had hoped to prove this through experimentation.</p> <p>Methods/Materials The method that had been used to receive results had been, and is commonly known as, the bomb calorimeter method. This is where food is completely oxidized to receive a reading. The calorimeter has been constructed using materials at hand; this is also true for the balance that was made. These include k#nex, wood, beakers, small heat resistant bowls, wire, and a nail to hold the food sample while it was being burned.</p> <p>Results When experimenting, the water that would give the results had an average rise in water temperature of 9.46 degrees Celsius. This was the average of all the foods that had been tested. All of the cereals had been tested the same way.</p> <p>Conclusions/Discussion After experimentation was complete, all of the results pointed to the statement that fat has a major impact on the amount of calories that are within a food.</p>	
Summary Statement Through many trials in the area of energy content in foods, it has become apparent that fat does cause food to have more calories per gram or per serving than non fat food.	
Help Received Help Received by my Dad, Buddy Iannone Supervised use of open flame.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Linus E. Kaiser	Project Number J0518
Project Title Impact of Extrinsic and Intrinsic Factors on the Rate of Reactions	
Abstract Objectives/Goals A chemical reaction happens if two or more reactants can collide with each other. They can be slowed down with an inhibitor and sped up with a catalyst. Reactions also speed up if the energy in which they collide increases. The purpose of the experiments was to analyze the effect of different factors on the rate of chemical reactions. The goal was to take different chemical reactions and vary the settings one at a time such that the reaction rate could be determined. A series of separate experiments had to be done to look at each factor (temperature, particle size, concentration, pressure) individually. Methods/Materials The basic reactions tested were dissolution of Alka-Seltzer tablets or baking soda (NaHCO_3) in H_2O or vinegar, or Zinc with hydrochloric acid (HCl). Different conditions were tested to determine the effect of temperature, particle size, concentration of the reactants, pressure, and mechanical stirring on the rate of these reactions. The Pasco Xplorer GLX was used to confirm the experiments with a different method. Results My experiments show that the rate of reaction varies considerably. Increased temperature, higher concentrations of the reactants, active stirring, larger surface (smaller particles) all increased the rate of the reaction; higher pressure reduced the rate of the reaction during which gas was formed. Catalysts accelerated the reaction as long as an optimal temperature was maintained. Conclusions/Discussion My experiments show that factors increase the reaction rate if they either increase the statistical chance for the reactants to come together, or if they improve the contact.	
Summary Statement I looked at different aspects of reaction rates by using different settings and tools, changing 1 parameter at a time.	
Help Received Teachers helped with the experiments, parents helped with the practical construction of the board.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Hailey C. Loehde-Woolard	Project Number J0519
Project Title Biodiesel: Transesterification of Soy and Corn Oils: Green Light for the Future	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of my experiment is to determine how biodiesel is made and produce a sample quantity of biodiesel from two different vegetable oils. I will then determine if the two fuels burn differently and if they are a better fuel than the original oil.</p> <p>Methods/Materials 500mL of 120 degree F oil is combined with 137mL of potassium ethoxide and allowed to react in a blender for 10 minutes. This was transferred to a jar to allow the biodiesel and glycerin to separate into two layers. The glycerin was removed and the biodiesel was washed with water to remove excess reactants, soap and glycerin. The biodiesel was heated to remove excess water and alcohol. The 100 percent biodiesel fuels, b100 soy and b100 corn, were placed into lamps and burned. Pictures were taken to record color and height for later analysis. The b100 soy and soy oil were burned and recorded the same way. The results were compared.</p> <p>Results The 100 percent biodiesel fuels, b100 soy and b100 corn, performed equally well in the burning tests. They burned at the same height and had flames of the same shape and color. The pure soy oil burned about 25-30% the height of the b100 soy. The pure soy did have the same shape and color of the biodiesel flame, just smaller.</p> <p>Conclusions/Discussion I learned and applied the techniques to make biodiesel. It is made by a chemical process called transesterification. In this process, a glycerol is exchanged with an ethyl alcohol on a fatty acid. An ethyl ester of the fatty acid was created (i.e. biodiesel). Soy biodiesel, corn biodiesel and glycerin were successfully produced. In a burning test, both had a flame of just over four inches with the same shape and color. They burn equally well. Because the color and intensity were identical they are probably about equal as fuels. I used soy oil as a control to test if biodiesel is a better burning fuel than oil alone. The biodiesel had a flame that was about three times the height of the soy oil. Soy oil does not burn as well as biodiesel. Converting vegetable oil to biodiesel provides a usable fuel. This fuel can be used in diesel engines and perhaps it can be used for cooking and light as an alternative to kerosene for camping and third world countries.</p>	
Summary Statement I produced biodiesel from different vegetable oils to determine if there is a difference between them as fuels and to determine if biodiesel is a better burning fuel than the original vegetable oil.	
