



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Robert J. Bellerose	Project Number S0501
Project Title Development of a Daily-Use Sunscreen Soap	
Abstract Objectives/Goals The objective was to develop a bar soap (glycerin) with the active sunscreen ingredient octisalate (octyl salicylate). The sunscreen could be used on a daily basis and provide an SPF of at least 15. Methods/Materials I surveyed 100 randomly selected individuals to determine if there was a need/desire for this product. I conducted research on the different types of skin cancer and methods of reducing the risk of it. My research led me to select octisalate, a waterproof UVB agent, and glycerin as the base for the bar soap. I created three different concentrations of the active ingredient: 0% (Control), 5%, and 10%. I used a chemical test to determine the effectiveness of the bar soaps compared to known SPFs (4, 15, and 30). I have conducted multiple tests to confirm the results. I created a UV light source to provide a constant level of UV radiation. The solutions I prepared consisted of benzophenone, isopropanol, glacial acetic acid, and mineral oil. A precipitate formed at the bottom of the test tube. The more precipitate, the less effective the product was at absorbing UV rays. Results The test tube with the 5% concentration of the active ingredient (applied to its exterior) produced the same amount of precipitate (0.8 grams) as the test tube with SPF 15 sunscreen did. Therefore, the 5% concentration of the active ingredient had an approximate SPF of 15. Concentrations exceeding this amount would not completely incorporate into the glycerin. Conclusions/Discussion My conclusion is that regular use of sunscreen soap with an SPF of 15 would significantly decrease the risk of skin cancer. A study indicated that regular use of sunscreen up to age 18 could decrease the risk of contracting skin cancer by 78%. The chemistry of this experiment involves a redox reaction. Benzophenone is reduced to yield benzopicanol (precipitate) and isopropanol is oxidized to form acetone. The stoichiometry of this reaction is 2 molecules of benzophenone to 1 molecule of benzopicanol.	
Summary Statement I created a glycerin bar soap with the active sunscreen ingredient octisalate (designed for daily-use) and chemically tested its effectiveness.	
Help Received Father helped build board; Parents provided financial and logistic support; Mrs. Acquistapace acted as my mentor throughout the project; Ron Tempest discussed the chemical reaction with me	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Mollie A. Boudoures	Project Number S0502
Project Title Can You Trust the Label?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of my project was to determine levels of saturated fat in cholesterol free foods in order to see if labels that claimed to have no cholesterol in them were telling the truth.</p> <p>Methods/Materials I added iodine to oils that were listed in cholesterol free foods as key ingredients. I observed how fast the iodine became colorless. The less time it took for the iodine to disappear, the less saturated fat the oil contained.</p> <p>Results The peanut oil contained the most saturated fat. The corn oil contained the least, and its label agrees, with zero grams of saturated fat. The canola oil label says it had one gram of saturated fat per tablespoon. Both the soybean and olive oil labels claim to have two grams of saturated fat per tablespoon. The peanut oil label says that it contains two and a half grams of saturated fat per serving. The coconut oil label says that it has six grams of saturated fat in one serving. So, the labels didn't always match my results.</p> <p>Conclusions/Discussion At the end of my experiment I found out that the labels of cholesterol free foods do not always tell the complete truth because some oils claimed to be cholesterol free, yet contained cholesterol free.</p>	
Summary Statement In my project I tested for saturated fat in cholesterol free foods.	
Help Received My teacher helped me with my project.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Alexander Chu; Losmeiya Huang; Colleen Tan	Project Number S0503
Project Title A Chemical Investigation of Water Content and Analysis of pH in Methyl-Ester Fuels using Different Washing Systems	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals We hope to quantify the amount of water in non-water wash fuels in order to determine thermal oxidation.</p> <p>Methods/Materials We weighed out 50 grams of beads on a balance and placed them into pre-weighed sealed plastic bags. Then, 100 milliliters of tap water, water washed oil, and non-water washed oil were measured out into 3 separate graduated cylinders. Coffee filters were secured on top of 3 beakers in order to filter out the beads after the liquids were poured into the 3 different beakers. All initial and final temperature readings of both liquids and beads were synchronized and recorded. After each set of beads were placed in their original bags, they were weighed on the same balance.</p> <p>Results Our test results, on average, show that our non-water wash batches contain less water compared to the water washed bio-diesel and the tap water. At the end of testing, more oil is retained and the non-water wash beads have a lower mass compared to the beads immersed in the water washed bio-diesel and water. This shows that the beads saturated in the non-water wash oil absorbs less water content than that of the beads saturated in the control and independent variable. Initial temperatures of beads saturated in water are between 89.5^o F - 90.5^o averages. The water wash's initial temperature is on average 76.8^o F with temperatures on average of 78^o F; the non-water wash's initial is on average of 75.6^o F - 76.7^o F. Because the greater level of water causes a faster reaction and a raised temperature, we can determine that the slower reaction and lower temperature of the beads saturated in the water washed oil is due to a lower level of water content and other impurities that could have been introduced to the oil.</p> <p>Conclusions/Discussion The water wash process used to cleanse Bio-diesel fuel was analyzed in accordance to water content. Two approaches were taken, including temperature comparisons and a weight system to quantify the amount of bead absorption. Data showed that the water wash had greater water retention and higher temperature when reacting with the beads; thus indicating that the beads had a higher absorption rate and a lower exothermic reaction with the non-water washed fuel. This shows that the non-water washed fuel had a lower water content compared to the water washed methyl-ester fuel.</p>	
Summary Statement Our study regards the analysis of water content in methyl-ester fuels to determine thermal oxidation.	
Help Received Mr. Michael Winters overlooked our project, Dr. James Ettaro helped us to conceptualize our ideas, and Ms. Natalie Della Santina gave us materials	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Vanessa E. Cox	Project Number S0504
Project Title A Three Year Study of Natural Antibiotics: Analysis of the Bioactive Compound in Arctostaphylos in Various Solvents	
Abstract Objectives/Goals The object of this experiment was to determine the best solvent for the extraction of the bioactive compound in Arctostaphylos. Methods/Materials In the preliminary tests, I tested five different solvents for enhanced extraction of the antibiotic compound. An extract of each sample was obtained by grinding the plant with the solvent using a mortar and pestle. A concentration disk was then soaked in the extract and placed on an agar plate inoculated with E. coli. Duplicate tests were run for each plate. Fresh garlic was used as a positive inhibitory control, while pure solvent was used as a negative control. These plates were incubated at 84 degrees. The degree of extraction was measured by the distance between the ring of inhibition for the test concentration disk and the ring of the control disk. The three solvents with the largest ring differences were retested in the secondary experiments. Results In the preliminary experiment, the largest ring of inhibition difference was apparent in isopropyl alcohol, 4.5mm, followed by DMSO, water, ethanol, and acetone. In the secondary experiment, DMSO showed the largest difference followed by water and isopropyl alcohol. Conclusions/Discussion The bioactive compound in Manzanita was more soluble in DMSO than water. Ethanol and acetone do not draw out this compound well. My results using isopropyl alcohol showed opposite extremes. In the preliminary test, isopropyl seemed the best solvent for Manzanita, but, during the secondary tests, it seemed the worst. Further testing should determine which results are correct.	
Summary Statement The purpose of my project was to determine the best solvent for the extraction of the bioactive compound in Arctostaphylos in hopes of using this information to isolated the antimicrobial agent in this plant.	
Help Received I would like to acknowledge the help of Ms. Barbara Mudrinich, for lending me the E. coli culture and the L B broth as well as Mr. Tom George for letting me use his electric balance and graduated cylinder. Tracie Baptista at the Butte County Health Department gave me the petri plates.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Phillip T. Deutsch	Project Number S0505
Project Title A New "Spin" on the Haasnoot-Altona Equation: Determination of Theta by Variable Solvent and Variable Temperature NMR	
