



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Jonathan R. Allison	Project Number J0501
Project Title Will the Real Colors Please Rise Up! The Separation of Crayola Markers through Chromatography	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of my project is to determine what are the real colors contained in Crayola colored markers. I believe there will be more than just one color contained in each marker, even though it's a primary color.</p> <p>Methods/Materials Five different filter strips, each marked with a different colored Crayola marker dot (red, blue, yellow, purple & black) were barely placed in 1/4 cup of Isopropyl Alcohol. They were measured and recorded at 10, 20 and 30 minute intervals to test what colors separated out and how quickly each color rose up. Each color was tested five times to ensure validity.</p> <p>Results On average, purple rose the fastest and highest at 10 min. 5.1 cm, 20 min. 6.3 cm, and 30 min. 7.1 cm; and yellow rose the least and took the longest at 10 min. 2.2 cm, 20 min. 2.6 cm, and 30 min. 3 cm. Black was a surprise, since I thought black was just black, but turquoise and forest green separated out quickly. Red and blue also separated out quickly. Pink separating out of blue was also a surprise.</p> <p>Conclusions/Discussion The results from my testing were because of polarity. With polarity the smaller molecule separates and rises faster and further and the bigger molecule separates slower and rises the least. I conclude that purple had the smallest molecule and yellow the largest of the colors I tested.</p>	
Summary Statement My project is about the separation of colors in Crayola markers through chromatography.	
Help Received My mother took pictures of me doing my experimenting and helped me proofread and type some of my notebook and this form.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Jayne Ranee R. Antolin	Project Number J0502
Project Title C-trus Screening	
Abstract Objectives/Goals This project aims to find out the citrus fruit that contains the most vitamin C from among nine selected citrus fruits. Methods/Materials Nine citrus fruits were selected and juiced separately. A vitamin C tablet was crushed and dissolved in water. The juices and the vitamin C solution were tested for vitamin C content using the titration technique with tincture of iodine, 2%. The vitamin C content of each of the citrus fruit juices was compared with the vitamin C tablet solution content. Results Five citrus fruit juices tested high and four tested low in vitamin C content compared to the vitamin C tablet solution. The navel orange showed the most vitamin C content; the tangelo, the least. It had four times (4x) more vitamin C than the tangelo. The pomelo came second and the tangerine came third high. The lime came second and the red grapefruit came third low. Conclusions/Discussion Citrus fruits had been noted as the richest sources of vitamin C. This project showed indeed that most citrus fruits contain excellent amounts of vitamin C. The result that the navel orange contains the most vitamin C ties in with similar studies done at the Columbia University in the late 1990's. The year-round availability, the sweet taste, the attractive color, and the reasonable cost of the navel orange make it the best source of vitamin C at all times.	
Summary Statement This project screens nine selected citrus fruits to find out which one contains the most vitamin C.	
Help Received Father gave me financial resources to purchase needed materials. Mother took pictures, helped with internet research and some typing.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Nilesh P. Argade	Project Number J0503
Project Title Determination of Nitrate and Nitrite in Meat Products	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To determine the levels of nitrate and nitrite in six different meat products by ion chromatography.</p> <p>Methods/Materials The six meat samples namely, ham, chicken hotdog, salami, pepperoni, bologna, and beef franks were analyzed. The samples were homogenized in water, centrifuged at a high speed, and filtered through two acrodisc filters. Then the nitrate and nitrite contents were determined by ion chromatography using the Dionex DX-600 Chromatography system with a UV detector.</p> <p>Results The levels of nitrate and nitrite were calculated in mg/Kg. Three separate runs were carried out for each of the six meat samples and then the average was calculated for each meat sample. The results showed that salami had the highest level of total nitrate + nitrite (143.92 mg/Kg). Pepperoni had the lowest level of total nitrate + nitrite (43.98 mg/Kg). The six meat samples were ranked from highest to lowest levels of total nitrate + nitrite as follows: salami, bologna, ham, chicken hotdog, beef franks, and pepperoni. The USDA approved level for total nitrate + nitrite is 200 mg/Kg.</p> <p>Conclusions/Discussion There was a large variation in the levels of nitrate and nitrite in various meat samples. Salami had more than three times the total amount of nitrate + nitrite than pepperoni. Since nitrite is a carcinogen and nitrate can convert into nitrite after digestion, the consumption of meat products that have high levels of total nitrate + nitrite should be done with caution.</p>	
Summary Statement I analyzed six meat products for their nitrate and nitrite contents.	
Help Received Used lab equipment at the UCSD Glycotechnology Core Laboratory under the supervision of my mother who is a research associate there.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Virginia C. Bittner	Project Number J0504
Project Title Antacid Effectiveness and Cost Analysis	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To determine which of the various is the most effectiveness. To determine the cost-benefit relationship between those antacids.</p> <p>Methods/Materials In order to determine the effectiveness of each antacid, I first prepared diluted samples of one dose of each antacid. I used three brands of tablet antacids, and two brands of the liquid antacids. Second, I prepared a simulated gastric juice solution (Sodium Bicarbonate). Third, I added indicator solution to each antacid sample. Fourth, I added the simulated gastric juice drop wise to each sample, and then was able to determine the mill equivalency (mEq) of each antacid. The higher the mEq value, the more effective the antacid is. The next part of my project was to conclude a cost-analysis. I acquired the cost of each antacid at three different retail stores, and then could determine the cost per dose for each antacid. The stores that I acquired the prices from were Longs Drugs, Ralph's, and Wall greens. Lastly, with the mEq value and the cost per dose value, I determined the cost per mill equivalency (mEq).</p> <p>Results The most effective antacid brand was Milk-of-Magnesia. The least effective antacid brand was Gaviscon. The most expensive antacid brand was the Gaviscon. The least expensive antacid brand was Tums.</p> <p>Conclusions/Discussion In conclusion, liquid antacids are more effective than tablet antacids. Liquid antacids had a higher mEq value than the tablets. Even though tablets are less costly than liquids, the are not as effective. The cost per dose gets higher as the quantity gets lower.</p>	
Summary Statement Determining the effectiveness of various antacids and determining the cost- benefit relationship among those antacid brands.	
Help Received Mr. Susman helped with materials	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Arielle A. Czerwinski	Project Number J0505
Project Title Watt Lights Up?	