Help Received Mother helped type report; Father supervised safety in production with chemicals, stove and burning tests; Utah Biodiesel Supply provided reference information for biodiesel production.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Kylon Dax C. Magat	Project Number J0520
Project Title How Can Freezing Make Something Warmer?	
Abstract Objectives/Goals The purpose of this project is to determine how and why the solution of water and sodium acetate freezes the way it does. I will also investigate why the solution heats up when it freezes. In order to reach my goals, I will have to find out how the change from a liquid to a solid state produces heat. I also want to find out if it is possible to create a solution that will produce similar effects, using vinegar and baking soda. Methods/Materials I made and tested eight different solutions. Four solutions were made from water and sodium acetate and the other four from vinegar and baking soda. The solutions were purposely created using different proportions to see if the different proportions produced different effects. Results All of the solutions produced the same effects, increasing about 40 degrees Fahrenheit in temperature. The solutions of vinegar and baking soda behaved exactly like the solutions of sodium acetate and water. As soon as I introduced a tiny amount of sodium acetate to the solutions, the solution began to freeze outwards from where the sodium acetate came into contact with the surface of the liquid. In a few seconds the entire solution was frozen and had noticeably become warmer. Conclusions/Discussion The solutions I made of sodium acetate and water were all supersaturated and supercooled. This made each solution very unstable. The sodium acetate also raised the temperature of the water from room temperature to about 110 degrees Fahrenheit. I concluded that when the solutions freeze, an exothermic process takes place in which heat is given off. The solution has to heat up in order to reach its freezing temperature and as it is freezing, it releases energy, which causes it to feel warm.	
Summary Statement In this project I hope to find out how and why the solution of sodium acetate freezes the way it does and why it significantly warms up when it does freeze.	
Help Received Mother helped in purchasing the materials I needed.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Caitlin M. Marshall	Project Number J0521
Project Title Try 'em All Tylenol	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To determine if there is a significant difference in how long different dose forms of Tylenol and generic acetaminophen take to dissolve in the gastro-intestinal tract compared with Tylenol rapid release gels.</p> <p>Methods/Materials 0.01M hydrochloric acid (at approximately 37.2C) was used as a model for gastro-intestinal conditions. This was stirred via a magnetic stirrer at a fixed speed and a 500 mg dose form of Tylenol or a generic acetaminophen was added. The time to obtain dissolution or uniform dispersal of the material was measured and the temperature recorded to ensure consistency. This was repeated in triplicate for each of 4 dose forms (3 Tylenol + 1 generic).</p> <p>Results The following Mean (+/- SD) results were obtained: Tylenol Rapid Release Gels - 103s (+/- 0), Tylenol EZ Tabs - 108s (+/- 1), Tylenol Caplets - 82s (+/- 15), Generic Acetaminophen Caplets - 440s (+/- 27). None of the dose forms fully dissolved under the experimental conditions due to the insoluble excipients added during the manufacture of the dose forms.</p> <p>Conclusions/Discussion The results demonstrated that the time required to disperse the various formulations of Tylenol did not vary significantly and therefore time to dispersion may not be an accurate model for actual dissolution. The only observation was that the generic acetaminophen took a significantly longer time (~ 4 times longer) to disperse than the Tylenol. This experiment demonstrated that visual inspection is inadequate to determine Tylenol dissolution and a more specific analytical technique such as hplc is required to accurately measure the dissolution of the active ingredient (acetaminophen). As a result no conclusions could be made regarding the original objective.</p>	
Summary Statement An assessment of the rate of dissolution of different dose forms of Tylenol and generic acetaminophen in the G-I tract.	