Abstract Objectives/Goals The objective of my project is to develop a method of determining the rotational conformational equilibrium about the central C-C bonds of substituted ethanes. Such methods already exist; the goal of this project is to develop a new method, which, unlike existing methods, does not require assumptions regarding the value of the dihedral angle theta for each rotamer. Methods/Materials Nuclear Magnetic Resonance (NMR) spectroscopy provided the raw data from which the conformational equilibrium was extracted. The difficulty lies in interpreting the NMR spectra, which do not clearly display conformational information because of averaging due to rapid rotation around the central C-C bond. To overcome this difficulty, a series of NMR spectra was taken while varying a single environmental parameter such as temperature or solvent. Each observable (such as a chemical shift or scalar coupling) in these spectra is the weighted average of the observables belonging to each conformer, and a linear equation exists that describes this averaging. A (nonlinear) system was constructed from these "averaging equations" for each series and interpreted using inferential methods on the root mean square error statistic. From these systems the conformational information was derived and an estimate of the dihedral angle theta for all conformers was obtained. Results Of the several series used, only one, (1,1 dichloro-2,2 difluoroethane) produced valid conformational information under rigorous statistical scrutiny. All other methods admitted multiple plausible solutions. The information provided by the new method indicated dihedral angles not significantly different from prevailing assumptions. Conclusions/Discussion The primary reason that the variable temperature-coupling constant method succeeded while the others failed was because it provided the greatest number of additional constraints (primarily thermodynamic) that could be used to eliminate plausible solutions. There is no reason that the analysis used for 1,1 dichloro-2,2 difluoroethane could not be extended to any asymmetric substituted ethane. Unfortunately, this new procedure is much more experimentally intensive than the currently prevailing one, but nevertheless allows an analysis independent of assumptions for theta, and it or similar methods should be used in all contexts where such assumptions cannot be safely made.	
Summary Statement This project develops new methods of determining the rotational equilibrium of simple ethanes.	
Help Received Work was done at the Gates and Crellin Laboratories of Chemistry at Caltech under the supervision of Dr. John Roberts	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Jennifer Dong	Project Number S0506
Project Title Photooxidation of Cobalt-Bound Thiolato Ligands	
Abstract Objectives/Goals This project studies the reaction of the complex bis(ethylenediamine)-(SO)(N,S-2-aminoethanethiolato)Cobalt chloride(III) with singlet oxygen. Similar sulfur- coordinated to transition metal complexes are found in many biological systems. Oxidation at a metal-sulfur site may lead to deactivation at that site. Methods/Materials Reaction rates in different solvents, dimethylformamide (DMF) and water will be attained. The rate-constants in this experiment were recorded through time-resolved Laser Spectroscopy. The compound's consumption of 1O_2 was monitored by the singlet oxygen decay at varying concentrations of quencher. Data was processed using Microsoft Excel and Origin 5.0 computer programs. Results It was found that polar solvents typically display a slower rate of quenching Co(SO)Cystamine. Conclusions/Discussion Solvents that were more nonpolar were supposed to show a faster rate of reaction. The increase in 1O_2 quenching rate on the polar solvents is believed to occur because of added stabilization caused by intermolecular hydrogen bonding from the amino protons to the sulfur	
Summary Statement Studying how solvent polarity affects the oxidation rate of reaction of Cobalt-Thiolato Complexes.	
Help Received Professor Matthias Selke provided lab and guidance, Mentors Billy Hernandez and Cesar Galvez taught experimental techniques, concepts involved in experiment, and provided supervision, Dad bought the science fair board.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Henry Fong; Johanna Tang; Allen Tran	Project Number S0507
Project Title Quantum Yield Studies of Singlet Oxygen Production by Square Planar Platinum(II) Complexes	
Abstract Objectives/Goals To determine the singlet oxygen quantum yields and quenching rates of several square planar Platinum(II) complexes and their trigonal-bipyrimidial Iridium(III) analogues. Methods/Materials Time-resolved laser spectroscopy was used to measure the singlet oxygen quantum yields. The procedure involves the preparation of a sensitizer solution in benzene. The solution is optically excited, and the singlet oxygen decay is detected with a Germanium photodiode detector. Data was processed with Excel and Origin. Results The singlet oxygen quantum yields were high. The five Platinum(II) compounds tested ranged from 0.97 to unity. The two Iridium(III) analogues of the Platinum(II) complexes exhibited lower quantum yields, 0.88 and 0.90. The complexes exhibited low quenching rates. Conclusions/Discussion Singlet oxygen quantum yields are affected by several processes, including spin orbit coupling and quenching rates. The higher quantum yields of the Platinum(II) complexes compared to their Iridium(III) analogues also shows that the active site of energy transfer involves the metal center and can, therefore, be affected by sterics.	
Summary Statement The efficiency of singlet oxygen production by several Platinum compounds was determined	
Help Received Used lab equipment at CSULA under the supervision of Dr. Matthias Selke and Billy Hernandez.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Kaidi He	Project Number S0508
Project Title Synthesis of Palladium Nanowires by Electrodeposition onto Highly Oriented Pyrolytic Graphite	
Objectives/Goals The project was aimed at finding the best combination of nucleation time, deposition time, and deposition potential for palladium nanowires. It was hypothesized, from the third scan of a cyclic voltammogram taken, that the deposition potential would be approximately .400 V. It was hypothesized that the nucleation time would be anywhere ranging from 5-7ms, and the deposition time anywhere from 600s-1800s based on previous research.	
Abstract Methods/Materials Materials: Highly Oriented Pyrolytic Graphite (HOPG) Palladium Nitrate Solution: 60% HClO ₄ (1.54 g/mL, 9.2 M), Water, Pd(NO ₃) ₂ · H ₂ O Potentiostat, Saturated Calomel Reference Electrode, Palladium Flag, Working Electrode, SEM, Scotch tape, ECHEM Software, Light microscope Methods: A solution of Pd(NO ₃) ₂ · H ₂ O was made. The working electrode containing HOPG, counter electrode, and reference electrode were inserted into the solution. During the conditioning period, the graphite was oxidized using the ECHEM program. A nucleation pulse was then applied to initiate the nanowire growth. Following their deposition, the wires were taken to the Scanning Electron Microscope (SEM) and imaged.	
Results After repeated trials, the best conditions for optimal nanowire growth was determined to be a deposition potential of .370 V, deposition time of 1200s, and nucleation time of 5ms. The hypothesis that the deposition potential would be near the value of 400 V was confirmed to be correct.	
Conclusions/Discussion Palladium nanowires of diameters ranging from 62.9 to 159 nm were synthesized by electrodeposition onto highly oriented pyrolytic graphite. Variables of nucleation times, nucleation potentials, and deposition potentials were adjusted to produce the most structured nanowires. It was concluded that a deposition potential of .370 V, a deposition time of 1200s, and a nucleation time of 6 ms resulted in optimal wire growth.	
Summary Statement This project attempts to find the optimal combination of variables of nucleation time, deposition time, and deposition potential for producing the most structured nanowires by the electrodeposition of palladium onto HOPG.	
Help Received I worked in the lab of Dr. Reginald Penner at University of California of Irvine, under the supervision of Dr. Penner and Stacey Rogers.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Amber I. Hess	Project Number S0509
Project Title Enhanced Color Thin-Layer Chromatography: A Novel, New Technique to Extend the Chemist's Venerable Chromatography Tool	
Abstract Objectives/Goals Thin-layer chromatography (TLC) is a widely used method to determine the number of components in a mixture and/or their identity, to monitor the progress of a reaction, or to determine the effectiveness of a purification. In my science fair project last year I reported the ability, using digital photography and color enhancement, to detect color in a chemical's spot on fluorescent TLC plates. The objective of this project is to develop this new Enhanced Color TLC technique by determining the source of the color, whether the color can be detected in a variety of chemicals, and under what conditions one can see this color. Methods/Materials Fluorescent chemicals were spotted on fluorescent TLC plates and then placed in a TLC chamber. A digital picture was taken of each TLC plate with a digital camera under 254 nm UV light. Photo-editing software was used to enhance the colors in the pictures to determine if the chemical's fluorescence could be identified. Certain colors in the picture of a TLC slide may not be visible to the human eye, but the camera and computer can pick them out. Results My research and results show that the source of the color is fluorescence. If a fluorescent chemical is spotted with a high enough concentration on a fluorescent TLC plate, photo-editing software can be used to enhance the colors in a picture of the plate and the fluorescence from the chemical's spot can be seen. I found that many fluorescent chemicals can be detected with Enhanced Color TLC at reasonable concentrations. TLC spots can be differentiated from one another with this distinctive Enhanced Color TLC method. Conclusions/Discussion While many techniques in chromatography take advantage of color, a literature search showed that no one else had reported the ability to combine the use of color AND fluorescent TLC plates, which normally show a chemical sample as nothing more than a black spot on a green or blue background. The ability to detect color from samples on a fluorescent TLC plate is valuable because chemists now have another easy technique besides R _f values to verify the identity of chemicals. By effectively using Enhanced Color TLC, chemists can save time and avoid using more expensive methods. Indeed, TLC is popular because of its low cost and simplicity, and Enhanced Color TLC stays true to these valued qualities. Enhanced Color TLC is a novel, new tool that can be added to a chemists TLC toolbox.	
Summary Statement Enhanced Color Thin-layer Chromatography is a novel, new technique to identify fluorescent chemicals by using traditional TLC and digital photography.	
Help Received Dr. Kimberley R. Cousins at CSU San Bernardino offered advice and answered questions.	



CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s) Isaac F. Ho	Project Number S0510
Project Title Temperature's Effect on the Collision Rate Factor	
Abstract Objectives/Goals I wanted to do something useful for society. I had no trouble choosing a topic, as my head is always full of questions. Being more interested in chemical kinetics, I went beyond the ordinary high school textbook, and found the Arrhenius Equation. The Arrhenius Equation inspired me to see if there was an equation for the Z-collision rate factor (a variable in the Arrhenius Equation). I had a feeling that somehow Z and temperature were related, and hypothesized a directly proportionality between Z and temperature. I prepared my procedures accordingly. Methods/Materials I used HCl and NaOH at dilute concentrations and small volumes for safety and to conserve resource. I used a pH probe, a magnetic stirrer, and a CBL. (I used the CBL to collect and to transfer the data to a TI 82) There were many challenges at first, things that seem as insignificant as how fast you pour the NaOH or where you pour it had a drastic effect on the data. Results In the end, I obtained data for 10oC, 23oC, 40oC, 60oC. Data were in the form of pH over time, so I had to convert it to [H+] over time, and then to rate of reaction over time, then to rate constant over time, then finally to Z over time. I averaged the Z at each temperature, and ended with an unique Z for each of the temperatures. Conclusions/Discussion After trying equation after equation, I decided that the data points are best represented by $Z = 24.4 t^{(1/2)}$, where t is temperature in degrees Celsius. Original hypothesis rejected. (Actually, conclusion is still under revision as I add more statistical findings to support a best fit curve and infer the range where an actual curve should lie.)	
Summary Statement I am trying to find a causation between temperature and the z-collision rate factor.	
Help Received Received help from textbooks and from educational CDs. I am about to ask help from my stat teacher, Mr. Waters.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Ryan Y. Huang	Project Number S0511
Project Title The Effect of Oxidizing Agents on the Surface Energy of Plastics	
Abstract Objectives/Goals Do oxidizing agents affect the surface energies of plastics? My objective is to expose each plastic to an oxidizing agent and to find out the results. Methods/Materials Methods: Oxidizing Agents were used to change the surface energy of plastic surfaces. Materials: Plastics: 70 Polypropylene (3## x 2## pieces); 70 High Density Polyethylene (3## x 2## pieces); 70 Low Density Polyethylene(3## x 2## pieces); 70 Acrylonitrile Butadiene Strylene(3## x 2## pieces); 70 Polyvinyl Chloride(3## x 2## pieces); 70 Acrylic Sheet. (3## x 2## pieces). Chemicals: 1 Hydrogen Peroxide (2L bottles); 2 Drano Drain Cleaner (1 L bottle); 1 Three quarts - Clorox; 1 Iodine Bottles (24 ounces bottle); 1 Baking Soda (12 ounce container); 1 Propane. Other: 30 Cotton Swabs; 3 Glass Cup; 1 Aluminum Wire; 1 Timer. Results Results: The plastics that were treated in Drano, Clorox, and propane seemed to have the biggest changes in my experiments. Baking Soda, Iodine, and hydrogen peroxide made differences, though not as drastic as the others. Conclusions/Discussion Conclusion: Plastics that are treated first will have greater surface energies. It is important to treat plastics that will be used in adhesion, for the adhesiveness will be greater.	
Summary Statement Oxidizing Agents were used to change the surface energy of plastic surfaces.	
Help Received Father helped build board.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) William R. Ito	Project Number S0512
Project Title Studying Clean: Determining the Effectiveness of Six HE Laundry Detergents upon Various Stains on White Cotton	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Determining what brand of HE liquid laundry detergent is most effective at removing a variety of stains. Creating a process to quantify the cleaning power of the detergents tested.</p> <p>Methods/Materials Six test stains (lipstick, BBQ sauce, mustard, shoe polish, grease, wine) were each applied to seven different shirts. An image of each stained shirt was recorded using a webcam and analyzed in Adobe Photoshop. Each shirt was assigned one of the six detergents tested (Cheer, Purex, Wisk, Gain, All, Tide) with the seventh saved as a control using water. Each shirt was washed with its respective detergent. An image of each washed shirt was recorded and analyzed.</p> <p>Results The Tide was on average most effective at removing the various stains, followed closely by All. In general, Tide was more effective at removing the organic stains while All was more effective at removing inorganic stains. Purex was worst at removing stains.</p> <p>Conclusions/Discussion Certain detergents are most effective on cleaning specific types of stains. Detergent manufacturers must decide whether to focus specific fabric or stain-types, or to create a more general purpose detergent that is less effective overall. For an accurate overall evaluation of the detergents, the tests will need to be repeated on different fabric types.</p>	
Summary Statement Determining the effectiveness of six HE laundry detergents upon various stains on white cotton.	
Help Received Father helped construct lab setup and backboard	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Annick-Marie S. Jordan	Project Number S0513
Project Title Making and Testing Soap	
Abstract Objectives/Goals Throughout this whole project, I have created various types of soaps and other ingredients that contribute to the soap making process. There are many different ingredients that are needed to create a great soap. I created three soaps made with vegetable oil, and three soaps made with vegetable shortening. I predicted that the soaps made with vegetable shortening would turn out the best. I felt that the soaps made with vegetable oil would not be as creamy, or evenly mixed compared to the other soaps made with vegetable shortening. Later, I performed a survey to see what the most popular soap would be. I had ten female students and ten male students wash their hands with every soap I made. Then, they told me which soap smelt the best to them, and which soap lathered or felt the best. I also produced three different types of essential oils through the process of distillation. I also tested the pH of different manufactured shampoos, using a pH meter. Methods/Materials Distillation: Condenser Tube, Rubber Tubing, Petri Dishes and Lids, Flask, L-Shaped Tube, Hot Plate, Beakers, 4 Tablespoons of ground coffee, orange peel, and lemon peel, Rubber stoppers, vegetable oil, reagent alcohol. Shampoo Testing: pH meter, 1 oz. bottles, 6 Different brands of manufactured shampoos, Beakers. Soap: Sodium Hydroxide, Spring Water, Vegetable Oil, Vegetable shortening. Results The soaps made with vegetable shortening turned out exceptionally well. They were creamier, evenly mixed, and just turned out better, as a whole. After completing the survey, it was apparent that the oatmeal soap was most popular and the vegetarian soap was least popular. All of the shampoos had a pH that was near 7, which is what they all should have read. Conclusions/Discussion After analyzing the survey I came to the conclusion that if I was to market the soaps, I would create a soap with the fragrance of the Oatmeal Soap, and the texture of the country apple soap for the females. For the males, however, I would just market the Oatmeal Soap the way it is. The distillation process worked in creating three different types of essential oils (orange, lemon, and coffee) that can be used in making more soap. All of the manufactured shampoos that I tested are perfectly fine. The pH of all of the shampoos is correct, and none of the shampoos should stop being marketed.	
Summary Statement I made and tested various types of soaps and many other ingredients that make up soap.	