Abstract Objectives/Goals My objective is to see which of four local water samples (tap water, rainwater, ocean water, and river water) and distilled water will conduct the most electricity. To help interpret my results, I will test water with different concentrations of salt, iron, acidity and alkalinity. My objective is to see which of four local water samples (tap water, rainwater, ocean water, and river water) and distilled water will conduct the most electricity. To help interpret my results, I will test water with different concentrations of salt, iron, acidity and alkalinity. Methods/Materials I collected water samples and put them into jars with 2 stainless steel electrodes. The electrodes were used to complete a 12-Volt circuit lighting a light bulb. In this circuit, I measured voltage, current, and resistance with a volt-meter, amp-meter, ohmmeter, and a mega-ohmmeter. Results My results, in order from most conductive to least conductive, were: ocean water, tap water, river water, rainwater, and distilled water. The ocean water was by far the most conductive and the distilled water was almost nonconductive. I found that as the amount of salt, iron, acidity, and alkalinity increased, so did the conductance. Conclusions/Discussion My conclusion is that the salinity of the water sample plays a great role in the conductance of the water sample based on my experiment with various concentrations of salt in the water. Water with higher salt concentration conducted more electricity. I was surprised that our tap water conducted more electricity than the river water. It was because our tap water comes from the same river and has chlorine and fluoride added to it. The rainwater still conducted some electricity because of its# impurities and acidity.	
Summary Statement My project is to find the conductivity of four local water samples compared to distilled water.	
Help Received Dad lent me the electrical test equipment and showed me how to use it; Mom helped me type my report.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Marissa E. Deal	Project Number J0506
Project Title Hydrogen through Electrolysis: A Case for Alternative Fuels	
Abstract Objectives/Goals The objective was to find the most effective way to produce hydrogen using electrolysis. Methods/Materials Three electric cells were constructed using 1000 ml glass vessels, with lids modified to accommodate the insertion of two test tubes with copper, steel, and aluminum electrodes. Each was connected to a 6 volt battery. Each cell was tested using a diluted solution of alcohol, hydrogen peroxide, and hydrochloric acid, and water, as electrolytes. Gas collection was measured over a two hour time period. Results Of the variables that I used as electrolytes, the hydrochloric acid clearly generated the most hydrogen in the shortest time period. The aluminum electrode produced the least amount of corrosion, while the steel produced the most. Conclusions/Discussion Different combinations of electrodes and electrolytes produced a variety of results, including the efficient production of hydrogen using hydrochloric acid in contrast to the slower, but steady, production using water. This suggests that this technique could be used to produce hydrogen as an alternative to carbon-based fuels that result in the production of carbon monoxide and carbon dioxide, which are considered pollutants.	
Summary Statement My project used various combinations of electrodes and electrolytes and measured the output of hydrogen gas.	
Help Received Father helped with locating the raw materials, drilling holes in the vessel lids, and provided general safety oversight; Science teacher provided hydrochloric acid.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Jacob Fiskin	Project Number J0507
Project Title Alkaline Electrolyte Fuel Cells: A New Look at an Old Technology	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The carbon dioxide reaction at the anode of an alkaline electrolyte fuel cell limits the cell's usefulness. The purpose of these experiments is first to determine if hydrogen from methane-based fuels is the primary source of fuel cell energy. The second objective is to see if the production of carbon dioxide from these methane-based fuels can be isolated in the cell reaction.</p> <p>Methods/Materials A variety of fuels both carbon and non-carbon based were compared using a simple dissolved alkaline electrolyte fuel cell to determine whether hydrogen is the determining factor in a cell's power output. Then a typical methane fuel reaction was broken into its component parts. Using methanol, methanal and methanoic acid, the reaction rate of these parts was compared to show that the production of carbon dioxide is the last and fastest part of the complete reaction.</p> <p>Results The first experiment suggests that available hydrogen anions are the principal source of a fuel cell's power. The second experiment showed that after methanol becomes methanal, the change from methanal to methanoic acid and from methanoic acid to carbon dioxide happens very quickly at the end of the reaction.</p> <p>Conclusions/Discussion These experiments suggest that hydrogen anions are the principal source of electrical energy in an alkaline electrolyte fuel cell. The experiments also confirm the timing of the carbon dioxide in the fundamental fuel cell reaction.</p>	
Summary Statement A solution to the problem of carbon dioxide formation in alkaline electrolyte fuel cells might be to combine the AFC with a hydrogen anion-rich regenerative system that would limit carbon dioxide build-up at the anode.	
Help Received My dad helped edit the final project. My mom helped with cutting and gluing the board.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Amy E. Goldman	Project Number J0508
Project Title Leavening Agents	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My project was to determine if leavening agents affect the height, taste, texture, and moisture of cookies. I believe they will.</p> <p>Methods/Materials I used: flour, sugar, vanilla extract, eggs, baking powder, baking soda with cream of tarter, mixing bowl, spoon, oven, cookie sheets, small bowls, plastic lid, baking scale, dish towels, Pam, and parchment paper in my project. I divided the ingrediants into thirds, made the cookie dough, made sure all the cookies were the same height, baked the cookies, identified them with food coloring, measured them with a caliper, had three subjcts rate them, and analized the results.</p> <p>Results The cookies with baking powder rose highest. In two out of three trials baking soda was rated best in flavor and moisture.</p> <p>Conclusions/Discussion Leavening agents do affect the height, taste, texture, and moisture of cookies.</p>	
Summary Statement For my project I tested baking powder, baking soda, and no leavening agent for height, taste, texture, and moisture in cookies.	
Help Received Father took pictures and taught me how to use the caliper.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Shannon M. Gray	Project Number J0509
Project Title Which Solution, An Acid or Base, Will Weaken Calcium (Our Teeth)?	