Help Received Father assisted with experimental design and editing of report.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Natalie R. Pita	Project Number J0522
Project Title How Fast Does an Alka-Seltzer Tablet Make Gas?	
Abstract Objectives/Goals My Hypothesis is that the reaction of the Alka-Seltzer tablet will occur at a faster rate when in hot water. Methods/Materials 1. Safety Goggles 2. 12 Alka-Seltzer Tablets 3. Thermometer 4. 60 ml Syringe 5. Plastic Tubing 6. Clear wide mouthed bottle with cap 7. Drill 8. center punch 9. Measuring Cup 10. Masking Tape 11. hot and cold water 12. Clock or stopwatch 13. Ice 14. a helper 15. Lab notebook and pencil Results The fastest was hot water(35 degrees Celsius) which finished at 60 seconds. Room temperature(21 degrees Celsius) was the second fastest and finished at 140 seconds Cold(4 degrees Celsius) was the slowest and finished at about 420 seconds Conclusions/Discussion After I completed all 12 trials of my experiment. My conclusion was that the hot water allowed to Tablet to produce gas the fastest. While Room temperature was the second fastest, and cold being the slowest. My hypothesis was correct.	
Summary Statement I tested different temperatures to see which one allowed the Alka-Seltzer to produce gas the fastest.	
Help Received My Dad used the stopwatch and timed the reaction, my mom helped with the decorating of my board, and my dad also helped to weight down the and wire the board, My dads coworker taught me to use excel	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Julia A. Pokorny	Project Number J0523
Project Title A Summer Fashion Statement or a Chemical Reaction? What Turns Hair Green in Pool Water?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of the experiment was to find out whether copper or chlorine causes blonde hair to turn green in pool water.</p> <p>Methods/Materials I made nine solutions with three different concentrations of copper-based algaecide and three different concentrations of chlorine bleach. I made a solution with dilutions appropriate for swimming pool water and solutions with lower and higher concentrations of algaecide and chlorine. I poured the solutions into clear containers, put lids on the containers and waited two days, placed hair in the containers, replaced the lids, and waited six days before taking the hair out.</p> <p>Results I found that only solutions with high concentrations of copper-based algaecide had hair that changed color. The solutions with high amounts of chlorine dissolved the hair. The exception was the container with high algaecide and high chlorine. In this solution the hair did not dissolve but did change color. A precipitate also appeared on the bottom of the container which suggests a chemical reaction between the copper and chlorine.</p> <p>Conclusions/Discussion I can conclude that copper does affect the hair color. I cannot make a conclusion about chlorine, because there was either no change or the hair was dissolved.</p> <p>I also did a secondary experiment. It suggested that copper pipes may be a source of copper in pool water and that chlorine be a factor in releasing the copper into the water.</p>	
Summary Statement I tested copper and chlorine to see what turns blonde hair green in pool water.	