Help Received I used Ribet Academy's chemistry lab	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Todd A. Karin	Project Number S0514
Project Title Calcium Oxalate as a Protector of Marble	
Abstract Objectives/Goals Marble statues, buildings and flooring all have one major downfall: they deteriorate when they come in contact with acids. Commercial methods to protect marble require many steps that are awkward for large, intricate statues. Also, marble statues all over the world have been deteriorating due to damage caused by acid rain. My goal is to find a way to prevent marble from deterioration caused by acids. Methods/Materials For each test, calcium oxalate is formed on the surface of the marble. Stage 1 - Tested calcium oxalate (Ca Ox) for protective capabilities against acid disintegration. Stage 2 - Compared Ca Ox protection to a professionally used marble sealant. Stage 3 - Tested if spray application protects marble as well as a dipping application. Stage 4 - Tested effects of acid rain on Ca Ox protected marble. Stage 5 - Tested effectiveness of different application methods: dipping, spraying and rolling. Results Stage 1 - Ca Ox protects marble dipped in acids. Stage 2 - Ca Ox protects marble 16 times better than a commercial sealant. Stage 3 - A spray method is 6 times more protective than a dipping method. Stage 4 - Ca Ox protects marble from acid rain. Stage 5 - Results in progress. Conclusions/Discussion Ca Ox is an excellent protector of marble. Treated pieces have much more resistance to acids than untreated ones. Ca Ox has 16 times the protective effects of methods currently in practice. Spraying is a practical application method for large or intricate statues. Acid rain is much less destructive on calcium oxalate protected marble than untreated marble.	
Summary Statement To see if calcium oxalate is a useful method of protecting marble against deterioration caused by acids.	
Help Received Supervised by Vicky Wendell; Recieved a technical paper from Dr. Schrer of Princeton University	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Syedali A. Khan	Project Number S0515
Project Title What Is the Effect of Temperature on the Corrosion of Aluminum?	
Abstract	
Objectives/Goals To determine the relationship between the temperature and the corrosion rate of aluminum and to prove or disprove the hypothesis that the corrosion rate would be affected by temperature.	
Methods/Materials Materials: 3 Rubber-band 3 Aluminum computer port covers 18g Sodium Chloride (NaCl) 41g Ferric Chloride (FeCl ₃) 3 600 ml beaker 1 Incubator 1 Storage bin 1 Aquarium heater 1 Aquarium circulator Method: The (3) 600ml beakers were filled with 450ml of water. The solution was created by adding 5.85g of sodium chloride and 13.52g of ferric chloride to the water. The (3) computer port covers were placed in the (3) beakers. Each of the beakers were covered with plastic wrap and a rubber-band was stretched around each to hold the plastic wrap securely. The (3) beakers were placed in 65C, 33C and 21C environments.	
Results The temperature did have an effect of the corrosion of aluminum. The port strip submerged into 65C corroded the most as compared to others. The 33C did not corrode due to time limitation. The solution set to 21C did not corrode because there was not enough kinetic energy to increase the rate of corrosion. The aluminum submerged into the higher temperature did corrode due to the increase of collision of particles.	
Conclusions/Discussion It was concluded that temperature does have some effect on the corrosion of aluminum. Time was also discovered to be an important factor in corroding the substance.	
Summary Statement The project determines whether or not if temperature has an effect on the corrosion of aluminum.	
Help Received None	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Natalya Kostandova	Project Number S0516
Project Title Thin-Layer Chromatography vs. Spectroscopy: Analysis Techniques of Color Identification in Cosmetics	
Abstract Objectives/Goals The objective of the experiment was to find out which one, Thin-Layer Chromatography (TLC) or Spectroscopy, is a more efficient way to identify and analyze FDA colors present in cosmetics, specifically for those used in the eye area. Methods/Materials After 30 standard colors were prepared, I ran them through TLC and spectroscopy, analyzing and comparing the Rf values for TLC and absorption peaks for spectroscopy. Then, I used these techniques to test several samples of actual cosmetic products and obtained data. I also tested three different application techniques to attain more efficient chromatograms. Results When testing standard organic colors, both methods were efficient, with spectroscopy being slightly better than TLC. TLC was deficient in separating inorganic colors, while spectroscopy was able to obtain peaks for 10 out of 16 colors tested. When testing actual samples, however, spectroscopy was largely inept, while Thin-Layer Chromatography showed to be quite efficient as most of the samples separated into several spots. Application technique two (application after development in methylene chloride, vortex, and sonicate) was the most efficient application technique. Conclusions/Discussion While spectroscopy was more efficient than TLC when identifying the standard FDA colors, it did not show absorbance peaks for most of samples because of their high concentration and oil-solubility. On the other hand, TLC allows the colors in the samples to be separated. Both spectroscopy and TLC were inefficient in identifying inorganic colors because of their insolubility in water. TLC also allows for analysis of colors based on their qualitative and quantitative data - the color of the spots resulting from separation and the Rf values.	
Summary Statement My project was conducted to compare and contrast two techniques that are used by chemists in color identification in products such as cosmetics.	
Help Received Used lab equipment at a local laboratory	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Dmitry Kravchenko	Project Number S0517
Project Title Modification of Calcium-Phosphate Coatings on Titanium by Recombinant Amelogenin	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Investigate the effects of amelogenin on calcium phosphate crystal morphology to gain a better understanding of the mechanisms in enamel biomineralization, and to design a coating with improved osteo-integration properties.</p> <p>Methods/Materials To simulate an environment similar to that in dental enamel, amelogenin was applied to a titanium surfaces submerged in SCS's, solutions that resemble physiologic fluid and allow for the formation of calcium phosphate crystals. The samples were then treated with various agents to improve surface reactivity.</p> <p>Results At certain concentrations, amelogenin had a significant affect on the morphology of calcium phosphate crystals. It is not known which conditions are favorable, but the data goes to show that dose-depnent amelogenin has an effect on the topography of calcium phosphate crystals.</p> <p>Conclusions/Discussion The spectacular effects of amelogenin on apatite crystals sustain the idea that amelogenin facilitates the formation of enamel crystals. Amelogenin was found to have a significant, elongationg effect on the morphology of Calcium-Phosphate crystals. Furthermore, the effects of amelogenin on the transformation of Calcium-Phosphate crystals is reliant on certain aspects, such as the concentration of amelogenin and the type of crystal.</p>	
Summary Statement Investigating mechanisms in dental enamel and potential development of a novel biomaterial.	
Help Received Used lab equipment at the Center for Craniofacial Molecular Biology at the University of Southern California under the supervision of Dr. Janet Oldak and Dr. Chang Du	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) So-Ky R. Loren	Project Number S0518
Project Title Electrolysis	