Abstract Objectives/Goals The goal of this project is to determine which solution will weaken an eggshell, which represents our teeth, the most. Methods/Materials First I pierced the eggshells to remove the egg from inside. I then boiled the empty eggshells, for 2 minutes, with a teabag in order to stain the shells. I chose one eggshell and covered it with a fluoride solution for two minutes before cleaning it off. I repeated this every 12 hours for 2 days. Next, each eggshell was soaked for 2 days in a different solution. The solutions included: hydrogen peroxide (a base), vinegar (an acid), water, water mixed with fluoride, and a sugar-water solution. Finally, I used an egg crusher and a two-liter bottle to determine how many of ounces of liquid each eggshell could withstand before being crushed. I placed each eggshell into a vise-like egg crusher, placed the empty bottle on top, and began to fill up the bottle with water. When the shell would crush, I'd measure the amount of water inside the two-liter bottle. Results As of now, I found out that vinegar solution dissolved the eggshell before it could be crushed. The Water/eggshell crushed at 72.72fl.oz. The Hydrogen Peroxide/eggshell crushed at 20.72fl.oz. The sugar-water/eggshell crushed at 88.32fl.oz. The fluoride-water/eggshell crushed at 82.08fl.oz. Conclusions/Discussion My hypothesis that the sugar-water solution would decay the teeth the most was incorrect; the acid solution actually dissolved the eggshell while it was in the solution.	
Summary Statement I want to discover which solution will weaken the eggshells the most.	
Help Received My mother helped me research. My grandmother helped me put together my board. My dad helped me build the egg crusher.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Michele K. Jenkins	Project Number J0510
Project Title Determining the Effects Fruit Peels Have on Freezing Water	
Abstract Objectives/Goals The objective of my project is to determine if fruit peels have any effect on the freezing of water. My hypothesis is that lemon peels will have the most effect, while orange peels will have the least. Methods/Materials 6 different types of citrus fruit were peeled (orange, lime, lemon, grapefruit, tangelo, and tangerine). 1 oz. of peel was weighed, and mixed in the blender for 8 seconds with a half a cup of water. The liquid was poured through a sieve, and the filtered liquid was drawn into an eyedropper. 100 drops were laid on the foil board, and put in the freezer for 3 minutes. The results were determined by the solidity and discoloration of the drops. The results were then compared against the control of water. Results 50.4% of the lemon drops froze, reducing the freezing rate by 24.8% over 5 trials. The tangelo was the least effective, with a freezing average of 71.6% frozen, reducing the freezing rate only 3.6%. Conclusions/Discussion My project shows that lemon peels reduce freezing in water the most effectively, with orange and lime peels 2nd and 3rd. To test this finding, another experiment was preformed. The mixtures of the lemon, lime, and orange peels were taken, and 40 orange leaves also. 10 orange leaves were dipped in a mixture, and frozen for 12 hours. The leaves were then allowed to thaw for a total of 72 hours. From the results of both experiments, lemon peels have proven most effective. To reduce freezing, lemon peels should be chosen to reduce.	
Summary Statement My project is about how different fruit peels have an effect on the freezing rate of water.	
Help Received Mother helped type conclusion; Grandmother helped glue board; Grandmother helped clean supplies	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Smita Mascharak	Project Number J0511
Project Title Acidic Foods in Contact with Aluminum Foil: A Cause of Parkinson's/Alzheimer's Disease?	
Abstract Objectives/Goals Aluminum has recently been implicated in neurodegenerative disorders such as Parkinson's and Alzheimer's Disease. The objective of my project was to find whether a substantial amount of aluminum dissolves when aluminum foil comes in contact with acidic foods. My hypothesis was that aluminum does leach out of the foil. Methods/Materials Three common acidic ingredients, vinegar, lemon juice and ketchup, were tested on aluminum foil. Strips of aluminum foil were kept in contact with the acidic material in a kitchen tray at room temperature and at 50° C for various time intervals. Samples were taken out of the tray and mixed with Aluver3 reagent, which gives a red color in presence of aluminum. The intensity of the color was measured in a spectrophotometer. Using the "Standard Curve" technique, the concentration of aluminum in each sample was determined. Results My results showed that under my experimental conditions, up to 25 ppm of aluminum leached out when vinegar was used for 60 min at 50° C. Little aluminum was detected when ketchup was used. Leaching in case of lemon juice was moderate (max 14.4 ppm). Heating definitely increased the rate of dissolution. At room temperature, the rate of leaching was modest. Conclusions/Discussion Collectively, the results show that aluminum does dissolve in acidic foods and heating accelerates the process of dissolution. Therefore, precautions must be taken when acidic foods are cooked in aluminum foil, pots, pans and utensils. Ingestion of dissolved aluminum could lead to brain disorders.	
Summary Statement My project is to find out whether aluminum is leached out when acidic foods are handled in contact with aluminum foil.	
Help Received I used equipment at UCSC under the supervision of Mr. Raman Afshar. Dr. John Rowland explained how the equipment worked. My father, Prof. Pradip Mascharak, explained some of the chemistry involved in the project.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Christopher D. Masson	Project Number J0512
Project Title The Effect of Temperature, Concentration, and a Catalyst on the Rate of the Iodine Clock Reaction	
Abstract Objectives/Goals The objective was to measure the effect of various things on the rate of a chemical reaction known as the Iodine Clock reaction. Methods/Materials The reaction known as the Iodine Clock reaction was used to study the rates of reaction. The Iodine Clock Reaction uses Potassium Iodate as solution A and Sodium Sulfite, Sulfuric Acid, and Soluble Starch as solution B. When these solutions were mixed, the solution will turn blue after a short time (measured with a stop watch). The solutions were heated or cooled and the rate of reaction recorded. The Molarity of each solution was raised to different concentration and the rate of reaction recorded. A catalyst for the reaction (Copper II Sulfate) was added to solution A, solution B, and both solutions and the rate of the reaction was recorded. Results As temperature went up the rate of reaction increased. When the Molarity of the solutions were raised without compensating by adding more acid, the rate of reaction decreased. When Concentration was raised with more acid present, the rate of reaction increased. When a catalyst was added to solution A and both solutions, it increased the rate of reaction, and when it was added to solution B only, it had no effect on the reaction. Conclusions/Discussion It was found that the rate of reaction varies directly with temperature. The reason why the concentration increase without acid decreased the reaction rate was because the Iodine Clock reaction is actually many different reactions. First, the Sodium Sulfite reacts with the Potassium Iodate to make Iodate ions, Potassium, and also during this process some Iodide ions are made. Under acidic conditions Iodate reacts with Iodide to make Iodine, then immediately the Iodine reacts with the Sodium Sulfite until there is no more Sodium Sulfite. Then the Iodine reacts with the water and the Soluble Starch and that is what forms the blue complex. The more acid the quicker the Iodate and the Iodide ions react with each other and the quicker the Sodium Sulfite is used up. Therefore when the Sodium Sulfite concentration went up there was more to use up even though there was the same amount of acid for each concentration. When additional acid was added, the reaction happened almost instantaneously. The catalyst in solution A and both solutions increased the rates of reaction by lowering the activation energy of the reaction therefore allowing more molecules to react at a given time.	