Help Received Dad helped me learn about dilution, supervised while making the solutions, and helped me choose the dilution factors for the solutions.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Adam Protter	Project Number J0524
Project Title Catalytic Decomposition of Hydrogen Peroxide: Kinetics, Mechanism, and Applications	
<p align="center">Abstract</p> <p>Objectives/Goals My project is to determine which catalyst, FeCl₃, MnO₂, Pb, or KI will have the greatest reaction rate in the decomposition of H₂O₂ in two substrate concentrations as measured by the volume of gas collected over time. Also, to determine the rise of the temperature of the reactants over time, and compare that with the volume of oxygen liberated.</p> <p>Methods/Materials Prepare a gas-collecting apparatus by fitting a side arm flask connected to a rubber hose. Insert a digital thermometer with a probe through the rubber stopper of the flask. Fill a 250 ml graduated cylinder completely with water and invert it into a water trough.. Place the end of the tube inside the cylinder. Add H₂O₂ to the flask, past the temp. probe. Add the catalyst to the flask and stopper the flask. Swirl to mix. Simultaneously record the temperature of the reactants and the volume of oxygen collected in the cylinder. Repeat this procedure 3 times per catalyst / concentration</p> <p>Results H₂O₂ undergoes an exothermic reaction to form O₂ and H₂O. (H₂O₂ → H₂O + # O₂) In my experiment, the decomposition of hydrogen peroxide, was studied with catalysts FeCl₃, MnO₂, Pb, and KI, with concentrations of 3% and 30%. I found catalytic type, amount of catalyst present, as well as the concentration of the H₂O₂ had a strong effect on the reaction rate, with increasing rate in the order KI<MnO₂<Pb<FeCl₃. First order kinetics was observed in all cases. The heat liberated in the exothermic reaction was directly comparable to the oxygen produced.</p> <p>Conclusions/Discussion Data analysis showed that my hypothesis was correct; that FeCl₃ had the greatest reaction rate in the decomposition of H₂O₂. The exothermic reaction of H₂O₂ was spectacular, with temperatures reaching over 400 degrees K. So spectacular, that I was forced to abandon further trials with FeCl₃ at 30% concentration, for fear of thermal runaway (which the decomposition of H₂O₂ is notorious for). Because H₂O₂ has such a high oxygen density, scientists are studying it for applications such as mono propulsion for automobiles. I would like to pursue the study of hydrogen peroxide propulsion and make a truly green automobile.</p>	
Summary Statement My project was about the kinetics, mechanism and applications of the catalytic decomposition of H ₂ O ₂ .	
Help Received My Mom helped take O ₂ readings.. My Uncle Paul tutored me and kept me safe, and most of all, my science teacher, Mrs. Armstrong, is probably the best teacher a kid can ever have. She teaches. She inspires.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Shalin N. Shah	Project Number J0525
Project Title Osmosis and Diffusion	
Abstract Objectives/Goals The objective of my project was to observe the osmotic pressure exerted by different solutes of varying molecular weight on water. My hypothesis was that the solutes with larger molecules would allow more osmosis than those with smaller molecules. Methods/Materials For my experiment, I used water as the control and made six 1% solutions using corn starch, potassium gluconate, sodium chloride, glucose, sucralose, and mannitol. I then used dental floss to tie the ends of semipermeable dialysis tubing to make a dialysis bag, which I filled with 5mL of a solute solution and immersed into a beaker of water. After one hour, I observed the volume of water that had entered the dialysis bag. To obtain more accurate results, I performed three trials for each of the six different solutes, plus the control, water. Results The order of the solutes' degree of osmosis from greatest to least was: corn starch, potassium gluconate, glucose, mannitol, sucralose, and sodium chloride. This has a significant relationship with the solutes' molecular weights from greatest to least. Conclusions/Discussion From my results I came to the conclusion that my hypothesis was correct. The larger solutes exerted more osmotic pressure on the water than the smaller solutes. By researching my project's topic I was able to apply it to the function of the kidneys in the human body. The nephron in the kidney is where membrane transport to maintain the body fluids and blood concentration occurs. One form of membrane transport is osmosis and diffusion.	
Summary Statement The purpose of my project was to observe the affect of different sized solutes on the osmotic pressure of water through a semipermeable membrane, and to relate it to the function of the kidneys in the human body.	