Objectives/Goals I wanted to see what would separate more hydrogen from salt water. Would a higher concentration of salt separate more, or would a higher voltage separate more.	
Abstract Methods/Materials How I went about this project was I set up a tub and filled it with 5000 mL of water at 47 degrees Celsius. I then added 5% salt concentration to the water. I put two graduated cylinders into the salt-water solution and filled them up to their top line. I would then put two electrodes attached to copper-wire in the cylinder and attach the wire to a 1.5-volt battery. I would allow the battery to be attached for a total of five minutes. After five minutes had passed I would observe how far the level of the water had dropped in the cylinder. I kept the first trial as a base trial, and I continued this process with a 10%, 15%, and 20% salt concentration at 1.5-volts. I tested a 5% concentration with 3-volts, 4.5-volts, and 6-volts.	
Results My results showed that the increase of voltage showed a significant increase of hydrogen separated. The amount of hydrogen separated during the voltage trials was much greater than the hydrogen separated during the concentration trials.	
Conclusions/Discussion My conclusion is that an increase of voltage will separate more hydrogen than an increase in concentration (of salt).	
Summary Statement I separated hydrogen from salt water.	
Help Received My teacher answered some questions, and I used my school's limited resources.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Fernando Magallon	Project Number S0519
Project Title Using Fluorescence Quenching as an Indicator for Successful Reaction in Copper (I) Catalyzed [3+2] Cycloaddition	
Abstract Objectives/Goals -Find reaction conditions for using fluorescence quenching as an indicator for successful reaction in copper(I) catalyzed [3+2] cycloaddition. -Find copper binding ligands that can accelerate the [3+2] cycloaddition. Methods/Materials Materials: Dansyl azide, dansyl alkyne, tris-HCl buffer pH 7.0, 7.5, 8.0 8.5, copper sulfate, DMSO, H ₂ O, sodium ascorbate, 96-well plate, phenanthroline. Procedures: 1) Place 100uL of 50uM dansyl azide/dansyl alkyne mixture into columns 1-6. 2) Place 100uL of 50uM unreactive quencher/dansyl azide mixture into row D and H in columns 7-12. 3) Place 75uL of 50uM unreactive quencher/dansyl azide mixture and 25uL of 50uM adduct solution into row C and G in columns 7-12. 4) Place 50uL of 50uM unreactive quencher/dansyl azide mixture and 50uL of 50uM adduct solution into row B and F in columns 7-12. 5) Place 100uL of 50uM adduct solution into row A and E in columns 7-12. 6) Place 50uL of 1mM CuSO ₄ solution in water into rows A-D. 7) Place 50uL of 500uM CuSO ₄ solution in water into rows E-H. 8) Place 50uL of Tris-HCl buffer pH=8.5 into columns 1-12. 9) Place 25uL of 10mM ligand into columns 1 and 7. 10) Place 25uL of 5mM ligand into columns 2 and 8. 11) Place 25uL of 2mM ligand into columns 3 and 9. 12) Place 25uL of 1mM ligand into columns 4 and 10. 13) Place 25uL of 500uM ligand into columns 5 and 11. 14) Place 25uL of 250uM ligand into columns 6 and 12. 15) Place 50uL of 100mM sodium ascorbate into columns 1-12. 16) Place 96-well plate in UV plate reader for 1 hour, set to collect fluorescence values every 2 minutes. Results Reaction conditions were found at 50uM fluorophore concentration. Ligands found that accelerate reaction to 100% completion are commercially available. Kinetics were done on best ligands and graphs with equations have been determined to calculate the concentration of the substrates at a certain time period. Conclusions/Discussion These conditions are very useful for efficiently labeling and functionalizing viruses with compounds in [3+2] cycloaddition to make them target for example certain cells in the human body, like cancer. Also, these conditions for reaction in [3+2] cycloaddition may have many other applications.	
Summary Statement I am finding reaction conditions for using fluorescence quenching as an indicator for successful reaction in copper (I) catalyzed [3+2] cycloaddition, and finding copper binding ligands that can accelerate the reaction.	
Help Received My mentor Warren Lewis, at The Scripps Research Institute helped me learn the level of chemistry required to perform this research, along with help on getting started on doing kinetics.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Robert Markey; Sean Shanahan	Project Number S0520
Project Title Recipe for Disaster	
Abstract Objectives/Goals The objective is to find the the mixture of black powder that yields the strongest reaction. Methods/Materials Potassium Nitrate, sulful and charcoal were purchased. Pestal, mortar, and saftey equipment were borrowed form our high school science lab. Different ratios of the chemicals were used to make mixtures of black powder and forced to react. Reaction yield was measured by reaction time, reaction height and distance, as well as unreacted pieces. Results The black powder mixture with the ratio of 6:4:1 of potassium nitrate, sulfur, and charcoal respectivley, was found to have the greatest reaction. The mixture with a ratio of 6:4:3 was found to have the fastest reactionm time, but had the most limited reaction distance. the other two mixtures provided no results to indicate their reactions as stronger than either the 6:4:1 or 6:4:3 ratios. Conclusions/Discussion All four mixtures reacted succesfully, however; the mixture with a 6:4:1 ratio clearly and consistently had a stronger, larger and longer lasting reaction. It produced a larger area of reaction over a larger time giving conclusivly showing that it had the strongest reaction out of all of our test samples.	
Summary Statement Our project was to determine what mixture of chemicals in black powder yielded the strongest reaction.	
Help Received Used lab equipment from Willits High School under supervision of Mr. Kirkpatrick	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Alison S. Mathis	Project Number S0521
Project Title Viability of a Simple "At-Home" Test of Relative Amounts of Ascorbic Acid	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Carefully follow the lab instructions and record, in order from the most ascorbic acid to the least ascorbic acid. Compare relative concentration with the actual amount of ascorbic acid in each fruit.</p> <p>Methods/Materials What I did was I made a ramp out of wood and also I made a spacer that would hold the wood at exactly 16 degrees. I would then ensure that the ramp was perfectly even against table so that there would be no bounce effect. When all that was checked I would then start the testing. First I placed the ball bearing on a marked spot on the wood (180mm from the end of the ramp) and pulled away the pencil that was holding it. After it stopped rolling on the material I measured how far it went and recorded it in my log book. I repeated this 100 times for each material.</p> <p>Results In order from most ascorbic acid to least ascorbic acid according to my tests: Tangerine, Orange, Tomato, Grapefruit, Lemon, Lime.</p> <p>In order from most ascorbic acid to least ascorbic acid according to their tests: Orange, Lemon, Grapefruit, Tangerine, Lime, Tomato</p> <p>Conclusions/Discussion My hypothesis was incorrect. The lab is not consistent in showing which fruit has the most ascorbic acid. When the lab stayed consistent for three tests, I noted that the results were not the same as the results given. This particular test cannot be done by a simple "at-home" lab test.</p>	
Summary Statement To test the viability of a simple "at-home" test for testing relative amounts of ascorbic acid in certain fruits.	
Help Received	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Dana A. Mead	Project Number S0522
Project Title Does the Amount of Ammonia Affect Forming Salt Crystals?	
Objectives/Goals I was looking at crystal growth and how it would change if the formula was changed. The regular salt crystal formula works well. If I was to omit ammonia from the formula, would it allow the crystals to form properly? I also wanted to double the amount of ammonia to see if the crystals would form better.	