Summary Statement My project is about the rates of chemical reactions and how chemical reactions work.	
Help Received Used Viewpoint School labs, Dad helped with board	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Jeffrey B. McClenahan	Project Number J0513
Project Title The Sugar Osmometer	
Abstract Objectives/Goals The objective of my experiment was to determine if the concentration of sugar in a dialysis tubing 'sausage' affected the rate at which water diffused into the 'sausage' to create equilibrium. Methods/Materials I gathered together my materials, and washed them thoroughly. Next I filled the mason jars about three-fourths full, and set them aside. Then I measured out the sugar to approximate percentages of 200ml of water. After I measured out the quantities of sugar I dissolved them in the 200ml of water, and labeled them. I then tied the dialysis tubing onto the silicone tubing with the dental floss, and also tied the bottom of the dialysis tubing to form a 'sausage'. I next poured the sugar solution down the silicone tubing and into the 'sausage'. I then got out some Benedicts solution and made sure there was no sugar in the mason jar before I lowered the 'sausage' into the jar. Finally I marked where the sugar water started in the osmometer with the Sharpie pen. Lastly I waited and recorded my results. Results My results are in two sets. My first set of data was recorded after 12 hours. This first set of data was not that accurate. This could be expected though, because many technical and uncontrollable factors could happen. This is mainly why my first set of results is so hard to figure out, but it was still important to my objective. This first set of data showed me some of what could go wrong and how I could correct it. Although hard to interpret, in my first set of data the osmometer with the 30% sugar solution, went up 15 inches in 12 hours, the osmometer with the 45% sugar solution went up 24.5in, and the osmometer with the 60% sugar solution went up 24in. My second set of data proved my hypothesis. Not as many inaccuracies occurred over the shorter time period. Conclusions/Discussion My second set of data/results proved my hypothesis to be correct. I reached my objective and proved that the higher the concentration of sugar in the dialysis tubing, the faster the water would diffuse into to the 'sausage' to create equilibrium.	
Summary Statement I used a home made osmometer to determine if higher concentrations of sugar resulted in higher rates of diffusion.	
Help Received My father helped me set up the osmometer and helped me edit some writings. My teacher, Mr. Swanner, loaned me some materials I needed (Benedicts solution, dialysis tubing, support, test tube clamp, and ring clamp).	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Morgan D. Nagatani	Project Number J0514
Project Title Energy Nuts	
Objectives/Goals The purpose of this experiment is to discover if various kinds of nuts contain any energy. If the nuts store energy, how much energy does each type of nut contain? This experiment discovers the energy content within peanuts, walnuts, macadamia nuts, cashews, and honey-roasted almonds.	
Abstract I tested small amounts (ten each) of salted peanuts, walnuts, macadamia nuts, cashews, and honey-roasted almonds. Each nut on a sewing needle, which is in the cork, is lit and allowed to burn under the soup can holding the half-cup of water for 2 minutes. I measured the temperature change of the water and calculated the Btu content of each nut.	
Methods/Materials I tested small amounts (ten each) of salted peanuts, walnuts, macadamia nuts, cashews, and honey-roasted almonds. Each nut on a sewing needle, which is in the cork, is lit and allowed to burn under the soup can holding the half-cup of water for 2 minutes. I measured the temperature change of the water and calculated the Btu content of each nut.	
Results The results of my experiment support my hypothesis that peanuts and other nuts contain energy just as the nuts give our bodies nutrition and energy. One way to measure each nut's energy is to test the amount of Btu's or British thermal units stored within the nut. The Webster's Dictionary defines the Btu as "The quantity of heat required to raise the temperature of 1 lb. of water 1 degree Fahrenheit." The nut with the highest stored energy is the walnut with an average 16.7 Btu. Following the walnut is the cashew with an average 13.1 Btu, macadamia nut with an average 10.6 Btu, honey-roasted almond with an average 9.2 Btu, and the salted peanut with an average 8.9 Btu.	
Conclusions/Discussion The purpose of my experiment is to find out if nuts contain any energy. The testing of the nuts I selected show that nuts do contain energy and can be measured in Btu or British thermal units. The experiment's results indicate that of the 5 types of nuts tested, the walnut has the highest amount of stored energy at 16.7 Btu, 13.1 for the cashew, 10.6 Btu for the macadamia nut, 9.2 for the honey-roasted almond, and 8.9 Btu for the salted peanut. Since nuts contain energy, some day we may not only eat them for fun but use nuts to fuel cars and power lights.	
Summary Statement How much energy do various nuts contain?	
Help Received Dad helped with color graphs.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Emily B. Olewiler	Project Number J0515
Project Title What Effect Does Baking Powder Have on Cooking?	
Objectives/Goals To determine what effect baking powder has on cooking. I think that the more baking powder put in a recipe, the higher it will rise, and the better it will taste.	
Abstract I baked five sets of muffins putting various amounts of baking powder in them; no baking powder, 1/2 the amount of regular baking powder, the regular amount of baking powder, 1 1/2 amount of baking powder, and twice the amount of baking powder. All batches were prepared, and cooked identically. I used flour, salt, sugar, eggs, oil, milk, baking powder, measuring spoons, timer, oven, cooling racks, knife, spoons, mixing bowl, muffin pan and ruler.	
Methods/Materials I baked five sets of muffins putting various amounts of baking powder in them; no baking powder, 1/2 the amount of regular baking powder, the regular amount of baking powder, 1 1/2 amount of baking powder, and twice the amount of baking powder. All batches were prepared, and cooked identically. I used flour, salt, sugar, eggs, oil, milk, baking powder, measuring spoons, timer, oven, cooling racks, knife, spoons, mixing bowl, muffin pan and ruler.	