Help Received Mother helped collect materials; Advisor/sister helped with research	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Stephen M. Tang	Project Number J0526
Project Title Acid vs. Teeth	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Acid is a highly corrosive substance that is in all batteries, many chemicals, and industrial wastes. Surprisingly, it is also on many people's teeth! According to the Mereck Manual of Medical Information, carbohydrates and sugars are the biggest culprits of tooth decay. It states that "all simple sugars including table sugar (sucrose) and sugars in honey (levulose and dextrose), fruit (fructose), and milk (lactose) have the same effect on the teeth. Whenever sugar comes in contact with plaque, streptococcus mutans bacteria in the plaque produce acid." Interestingly, the bacteria and the sugar do not directly cause the tooth decay. It is really the acid, the byproduct resulting from the bacteria consuming the sugars, that causes tooth decay. Acid demineralizes or dissolves teeth and cause tooth decay. Thus, a tooth with decay should weigh less than a tooth without decay.</p> <p>Methods/Materials The process of this experiment is as follows. 80 teeth were gathered and cleaned of all stains, plaque, and debris by special tools such as hand scalers, EMS (electro-magnetic scalers), and polishers. The teeth were blotted dry with lint-free Kim-Wipes tissue and weighed on a Sartorius scale to 0.0001 gram. They were then placed in 10 individual vials in 8 categories and labeled from control (pH7), pH2, pH3, pH4, pH5, pH6, Neutral Sodium Fluoride, and Acidulated Phosphate Fluoride. The teeth were allowed to decay for about 2 months before reweighing them on the same Sartorius scale in the exact same manner.</p> <p>Results According to Dentistry Today (November 2005), "acid pH levels cause tooth surfaces to lose calcium and phosphorous ions" which leads to decay. Acid is able to start to damage teeth once the pH drops below a 5. Acid essentially chelates and dissolves the teeth. The teeth in solutions with pH4, pH5, and pH6 had very little change. But, when the pH level dropped below pH4, the demineralization process occurred at a much faster rate. In fact, there is a 4 fold difference between pH2 and pH6. Our study shows that there is a dramatic increase in demineralization at pH under 4.</p> <p>Conclusions/Discussion In summary, acid does affect the decay of teeth. The more acid there is in the solution, the greater is the amount of decay. The greatest destruction occurs when the pH level drops below 4. Fluoride definitely helps in reversing or minimizing the damaging effect of tooth decay!</p>	
Summary Statement This project examines how various levels of acidity affect the decay or demineralization of teeth.	
Help Received My parents helped me gather the teeth. I borrowed the microgram scale at a lab at UCSF.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) LeCheng Tong	Project Number J0527
Project Title Taking Apart Water	
Objectives/Goals My project was to determine if it is possible to achieve a 2:1 volume ratio of hydrogen to oxygen during an electrolysis process. I believe that it is possible because a water molecule consists of two atoms of hydrogen and one atom of oxygen.	
Abstract An electrolysis device was set up, consisting of two carbon rods, two long insulated wires, two graduated test tubes, a 1.8 liter large bowl filled with purified water, and an AC to DC transformer. Three types of electrolytes, table salt (sodium chloride), baking soda (sodium bicarbonate), and soda ash (sodium carbonate), were used. As the gas volume increased in the test tubes, measurements were taken at certain intervals of time. At the end of the experiment, the gas in each tube was ignited using a lit candle to determine the type of gas.	
Methods/Materials An electrolysis device was set up, consisting of two carbon rods, two long insulated wires, two graduated test tubes, a 1.8 liter large bowl filled with purified water, and an AC to DC transformer. Three types of electrolytes, table salt (sodium chloride), baking soda (sodium bicarbonate), and soda ash (sodium carbonate), were used. As the gas volume increased in the test tubes, measurements were taken at certain intervals of time. At the end of the experiment, the gas in each tube was ignited using a lit candle to determine the type of gas.	
Results Electrolysis using soda ash did achieve a 2:1 volume ratio of hydrogen to oxygen. However, the experiment with baking soda could only generate a 1.6:1 ratio at the most while the experiment with salt ended up with a ratio as far off as 170:1.	
Conclusions/Discussion I proved my hypothesis right; it is possible to achieve a 2:1 volume ratio of hydrogen to oxygen under certain circumstances. The electrolyte, in this experiment, had to be sodium carbonate.	
Summary Statement My project is about the electrolysis of water.	
Help Received Dad helped set up experiment; mom helped tape board.	