Abstract Methods/Materials For this project I needed 9 sponges, 9 bowls, Mrs. Stewarts bluing, table salt, ammonia, ruler, marker, camera, mixing glass and measuring spoons. I labeled the bowls IABC, IIABC, IIIABC (3 each) and put the same size sponge in each bowl. Day one I mixed 2TbIs of each: bluing, salt, water, and poured this into IABC. For bowls IIABC, I added 2 TbIs of ammonia to the formula and to bowls IIIABC added 4 TbIs of ammonia to the formula. On day 2, I added 2 TbIs of salt to each bowl. On day 3, I repeated day 1. Don't pour solution on the crystals or they will dissolve.	
Results Group I started forming crystals in 5 hrs. This group had no ammonia and formed crystals that were hard and platelike instead of being soft and fluffy. They only formed .5mm up from the solution on the side of the bowl. They formed crystals up to 2 mm on the sponge and were very sparse. The color was a yellowish tint. There wasn't any formation after 11 days. Group II started forming in 1 hour and it had 2 TbIs of ammonia in the formula. Crystals formed up the side, over the lip, and down the outside of the bowl. Crystals formed up to 3 mm high and were snowwhite, soft, fluffy, and very dense. A lot of crystal sloughed off onto the table. The crystals stopped forming in 11 days. Group III had the same results as group II except the crystals formed to 5 mm high. They started forming slower but ended up forming higher.	
Conclusions/Discussion My conclusion is that the chemical reaction to form salt crystals is very complex. When there is no ammonia there is not the right ingredients to cause a chemical change to form salt crystals that look like the original salt formula, or form many crystals at all. The regular formula had all of the right ingredients to cause a good chemical reaction and formed salt crystals very well. When the ammonia was doubled, the crystals didn't form as fast but they out performed in the end. The amount of ammonia does make a difference in forming salt crystals.	
Summary Statement My project is to see how the amount of ammonia will affect the growth of salt crystals.	
Help Received My grandfather helped gather the materials used and gave me advise on setting up the project.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Sliman M. Nawabi	Project Number S0523
Project Title The Effect of Different Types of Woods on the Energy Released in a Combustion Reaction	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this experiment was to determine and relate the energy that is released in a combustion reaction for four different types of wood.</p> <p>Methods/Materials A small block of wood was placed on top of a 25.4 cm long bolt that was glued to a 2cm in diameter washer. This allowed the wood to burn under the test-tube, which was set 5 cm from the wood. The block of wood was then burnt, and the temperature of the water was recorded before the reaction and then again 35seconds after the reaction had taken place. The temperature change of the water, along with the mass of the wood before and after reaction, allowed the energy of the wood to be calculated.</p> <p>Results From the data it was shown that pine wood had the highest average energy at -330.8 Joules/gram, fur wood had the second highest average energy at -117.4 Joules/gram, Redwood had the third highest average energy at -107.7 Joules/gram, and finally cedar had the lowest average energy at -104.2 Joules/gram.</p> <p>Conclusions/Discussion In conclusion it was found that pine wood had the highest amount of energy released in combustion reaction. The purpose of this experiment was to determine and relate the energy that is released in a combustion reaction for four different types of wood. A piece of wood was placed on top of a 25.4 cm long bolt that was glued to a 2cm in diameter washer. This allowed the wood to burn under the test-tube, which was 5cm away from the block of wood. The block of wood was then burnt, and the temperature of the water was recorded before the reaction and after 35seconds that the reaction had taken place. The temperature of the water allowed the energy of the wood to be calculated by using to separate equations.</p>	
Summary Statement How four different types of woods compared to each other in the energy released when they were combusting.	
Help Received My teacher helped me by lending me some of the equipment necessary to complete this experiment.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Aditya Rajagopal	Project Number S0524
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Project Title Synthesis of Gallium Oxide Nanowires by Chemical Vapor Deposition
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<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The goal of this project was to synthesize gallium oxide nanowires.</p> <p>Methods/Materials The fabrication of the nanowires was done by a process known as chemical vapor deposition. In this method, the gallium metal is vaporized in a vacuum tube, while an mixture argon-oxygen gas is flowed in. The oxygen reacts with the vaporized gallium to form a gallium(3+) oxide molecule. This gallium oxide molecule then deposits on a silicon substrate laced with a gold catalyst. The wires then grow radially outward from the single gold catalyst molecule. The stucture, composition, and presence of wires is then checked using a Scanning Electron Microscope.</p> <p>Results In my project, I tested the effect of temperature fluctuation on the synthesis of gallium oxide, Ga₂O₃, nanowires. I attempted to synthesize wires at the following temperatures: 850 centigrade (C), 860 C, 870 C, 880 C, 920 C, 940 C, 950 C, and 980 C. During all the synthesis the pressure was kept approximately constant at 10⁻⁴ torr; furthermore, the a constant flow-rate, constant reaction time, and similar silicon wafers assured that the differences in the synthesis processes would be due to differences in temperature alone.</p> <p>To that end, I observed a distinct difference between the synthesis of nanowires in the different temperature ranges. In the first synthesis at 920 C, I observed a plethora of nanowires of different sizes and lengths. Most wires appeared to be well over tens of microns in length. The diameter of the wires, which is controlled by the size of the gold catalyst molecules, ranged from 16.2nm to 34nm, with an average of 22.4nm.</p> <p>Furthermore, a large number of nanowires were also found on the samples fabricated at 940 C, 950 C, 880 C, and 870 C. The synthesis reactions at 980 C, 860 C, and 850 C yielded no wires.</p> <p>Conclusions/Discussion I found empirically that the best heating temperature was 920 degrees; this temperature resulted in the largest number of actual wires (approximated), as well as the best quality of wires. The goal of this project was to discover if it was possible to grow gallium oxide nanowires, and if so, to find the best synthesis conditions for these wires. To this end, I was successful. The data I collected in this experiment serves as a foundation for my continuing research concerning the electrical properties of gallium oxide nanowires.</p>
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Summary Statement My project is about the synthesis of Gallium Oxide nanowires, possible semiconductors, for future use in nanodevices such as MEMs.
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Help Received Used lab equipment at UCI; Mr. Zhiyong Fan's help in the electron microscope imaging of the wires.
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**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Cameron J. Shepherd	Project Number S0525