Results The group of muffins containing no baking powder were cream colored and had 'hard shells'. The group with 1/2 the regular amount of baking powder appeared tall and very light golden, and were partially rounded. The group containing the regular amount of baking powder were light golden and were perfectly rounded, with few cracks. The group with 1 1/2 the amount of baking powder were golden and had many air pockets; they had many cracks. The group with twice the amount of baking powder looked burnt and were dark golden, and had many cracks.	
Conclusions/Discussion I was correct in my hypothesis. I said that the more baking powder put in a recipe, the higher it would rise, with the exception of the group with twice the amount of baking powder. The less baking powder put in a recipe, the lower it would be.	
Summary Statement My project explains how to find the effect baking powder has on cooking.	
Help Received My parents supervised the cooking process.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Ryan H. Parry	Project Number J0516
Project Title Can Amino Acids Form Under the Conditions of Europa?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My project was if amino acids could form under the conditions of Europa. I believe that if Europa's conditions are present, then amino acids will form.</p> <p>Methods/Materials In order for this project to be done, it required a lot of research. I first found all the information I needed in the library and on the Internet. I needed to find out about the amino acids, what the conditions and chemical composition of Europa was, and finally, I needed to determine my procedure. What I did was I took a beaker, put the things that were in Europa in it, set it in a heat bath (basically a pan of water that will regulate a constant temperature), let it set in there for a few days and then sprinkled a chemical called ninhydrin on a sample from my beaker and if it turned yellow, amino acids were present.</p> <p>Results After completing my experiment, I found that amino acids did form in my experiment.</p> <p>Conclusions/Discussion In conclusion, I found that if Europa's conditions in real life are the same as my experiment, then amino acids will form. Since amino acids are essential for life to exist, then life itself may currently exist, waiting to be found by a space probe that would be most likely launched within this century.</p>	
Summary Statement Amino acids can form under the conditions of Europa based on current data.	
Help Received Parents transported me to science fairs and helped obtain materials; Ms. Ligeti and Mr. Newell helped narrow down question; Tri-Essences helped obtain rare materials	



CALIFORNIA STATE SCIENCE FAIR 2002 PROJECT SUMMARY

Name(s) Nicholas J. Pinkerton	Project Number J0517
Project Title Compost Corrosion	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This experiment was conducted by hypothesizing that iron in a sterile environment corroded and decreased in mass more with the addition of compost. My objective was to determine if wrought iron would rust more quickly in an environment with compost than in an environment without compost.</p> <p>Methods/Materials Eight wrought iron pieces were weighed for their masses in grams. 250mL of distilled water was added to eight sterilized jars. 125 mL of Orchard Supply Hardware Organic Compost was added to four of the jars. The iron pieces in the sterile environment were labeled the "A" group. The iron pieces in the compost environment were labeled the "B" group. The eight pieces of wrought iron were placed in the eight jars and were left to sit for twelve days while corrosion occurred. The iron pieces were removed from the jars and then the masses of the iron pieces were weighed again.</p> <p>Results The mass of each iron piece increased in seven of the eight results. The four pieces of iron in the sterile environment all increased in mass. Three of the four iron pieces in the compost environment increased in mass. The addition of compost to the sterile environment caused the "B" iron pieces to increase more in mass than the "A" pieces. The average mass increase of the "A" group was 0.175 grams. However, the average increase of the "B" iron pieces was 0.35 grams. The independent variable was the environment in which the iron was placed. The dependent variable was the mass after the wrought iron pieces corroded.</p> <p>Conclusions/Discussion My hypothesis was that if compost was added to a sterile environment containing a piece of iron, then more corrosion would occur, causing the iron's mass to decrease. My results did not support my hypothesis in seven of the eight results. From knowledge collected, corrosion is supposed to decrease iron's weight. The iron was measured for its mass, and the mass increased in seven of the eight tests. The idea of compost affecting iron's mass in a sterilized environment can be concluded from this experiment. There was some corrosion on a couple of the iron pieces before the experiment was performed. They were buffed with steel wool, but it is possible that all of the corrosion didn't wear off before commencing the experiment. This may have affected the mass of the iron pieces. The shape and thickness of each piece may have affected the final masses, too.</p>	
Summary Statement The project is about how compost affects the amount of corrosion collected on iron.	
Help Received My mother helped me sterilize the jars and iron and helped me cut the letters for the backboard.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Anthony Polverini	Project Number J0518
Project Title How Does the Time of Day Affect Solar Energy Conversion using Ruthenium tris-bypridine?	
Abstract Objectives/Goals The objective behind this project was to find a way to produce hydrogen from sunlight. Ruthenium tris-bypridine is a catalyst which can be used (with the correct chemicals) to create hydrogen. The purpose of this experiment was to find other types of creating fuels so we can lose our dependancy toward petroleum products.I wanted to find how much this experimental chemical could point us in another direction away from petroleum. My goal, in the end, was to eventually be able to produce hydrogen, and a more effective system of gathering hydrogen from sunlight alone. Methods/Materials The materials behind the experiment help make the method easier to understand. I used: Ruthenium tris-bypridine=(Ru(bpy)), methyl-violigen=(mv), and Ethylene Diamene Tetraacidic Acid=(EDTA). All these chemicals work together to form the hydrogen. The (Ru(bpy)) gathers sunlight and becomes excited from the photons, the (mv) takes an electron away and give is to the (EDTA). Lastly, the (EDTA) gives it's electron to a Platinum catalyst which in turn, through the chemical process, makes hydrogen. In order to test the amount of possible changed hydrogen, I used a Spectrophotometer to see how much the Ruthenium changed because (Ru(bpy)) changes color proportionally to how much (mv) is changed in the electron swapping. The spectrophotometer then measures the energy in a specific wavelength. This then explains how much hydrogen would've been created Results The results of the experiment was a success. Enough methyl-viologen was changed to create hydrogen. This was due to the fact that enough (mv) was changed to make a significant impact on the spectrophotometer. The results showed that the time of day, and the amount of exposure, had a great impact on the amount of (mv) changed. My original hypothesis was correct. The time of day had a large impact on the possible hydrogen amount. The data also showed that without (Ru(bpy)) the experiment couldn't work, the (mv) and (EDTA) alone, couldn't produce hydrogen. Conclusions/Discussion In conclusion, with enough research, (Ru(bpy)) could be used as a wonderful catalyst for production of hydrogen. The experiment was a success proving that this is definently a plausible source for hydrogen. I hope that this chemical gets the attention it deserves because I feel in the near future, we'll be needing it.	