CALIFORNIA STATE SCIENCE FAIR 2009 PROJECT SUMMARY

Name(s) Emily M. Venable	Project Number J0528
Project Title Hydrogen Production: Nano Metals vs. Bulk Metals	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The experiment's objective was to use nanotechnology in the process of electrolysis of water to produce hydrogen to compare its efficiency to bulk metals. Clean energy is a world issue and hydrogen is one clean energy source. However, there is no cost effective way to produce hydrogen.</p> <p>Methods/Materials To test the efficiency of the electrodes, an electrolytic cell was built. Four electrode types were obtained: nickel, SS304, SS316, and nickel/iron nano material. A 30% solution of potassium hydroxide was prepared as an electrolyte. Twelve voltage measurements per electrode type were split over three trials. The theoretical voltage, or ideal voltage to pass between two electrodes in the process of electrolysis of water, 1.23 volts, was used as 100% efficiency to calculate and compare the efficiency of the electrodes.</p> <p>Results The 12 measurements per electrode were averaged and the voltage for SS304 was 2.33 volts, the voltage for SS316 was 2.19 volts, the voltage for nickel was 2.66 volts, and the voltage for the nano material was 2.15 volts. The efficiency of the electrodes was calculated and SS304 had 52.79% efficiency, the SS316 had 56.16% efficiency, the nickel had 46.24% efficiency, and the nano material had 57.21% efficiency. Although the gas produced by each electrode could not be measured as planned, it is justified that every electrode produced the same amount of gas by Faraday's law of electrolysis which states that in an electrolytic cell, the amount of a substance produced at one end of the electrode is directly proportional to the amount of electricity that passes through the cell. Therefore, the amount of gas produced by each electrode was constant because the same amount of voltage was applied.</p> <p>Conclusions/Discussion The most efficient electrode in the process of electrolysis of water to produce hydrogen was the nano material. This supported the hypothesis, however, the data did not support that nickel would be the next most efficient. In conclusion, scientists should further their research of the electrolysis of water with nano materials/metals due to the fact that they are more efficient in the production of hydrogen.</p>	
Summary Statement The project's focus was to use cutting edge nanotechnology in the process of electrolysis of water to produce hydrogen to compare its efficiency to bulk metals.	
Help Received Kim McGrath of Quantumsphere Company donated nano material and potassium hydroxide. San Clemente Sheet Metal Company donated metal samples.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Stephanie M. Vistnes	Project Number J0529
Project Title Get More Hydrogen from Your Water	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Electrolysis must have an electrolyte in order to work. But what factors affect an electrolyte's effectiveness? My hypothesis is that it is either the pH of the solution or the ion concentration.</p> <p>Methods/Materials I tested 6 different electrolytes three times each, each trial with a different quantity of electrolyte. The following electrolytes were used: sodium chloride, potassium chloride, sodium bicarbonate, sodium hydroxide, hydrogen peroxide, and isopropyl alcohol. During each trial, I measured the pH of the solution, the temperature of the water, and the mL of gas produced in 5 minutes with a 9-volt charge. A trial with plain tap water was also performed as a control.</p> <p>Results Two of my electrolytes did not produce any gas: isopropyl alcohol and hydrogen peroxide. I hypothesized that this was because they did not ionize in water. I confirmed this hypothesis with one trial of sucrose, which I knew did not ionize. When I made a graph of gas production vs. electrolyte molarity that excluded the unproductive electrolytes, all of the points fell on a relatively straight line except for sodium bicarbonate. When an estimated percent of ionization was applied to the sodium bicarbonate, in a graph of mL gas vs. ion concentration measured in moles per liter, all of the points fell on a relatively straight line, demonstrated by a regression coefficient of 0.89.</p> <p>Conclusions/Discussion My results did not explain my first hypothesis because many substances did not change the pH but did produce gas. My second hypothesis explained all of my results. Gas production is directly proportional to the ion concentration in moles per liter, and the type of electrolyte is irrelevant.</p>	
Summary Statement I determined the effectiveness of different concentrations of different electrolytes in electrolysis; the volume of gas produced is directly proportional to ion concentration, and independent of the type of electrolyte.	
Help Received My dad helped build the apparatus, and introduced and explained some chemistry terms.	