Project Title Ionic Equilibria Control by Hydrophilic Micellar Sequestration Applied to Purification of Oily Mixed Radioactive Waste	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals I investigated properties and application of amphiphilic micelles. I found, atypically, that hydrophilic SDS micelles were able to sequester polar compounds in polar solutions. This suggested that mixed phase extractions could be improved. I was able to obtain enhanced separation of simulated oily mixed radioactive waste by washing ion-contaminated motor oil with water containing hydrophilic micelles.</p> <p>Methods/Materials I built a conductivity detector using graphite rods, current meter, and 5 volt oscillator circuit. The rod sides were coated in paraffin. Solutions were magnetically stirred in a beaker in my garage. Calibration was achieved using potassium chloride (KCl) standards. Experimental solutions included deionized water (DI), Chevron 20W50 motor oil, sodium dodecyl sulfate (SDS) in DI and oil, KCl in DI and oil, and Triton X-100 in DI and oil.</p> <p>Results Aqueous SDS conductivity increased linearly until 0.007 M, showing the threshold at which SDS molecules aggregated and micelles began to form. Ion sequestration was evidenced by lack of conductivity increase during the addition of KCl to two well-formed micelle solutions, SDS at 0.057 & 0.04 M until KCl concentration reached 0.002 M. The capability of micelles to aid in extraction of ions from regular and KCl-saturated oil was tested by vigorously mixing oil and DI for 15 minutes and then measuring the conductivity of the aqueous component. Further tests with hydrophilic micelles in aqueous phase or with hydrophobic micelles in organic phase revealed that aqueous micelle addition significantly increased the extraction efficiency over DI. Triton X-100 micelles did not sequester KCl and did not enhance extraction, consistent with the hypothesis.</p> <p>Conclusions/Discussion The advantage of hydrophilic micelles in extracting ions from simulated oily mixed radioactive waste demonstrates a counterintuitive application of micelles. Ionic equilibrium is affected by micelles as they begin to form (above 0.007 M SDS) and when micellar rearrangements occur (0.013 M and higher SDS concentrations). When initial micellar ion capacity is reached (above 0.004 M KCl), non-equilibrium behavior is observed as the micelles appear to rearrange to increase exposed binding sites. These non-equilibrium behaviors can be exploited to enhance ion extraction, especially in combination with factors influencing micelle development such as stirring rate and pH, as shown in my report.</p>	
Summary Statement I investigated micellar impacts upon ionic equilibrium and found a way to use micelles to improve the extraction of ions (simulated radioactivity) from oil.	
Help Received Deionized water, pH buffers, and conductivity standards were donated by the Metropolitan Water District. My mother and father assisted in board arrangement and critiqued my conclusions.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Teiwaz T. Steenblock-Smith	Project Number S0526
Project Title Hydrofoam: Changing the Way the World is Powered	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To make the use of hydrogen as an energy resource safer and more versatile to prevent pollution. To determine the combustibility of hydrogen foams made up of specific bubble sizes. To determine effects of solution chemistry on the foam (absorption, diffusion, combustion, and electrochemistry). To compare the propulsion of the combustion of Hydrofoam to that of hydrogen gas (using rockets). To test the absorption of Hydrofoam and compare it to that of hydrogen gas for safer storage possibilities (using open-ended monometers). To run a generator engine on Hydrofoam. To power a hydrogen fuel cell on Hydrofoam.</p> <p>Methods/Materials Use a hydrogen tank and various filters to create hydrogen foams in fire-fighter foam solutions. Create bubble sizes in each foam solution in .5mm increments from .5mm on. Ignite foams and evaluate combustibility. Additional experiments were conducted in Hydrofoam versatility by: 1) Making Hydrofoam rockets. 2) Testing hydrogen absorption. 3) Adding materials to the solution to increase combustibility. To run combustion engine on Hydrofoam, the foam must be created at pressure and propelled to the engine.</p> <p>Results Hydrogen foams range in combustibility from noncombustible in bubble sizes up to 5.5mm to explosive at approximately 20mm. Rates vary for different solutions (A, B and Joy). The Hydrofoam rockets went about the same height as the hydrogen gas rockets. There appeared to be no difference in the amount of absorption between the foam and the gas. Using additives to increase combustibility of solution did not work because all reacted with the solution making it unable to foam. Hydrofoam was created at pressure to propel itself through piping. The engine was powered by Hydrofoam. The fuel cell has a system designed to power it on Hydrofoam and will be running hopefully soon.</p> <p>Conclusions/Discussion The rate of hydrogen foam's combustion is directly related to the bubble size in the foam. Hydrogen foams can be physically and chemically altered for different applications of combustion and chemical reaction rates. Hydrofoam can be used to power generators and hydrogen fuel cells. It could be used as a safety precaution in the system before entering an adjustment phase. The largest issue with powering the fuel cell on Hydrofoam is that the foam would need to be transformed back into pure hydrogen gas in order to power the fuel cell.</p>	
Summary Statement Controlling the combustion rate of hydrogen by making it into a foam and controlling the bubble size within the foam.	
Help Received Father helped oversee the early experiments and helped get some of the materials.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Zhuo (Matthew) Sun	Project Number S0527
Project Title Comparing Lactose Percentage between Whole Milk and Powdered Milk	
Objectives/Goals To measure and compare the carbohydrate content of whole milk and powdered milk, using lactose free milk as control, by isolating and crystallizing lactose. To calculate percentage lactose of these milk.	
Abstract	
Methods/Materials Method: 1) Measure 24.27ml(25g) of lactose free and whole milk into separate test tubes(50ml). Mix 3.225g of milk powder with 21.775ml of distilled water, based on the 88.1% water composition in milk. 2) Heat 50°C for 5 min. in water bath. 3) Centrifuge at 3500rpm for 10 min. All fat will float on top. 4) Remove the fat layer using a spatula 5) At 40°C, add 1ml of 10% acetic acid in increments of 0.5ml while stirring using the vortex machine. Casein precipitates. 6) Centrifuge for 8 min. at 3500 rpm. 7) Decant the supernatant(whey) to another test tube, and then to each, add 0.22 g of CaCO ₃ . 8) Heat in water bath at 60°C, then let it cool. Lactalbumins and lactoglobulins precipitates. 9) Add 15ml of ethanol 95% to each test tube with stirring, then heat to 60°C for 4 min. Layers of different densities and solutes separate. 10) Centrifuge for 5 min. at 3500 rpm 11) Transfer to a pre-weighed test tube. 12) Place in heater at 60°C for 2 hours. 13) Continue heating at 80°C for 20 hours. 14) Freeze dry with vacuum for 24 hours.	
Results Lactose/fat free milk has the greatest percentage carbohydrate with an average of 5.379%. On the other hand, the experimental results showed that whole milk and powdered milk statistically have the same percentage lactose with averages of 4.556% and 4.884% respectively.	
Conclusions/Discussion The lactose content of the milk has been fully preserved when the milk is dried and turned into powder. However, unlike powdered milk which can stay fresh for a long period of time at room temperature, the bacteria present in whole milk that has not been pasteurized will convert the lactose present in milk into lactic acid gradually, making the milk sour.	
Summary Statement This research compares the percentage lactose between whole milk and powdered milk while using lactose/fat free milk as control.	
Help Received parents helped in providing a place of and setting up the experiment.	