Summary Statement My project is about how Ruthenium tris-bipyridene can be used for making hydrogen from sunlight, and how the time of day effects the hydrogen conversion.	
Help Received Used lab equipment at CalTech; was under the supervision of Dr.Gray	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Carlos J. Ramos	Project Number J0519
Project Title Vitamin C Testing	
Abstract Objectives/Goals My objective was to determine which beverage contains the most Vitamin C. I believe that orange juice will have the highest level of Vitamin C, while Sprite will have the lowest. Methods/Materials Eight different beverages were purchased; freshly squeezed orange juice, Sunny Delight, lemonade, lemon juice, Sprite, Gatorade, Kool-Aid and apple juice. A starch solution consisting of one part baking soda and five parts water was added to each drink to neutralize the acid. Using a pipette, iodine was then dropped into each beverage until the color changed from its original. The beverage that took the most iodine to change the color has the most Vitamin C. Results The orange juice consistently tested highest for the level of Vitamin C of all eight beverages, while Sprite and apple juice tested the lowest. Conclusions/Discussion My conclusion is that the orange juice has the highest level of Vitamin C, and Sprite and apple juice has the lowest. These results supported my hypothesis. Surprisingly, other beverages also contain high levels of Vitamin C.	
Summary Statement Determining Vitamin C levels in selected beverages.	
Help Received Father helped in layout of board, Grandmother helped type report.	



CALIFORNIA STATE SCIENCE FAIR 2002 PROJECT SUMMARY

Name(s) Jessica Rucker	Project Number J0520
Project Title "Aluminum Soup": The Absorption of Aluminum and Iron into Citric Acid Solutions Boiled in Metal Cookware	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Are we unknowingly consuming toxic metals when we eat foods cooked in metal pots and pans? The objective of this experiment was to determine whether significant amounts of aluminum or iron could be absorbed from metal cookware into boiling solutions of 1% or 2.5% citric acid or distilled water (the control). Citric acid is the main acid in tomatoes and citrus fruits.</p> <p>Methods/Materials Two liters of 1% and 2.5% citric acid solutions and distilled water were boiled for 30 minutes in an iron skillet, an aluminum pot, a stainless steel pot, a Teflon pot, and a scratched Teflon pot. Samples of each solution were assayed for levels of iron using an atomic absorption spectrophotometer at the University of San Diego. Samples from the aluminum and scratched Teflon cookware were assayed for levels of aluminum by the Environmental Engineering Lab. The results were compared to health and toxicity standards for daily allowable intakes of iron and aluminum.</p> <p>Results Low levels of iron (less than 0.53 mg/L) were absorbed from the aluminum, stainless steel, Teflon, and scratched Teflon cookware. Significant amounts of iron were extracted from the iron skillet into the 1% and 2.5% citric acid solutions at 53.7 and 181.2 mg/L respectively. Significant amounts of aluminum were absorbed into the 1% and 2.5% citric acid solutions from the scratched Teflon pot (at 3.13 and 6.35 mg/L respectively) and the aluminum pot (at 17.2 and 54.5 mg/L respectively.)</p> <p>Conclusions/Discussion Stainless steel and unscratched Teflon cookware appear safe to use when cooking foods that contain citric acid. In fact, the low levels of iron absorbed from the stainless steel pot, the aluminum pot, and the Teflon and scratched Teflon cookware may contribute to the recommended dietary allowance of 10-15 mg/day. The larger amounts of iron absorbed from the iron skillet at 53.7-181.2 mg/L, however, are aesthetically objectionable and may approach levels of toxicity. Significant levels of aluminum were extracted from the scratched Teflon pot and the aluminum pot at 3.13 to 54.5 mg/L. These amounts greatly exceed the US NSDWR standard and are 3 to 55 times the California EPA primary or health-based maximum contaminant level (MCL) for aluminum in drinking water. These levels are sufficient to adversely affect taste and odor and may provide unnecessary exposure to aluminum in the diet that may contribute to unknown and possibly adverse health effects.</p>	
Summary Statement This project investigates the absorption of aluminum and iron into citric acid solutions boiled in metal cookware and compares the results to health and toxicity standards.	
Help Received Thanks to Carole Ziegler at the University of San Diego for inviting and allowing me to use the atomic absorption spectrophotometer at the USD Environmental Studies Lab and to Robert Chambers at the Environmental Engineering Lab for the lesson on inductively coupled plasma spectrometers.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Dana L. Starrh	Project Number J0521
Project Title Hydrogen Separator 2002	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Which fluid/liquid will produce more hydrogen through electroysis; tap water, Sprite, Coca Cola, aspirin, baking soda, white vinegar, lemon juice, or Windex?</p> <p>Methods/Materials 1 gal milk carton, two stainless steel welding rods(defluxed), test tube, 6 inch coated copper wire, bottom of a plastic cup, 12v. battery charger, asprin, Coca Cola, White Vinegar, Sprite, Windex, baking soda, tap water, lemon juice, ruler, timer.</p> <p>Results After letting the Seperator 2002 work for an hour I would measure the results. I did this three times and recorded how many inches of hydrogen each fluid produced. The replications showed that Baking soda produced the most hydrogen, followed by the vinegar, lemon juice, Coke, aspirin, Windex, Sprite and tap water. This was not what I had stated in my hypothesis which I had made based on the ph balance of each fluid.</p> <p>Conclusions/Discussion In looking at the results of the test, the baking soda produced H+ the fastest. According to the reasearch on PH, and baking soda having such a small amount of H+ in comparison to other liquids tested, it should have produced it the slowest. Putting the baking soda aside, vinegar and lemon juice did produce H+ the fastest, which was my hypothesis. Coke and aspirin should have followed in order and they did however, the Sprite, water and Windex broke the pattern. Then the question became why? Maybe it is not the PH of a solution that governs the amount of H+ produced. So I did more research with my dad on electrolysis and conductivity. I discovered that electrolysis can not happen if the fluid can not conduct eletricity. The greater the conductivity of the fluid the greater the electrolysis process. Therefore I concluded that the Hydrogen Separator 2002 told me which fluid conducted electricity better. Therefore the reason baking soda was so fast in producing H+ is probably due to its ability to conduct electricity better.</p>	
Summary Statement Finding which fluid will produce more hydrogen through electrolysis.	