CALIFORNIA STATE SCIENCE FAIR 2004 PROJECT SUMMARY

Name(s) Claire A. Totten	Project Number S0528
Project Title FCSI: Fingerprinting the Crime Scene Investigation	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This experiment involves the various ways of fingerprinting, and how they measure up to the most common method of fingerprinting- bi-chromatic powder. The goal in this experiment is to determine if the bi-chromatic powder will usually work well on all surfaces.</p> <p>Methods/Materials The fingerprinting scale is the control in this experiment. The surfaces that will be tested are a piece of painted wood, a soda can, unfinished wood, computer paper, a piece of plastic, and a glass bottle. These surfaces will be tested with your traditional bi-chromatic powder, white powder, magnetic powder, fluorescent powder, super glue with glue fuming process, a dye stain process, and a Ninhydrin solution. The various methods of fingerprinting will be performed on the various surfaces, and then the resulting fingerprints will be examined and matched to the fingerprinting scale.</p> <p>Results The results of experiment very closely proved the hypothesis. The bi-chromatic powder proved to actually obtain a 5 or above on all the surfaces except the unfinished wood. The 4 powders tested faired quite well in the experiment, usually producing a 3 or above on the scale. All of the other methods of fingerprinting proved to work best on specific surfaces;the super glue with glue fuming, dye stain process, and the Ninhydrin solution.</p> <p>Conclusions/Discussion In this experiment; the hypothesis was very closely proved through the analysis of data. Yet, these answers happened for a reason. All the powders worked fairly well, because they are attracted to the moisture within the print. The bi-chromatic black is basic, therefore working well on most materials. The white powder will work best on a dark surface or on a clear surface. The Fluorescent powder is best to use on electronic items or things that we do not want to be ruined, such as expensive items- it is only visable with an alternate light source. Finally, the magnetic powder, also works well on almost any surface. The Super Glue and Dye Stain work the best with the painted wood, the soda can, and the plastic because it allows for them to have something to adhere to; yet one has to be willing to destroy the item in order to obtain the print. Finally the Ninhydrin works the best on paper, and most often produces a perfect print; it stains the amino acids that were set onto the paper with the application of the fingerprint.</p>	
Summary Statement This project is about all the different types of methods tested on assorted materials; to conclude which method is most reliable.	
Help Received Sheriff Bob Brooks aided me in contacting the Ventura County Crime Lab; Renee Artmen, head of the crime lab, gave my family and I a tour of the Crime Lab; Debbie Pearson, a skilled fingerprint examiner taught me about fingerprints; And a big thanks to Officer Erik Knepper for spending weeks with me	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Samantha V.A. Tran; Kristina N. Tubera	Project Number S0529
Project Title Ice Spike Formation in the Presence of a Strong Wind	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this experiment was to characterize the specific conditions of ice spike formation in the presence of a strong wind.</p> <p>Methods/Materials The experiment was conducted by testing various types of water (i.e. Arrowhead steam-distilled water, Alhambra crystal fresh reverse-osmosis drinking water, and Santa Clara city tap water) in different ice cube containers (plastic and aluminum). A temperature-controlled environmental chamber was used to conduct the trials. Containers were filled with the same amount of water, with and without contaminants. Spike growth was continuously monitored over a range of temperatures (-5C to -30C). The process was visually and continuously observed with a video camera.</p> <p>Results Ice spike formation under conditions of a strong wind created by the blower in the temperature-controlled environmental chamber is best in a non-aluminum container using distilled water at -5C to -11C.</p> <p>Conclusions/Discussion Any minimal amount of sediment, particles, or minerals present in the water prevented the formation of ice spikes. The internal pressure that builds up in the ice cell results in bulges and cracks, which eventually pave the way for the formation of ice spikes. Ice spike growth continues to a certain limit, yet further research must be done to determine the nature of this process. It was concluded that the research hypothesis of this project was fully supported because: 1. ice spikes of different character formed in distilled water at a variety of temperatures; 2. ice spikes did not form in Santa Clara city tap water due to its mineral content; 3. ice spikes did not form in distilled water contaminated by sodium chloride; 4. it appears that the smallest amount of contamination inhibited ice spike formation. Avenues for further study were also identified.</p>	
Summary Statement Ice spike formation was observed in a temperature-controlled environmental chamber and optimal conditions for their formation were identified.	
Help Received Supportive mentoring was provided by Dr. John C. Howe and Dr. Charles Barker. They also provided ongoing supervision in the use of the environmental test facilities at Aurora Networks in Santa Clara to ensure proper safety procedures were followed.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Rachel L. Woolf	Project Number S0530
Project Title Discovery of a New Natural Dye in My Own Backyard: Ipomoea indica	
Abstract Objectives/Goals Since I knit and spin wool for a hobby, my goal was to find a natural dye, that has not yet been discovered, to dye wool. After testing several flowers in my backyard, I chose Ipomoea indica, or morning glories because they have not been, according to my search, extensively studied. Since the flowers are blue, I predicted that the wool would end up blue or purple. I chose to compare morning glories to a well-documented natural dye, marigolds. Methods/Materials I dyed the wool using two concentrations of six mordants (chemicals that bind color molecules to wool) in both morning glories and marigolds. I used standard dyeing methods for natural dyeing. Results I produced a wide range of pleasing colors using morning glories, depending on the mordant used, from pink to yellow and green. This was very surprising since the original dye bath was blue. The pH's of the mordanted wool varied greatly and changed the color of the dye bath and the color of the wool. The wool dyed with marigolds, however, stayed in the range of yellows, golds, and browns. Conclusions/Discussion I found that the dye of the morning glory flower produces a variety of beautiful pastel colors which can be useful to knitters or weavers. These colors are the result of the pH dependent cyanidin (the color molecule of the flowers) as well as the mordants used.	
Summary Statement I discovered Ipomoea indica, or morning glories, to be a new natural wool dye that produces a wide variety of colors useful for knitters and weavers.	
Help Received I did the work myself with the support and advice of my teachers and parents.	



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) <p align="center">Arman S. Zaman</p>	Project Number <p align="center">S0531</p>
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Project Title
The Effect of Electrolyte and Non-Electrolyte Solutes on the Freezing Point Depression of Water

Abstract

Objectives/Goals
The objective is to determine the effect of electrolyte and non-electrolyte solutes on the freezing point depression of water.

Methods/Materials
1. Prepare a solution of salt (NaCl) by adding 5.8 grams of salt to 100 mL of distilled water. This makes a 1 molal solution. 2. Prepare a solution of sugar by adding 34 grams of sugar to 100 mL of distilled water. This is a 1 molal solution. 3. Place a test tube that is 1/2 full with the NaCl solution in an ice bath. 4. When the 1st ice crystals appear on the inside wall of the test tube, record the temperature. This should be the freezing point of the liquid. 5. Repeat steps 3 and 4 two more times and take the average of the results. 6. Repeat steps 4 through 5 with the prepared sugar solution. 7. Repeat steps 4 through 8 with the 0.5 and 1.5 molal solutions of NaCl and sugar.

Results

Salt Water Solution

Solute Concentration (Molal)	Freezing Point Depression (C)			
	Trial 1	Trial 2	Trial 3	Average
0.5	-1.9	-1.9	-1.8	-1.86
1.0	-3.7	-3.7	-3.7	-3.7
1.5	-5.7	-5.7	-5.7	-5.7

Sugar Water Solution

Solute Concentration (Molal)	Freezing Point Depression (C)			
	Trial 1	Trial 2	Trial 3	Average
0.5	-0.9	-0.9	-0.9	-0.9
1.0	-1.9	-1.9	-1.9	-1.9
1.5	-2.8	-2.8	-2.8	-2.8

Conclusions/Discussion
The results of my experiment show freezing point depression of water at different molal concentration of salt and sugar. These results support my hypothesis. My hypothesis was that the higher the molality of a solution the greater would be its effect on the freezing point depression of water. Also salt (an electrolyte) would have a higher effect than sugar (a non-electrolyte). We can see from the data table and the graph that the freezing point depression is indeed higher at higher molality and at the same concentration level

Summary Statement
The project investigates the effect of electrolyte and non-electrolyte solutes on the freezing point depression.

Help Received
Valuable suggestions from Mr. Bob Ferazzi (science teacher).



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Joshua M. Zenker	Project Number S0532
Project Title From the Fryer to the Fuel Tank	
Abstract Objectives/Goals My goal was to create and test a vegetable based fuel that both performs well and burns cleanly compared to modern energy sources. Methods/Materials I produced bio-fuel from vegetable oil in order to compare its performance to other common fuels. I measured the length of burn and the output of joules for kerosene, lighter fluid, gasoline and petroleum diesel and compared their results with that of bio-fuel. I did this by burning the fuel under a constant amount of water on a ringstand apparatus, under a fume hood, then measuring the difference in the temperature with a Texas Instruments graphing calculator with a thermometer attachment. Then, putting those numbers into formulas that allow me to find the heat calculated in joules. These numbers also gave me the information necessary to determine the total burn time and other information for each fuel. Results I did discover that bio-fuel is very competitive with today's modern energy sources. Although the fuel did take a long time to get started it did eventually show that it was a competitive source of energy. All fuels, with the exception of motor oil, at least doubled the water sample's temperature. With bio-fuel there was no residue left behind after the burn. The bio-fuel burned an average 241 seconds per trial and produced 288.6 joules of heat. Diesel, gasoline, and lighter fluid left a significant amount of soot. Thicker fuels like kerosene and diesel and especially motor oil had to us the wicking effect to warm the fuel before it burned. Conclusions/Discussion I discovered that biodiesel did compete with the fuel sources that were tested. This means that a much cleaner fuel that is also efficient can be used more widely in the near future. Some of the fuels were tested in a manner that is inconsistent with how they are normally used, but I believe that my results indicate that bio-fuel burns efficiently.	
Summary Statement The purpose of my project was to create and test a vegetable based fuel and compare it with modern energy sources.	
Help Received Mother helped with arts and crafts (that gene skips a generation) Guy Row as a mento and lended his expertise in chemistry.	