Help Received Dad helped make the Hydrogen Seperator 2002 and helped me measure conductivity of the fluids using a multi-meter. Dad and Mom help do the experiments.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Melody N. Tehrani	Project Number J0522
Project Title Liquid Conductivity	
Objectives/Goals To determine which solutions will conduct electricity the best, and why.	
Abstract Methods/Materials 1 miniature lamp holder; 1 9-volt battery snap connector; 1 9-volt battery; 1 9-volt screw based lamp; 2 flexible coated 13-inch wires; 1 cup with a 3-inch diameter and 2-3 inch depth; 2 small metallic 3x1 inch metallic weights; glue gun/glue; 3 small screws; 1 small washer; 1 soldering gun; 1 12x3.5in wooden plank; 1 tablespoon; 1 volt meter; water; salt; vinegar; baking soda; baking powder; lemon juice; cranberry juice. After setting up the electric circuit, I connected the voltmeter to it. From there, I poured in the different solutions, recorded all observations, and recorded the reading of the voltmeter. I repeated the procedure for all of the solutions.	
Results Water did not conduct very much electricity. Baking powder was able to conduct more electricity with a direct current of 147mA.	
Conclusions/Discussion I came to the conclusion that tap water alone can conduct electricity, but not very well. Acidic solutions were not the best conductors of electricity; baking soda was. This was because of the molecular bonds of the baking powder solutions. Because it had more ions, it created a greater amount of electric charge.	
Summary Statement I determined what solutions (if any at all) were able to conduct electricity best and what caused them to do so.	
Help Received Parent soldered the wires to the metallic plates.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Marissa L. Torres	Project Number J0523
Project Title Bio-Rusting	
Abstract Objectives/Goals In my science fair project I was trying to figure out whether or not the presence of bacteria affects the speed in which a nail rusts in a jar of water? And does its environment affect the speed also Methods/Materials I got four glass jars and filled them with purified water. In two of the jars I put bleach in the water to kill all the bacteria. Then I took sand paper and cleaned the nails to take any oil coatings off. Next in the last two jars I put a pinch of dirt from the ground into them. I then placed one nail into each jar. Then I placed one of each jars in the sun and shade, then checked them every twenty minutes for one hour. Results I found out that that jar that was placed in the sun and that had bacteria in the water rusted the fastest out of all the nails. The nail that was in the sun without bacteria in the water rusted the second fastest, then came the the jar that was placed with bacteria in the water into the shade than the other jar that also was in the shade. Conclusions/Discussion I conclude that bacteria and its environment does speed up corrosion. I think this because of the amount of micro organisms that live in bacteria multiply when they heat up which causes things to grow faster, not to mention the amount of oxygen that is made from the sun and the organisms.	
Summary Statement Finding out if bacteria affects the speed of a nail rusting in water, and if its environment affects it also.	
Help Received Mom helped me correct all spelling and grammar punctuations; Dad helped me run my experiment; Mrs.Dunn gave ideas on how to improve my project; Uncle Tom helped me improve my project and how to get more scientific and more data	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Lincoln L. Tran	Project Number J0524
Project Title Taking the Pressure off Chrome Alum Crystal Growth	
Abstract Objectives/Goals My objective to determine whether chrome alum crystals grown at pressure lower than normal atmospheric pressure would grow faster than crystals grown at normal pressure at sea level. Methods/Materials Materials: Powdered chrome alum, bell jar, vacuum pump, beakers, graduated cylinders, various measuring apparatus. Methods: Prepare supersaturated solution of chrome alum (200 ml H ₂ O and 120 g chrome alum). Upon formation, select two small seed crystals from saturated solution. Suspend seed crystals in separate beakers containing equal volumes of solution. Place one inside bell jar and attach to vacuum pump. Pump air out of the jar everyday for ten days. Results The crystal grown at normal atmospheric pressure had a mass of 0.62 grams and a volume of 1.27 cm ³ . The mass of the smaller crystal was 0.41 grams and had a volume of 0.77 cm ³ . Conclusions/Discussion Crystals grown in lower atmospheric pressure grew slower than crystals grown in normal atmospheric pressure at sea level. Decreasing the pressure should have allowed for faster evaporation of the liquid at lower pressure thus forming crystals faster (the solute should have come out of solution). Lowering the pressure did not increase crystal formation.	
Summary Statement To determine if lowering pressure increased chrome alum crystal growth.	
Help Received Mr. Ryan helped set up vacuum apparatus. Participant in UCI/Costa Mesa High School Science Fair Initiative under direction of Dr. Lidia Yoshida	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Andrew S. Tubbs	Project Number J0525
Project Title How Do Your Crystals Grow?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My project was to see whether crystal growth is affected when sugar or salt solutions are added.</p> <p>Methods/Materials What I did was boil 3 solutions in 3 small jars. The first solution contained the base mineral (monoammonium phosphate). I put some of it in a jar and labeled it "control." The second jar contained a saturated solution of sugar and some of the mineral solution. It was labeled "sugar." The last jar contained a saturated solution of salt and some of the mineral solution. It was labeled "salt." In my second experiment I did the same thing except the mineral solution had a food dye that was red. In both experiments, the crystals were allowed to grow for one week.</p> <p>Results The control group grew crystals normally and as expected. The sugar group grew altered crystals of the base mineral. The salt group inhibited crystal growth.</p> <p>Conclusions/Discussion Crystal growth is affected by the additions of sugar or salt.</p>	
Summary Statement My project was to see whether crystal growth is affected when sugar or salt solutions are added.	
Help Received My dad supervised , but did not do the experiments for me.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Kelsey G. Weeks	Project Number J0526
Project Title Yur A Peein': The Specific Gravity of Urine	
Abstract Objectives/Goals The objective was to see which fluid, after drinking it, will cause urine to have the lowest specific gravity and the most output. I believe that water will have the lowest specific gravity and the most output. Methods/Materials I drank three different fluids for one four-hour time period each. I drank 16 fluid ounces of each fluid within the first ten minutes of the hour. Towards the last five minutes of the hour, I went into the bathroom, urinated into the cup(s), measured the specific gravity, and then measured the output. I repeated this process three more times with each fluid. I drank water, 7up, and Gatorade. I used a glass measuring cup to measure my intake, a plastic measuring cup to measure my output, and Multistix 10SG to measure the specific gravity. I urinated into 16-ounce plastic cups. Results Gatorade had the lowest specific gravity with three readings of 1.005 and one reading of 1.010. Water was second with two readings of 1.005 and two readings of 1.010. 7up was last with two readings 1.005, one reading of 1.010, and one reading of 1.015. Water had the most output with 72 fluid ounces total. Gatorade was second with 56 2/3 fluid ounces total. 7up was last with 49 1/3 fluid ounces total. This means that my hypothesis was incorrect when it stated that water would have the lowest specific gravity. My hypothesis was correct when it stated that water would have the most output. Conclusions/Discussion I was able to obtain my objective of seeing which fluid, after drinking it, would have the lowest specific gravity and the most output. My results did not support the first part of my hypothesis, but they did support the second part. This project expands my knowledge about the function of kidneys and excess fluid intake on the specific gravity of urine.	
Summary Statement My project determines which fluid, after drinking it, will cause my urine to have the lowest specific gravity and the most output.	
Help Received Dr. Kathryn Hall, M.D. gave me information about specific gravity and project idea. Kaweah Delta Hospital's lab sold me the Multistix to measure the specific gravity. Mom helped design the graph and with the layout of information on the board.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Erin M. Wessel	Project Number J0527
Project Title Ion Exchange vs. Filtering	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My objective is to learn if a cation exchange column purifies water more efficiently than a micron filter.</p> <p>Methods/Materials To conduct my experiment I used pond water, a micron filter, a cation exchange column, beakers and a hot plate. My method was to compare pond water processed through a cation exchanger vs a micron filter. The raw pond water was used to show what unprocessed water looked like compared to processed water. After the water was processed it was evaporated and the residue was visually compared.</p> <p>Results After testing my hypothesis 5 times I came to the conclusion that my hypothesis was correct 100% of the time. The results showed that the cation exchange column filters water more efficiently than a micron filter.</p> <p>Conclusions/Discussion The main ingredient in a cation exchange column is a cation resin. Each bead of resin has millions of exchange sites on it. The exchange sites are filled with sodium. In the process of purification the sodium is exchanged with the impurities in the water. This removes both dissolved and solid impurities. The micron filter only removed the solid impurities.</p>	
Summary Statement A cation exchange column purifies more efficiently than a micron filter.	
Help Received My father provided me with the necessary supplies.he's in	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Kevin M. Wolff	Project Number J0528
Project Title Will It Pass? The Study of Osmosis	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The experimenter believes that different concentrations of sugar and water affect how quickly the water moves across a semipermeable membrane.</p> <p>Methods/Materials Materials used: eggs, distilled water, corn syrup, triple beam scale, containers, vinegar, timer, spoon, measuring cups (1 cup, 1/2 cup, 1/4 cup), pencil, data sheet to record results, paper towels. Twelve eggs without shells were placed in different percentages of corn syrup and water over a 2 hour time period. The weight was recorded at the beginning of the process and then at 15 minute intervals for a total of 9 readings.</p> <p>Results Only the eggs immersed in 100% distilled water gained weight. While eggs immersed in 100% corn syrup lost the most weight. The amount of fluid moving across a semipermeable membrane from areas of high concentration to areas of low concentration varied based on the percentage of water contained in the solution. The eggs gaining weight visibly swelled and the eggs losing weight shrank.</p> <p>Conclusions/Discussion The results showed that when the eggs were immersed in 100% distilled water, the concentration of water molecules inside the egg was lower than outside. On the other hand, when corn syrup was mixed with various amounts of distilled water the concentration of water molecules was greater inside the egg than outside. The rate at which diffusion took place varied based on the ratio of corn syrup to distilled water in a constant volume of fluid.</p>	
Summary Statement This project is the study of fluid passing through a semipermeable membrane.	
Help Received Mother helped glue pictures and charts to experimenter's project board.	



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Rajind K. Devendra	Project Number J0599
Project Title Comparing Fuel Cell Efficiency	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Fuel Cell technology is the passageway to the future. It allows less fossil fuels in our atmosphere. This project compares the efficiency of a fuel cell when using regular air and hydrogen verses pure oxygen and hydrogen.</p> <p>Methods/Materials The efficiency was calculated by dividing the amount of coulombs produced in the fuel cell by the amount of coulombs produced in the Power supply. The hydrogen and oxygen were obtained using an electrolysis procedure, which gave the hydrogen and oxygen to he fuel cell.</p> <p>Results With the thirty three total efficiency tests I have executed I have an efficiency of air that varies fom 30% to about 60%. The efficiency ithpure oxygen is about 50% to 80%.</p> <p>Conclusions/Discussion A fuel cell operates using oxygen and hydrogen. The hydrogen creates a reaction with the cathode. In this reaction the products are hydrogen and electrons. The electrons proceed to have a reaction with the anode. While they are traveling to the cathode they run through a circuit, creating energy. While they are running through the circuit they have the ability to produce power. In the end the electrons combine with the oxygen molecules and positive hydrogen ions, creating water and heat. These are environmentally sound byproducts, which will help industries comply with the Kyoto Protocol.</p> <p>In December of 1997 the Japanese created the Kyoto protocol. The pact, signed by official from 160 countries, requires 38 industrialized countries to ratify it. If these countries except the restrictions they will produce 5% emissions lower than in 1990. These reduced levels are supposed to be achieved from 2008-2012. America will not sign this document in feat that it will hurt their economy. It will hurt the car production business and industries in the United States, however there is an alternative that is a use of fuel cells. If the United Nation Framework Convention on Climate Change can have the Kyoto Protocol passed it will open all sorts of new opportunity for fuel cell technology.</p> <p>To take this project further, I plan on testing th efficiency of my electroylsis procedure and the efficiency of a fuel cell when using a 50% air and 50% oxygen solution as another independant variable.</p>	
Summary Statement Comparing Fuel Cell Efficiency	
Help Received I had a mentor, Dr. Sitiram Ramaswamy, from the UC Davis, he mentored me throughout the project	