



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Brandon David Alexander	Project Number S0801								
Project Title Hydrogen Generator									
<table border="0"><tr><td data-bbox="77 611 698 667">Objectives/Goals</td><td data-bbox="698 611 1528 667">Abstract</td></tr><tr><td data-bbox="77 667 698 703">For an engine to run on hydrogen only, no gasoline</td><td></td></tr><tr><td data-bbox="77 703 698 739">Methods/Materials</td><td></td></tr><tr><td data-bbox="77 739 698 774">major components: engine, battery, hydrogen generator</td><td></td></tr></table>		Objectives/Goals	Abstract	For an engine to run on hydrogen only, no gasoline		Methods/Materials		major components: engine, battery, hydrogen generator	
Objectives/Goals	Abstract								
For an engine to run on hydrogen only, no gasoline									
Methods/Materials									
major components: engine, battery, hydrogen generator									
Summary Statement This project was to use hydrogen from water to run a engine.									
Help Received Dad helped with theory and fabrication.									



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Anthony F. Alvarez	Project Number S0802
Project Title Wind Power in Ventura: A Future Worth Examining	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The goal of my project is to identify optimal sites for wind power generation for Ventura County. Objectives: to estimate (calculate) and compare the wind power potential for designated Ventura County sites. Since Ventura County can both benefit environmentally as well as economically, I think it would be a good thing to evaluate this information. Through geographic exploration, wind speed measuring and potential power calculations, I can conclude which area(s) would be most effective for wind turbine placement.</p> <p>Methods/Materials -First, select some locations around Ventura County that you think might have the greatest output of wind energy -After coming up with several geographical spots mark them on a county topographic map so that you know the exact location of your recording spot. - Next, over a short period of time, drive to all of the designated recording areas and measure the wind speed (with the anemometer attached to the long pole).- After that, calculate average wind speed, and wind power conversions and record the data.- Approximate and plot annual power output for all locations selected and compare sites for their future potential and usefulness.- At the end you should be left with one optimal area that would benefit Ventura both economically and environmentally. Materials:-An anemometer-Research Table-Computer-Map of Ventura County-Long attachment pole- Access to local wind recording areas</p> <p>Results Site 1: Max: 8.3mph-3.7m/s, Avg: 5.3mph-2.4m/s, Low:2.2mph Site 2:Max: 14.4mph-6.48m/s, Avg: 11.8mph-5.3m/s, Low:9.0mph Site 3: Max: 13.6mph-6.12m/s, Avg: 8.9mph-4.005m/s, Low:1.4mph</p> <p>Conclusions/Discussion It appears that Ventura has potential for having fairly ideal locations for a wind power turbine farms. These spots all demonstrate some consistently of winds and at some times close to optimal wind speeds for a good energy output.My hypothesis of the coastal hilltop area being the most ideal for the wind farm, actually proved to be the most constant of the sites and maxed out at high wind speed. Some of my experimental errors included, to not have big time gaps from traveling one site to another. Also, I could have test different times of the day to get a more overall perspective.I learned so much from this,like how such a simple thing like wind can be transformed into a green energy source.I have proved that in Ventura there are possibilities for wind farms.</p>	
Summary Statement Evaluation of wind power potential for Ventura County.	
Help Received My dad helped drive me to the various site locations.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Jasleen K. Bains	Project Number S0803
Project Title Investigating Arsenic Contamination in Older Cemetery Soils	
Abstract Objectives/Goals Older cemetery soils were tested to see if there was any arsenic contamination in the soil. Older cemeteries were tested because arsenic was used as an embalming fluid, particularly in 1880s. Methods/Materials There were three main procedures: collection of soil, experiment for arsenic contamination, and test effect on daphnia. For collection of soil, 3 different cemeteries were tested, 2 graves per cemetery, and 3 distances (5 ft, 10 ft, 15 ft) from each grave and on all 4 sides of the grave, totaling 72 samples. A metal pipe was twisted 7 feet into the soil at the specified distance. The soil was mixed with water and filtered into a reaction bottle up to 50 ml. Next, the soil was tested for arsenic contamination. A test strip was inserted into the cap of the reaction bottle, two reagents were added to the sample. The test strip was removed 20 minutes later and compared with the arsenic level chart. To test effect on daphnia, the soil was mixed with water and 20 ml were filtered into a test tube. Five daphnia were added to the test tube and the death rate was timed. Note: All soil samples, even if no arsenic was present, were tested with the daphnia. Results Results indicate that the cemetery soils are more toxic than other soils (control). The higher the amount of arsenic, the more likely it was that the daphnia were killed. In some tests where there was not any arsenic present, the daphnia still died later, suggesting that other toxins were in the soil. The graphs also show a plume forming in which the arsenic levels crossed the daphnia death rate. This indicates that the ground water runs in the direction of the plume and thus the arsenic and any other toxins have moved in that direction. Conclusions/Discussion It appears that this study has brought a more precise understanding of older cemetery soils. They are more toxic than soils outside of the cemetery, because they have arsenic and other toxins which killed the daphnia. Thus, the objective was attained because toxins were found in the soil. Additionally, arsenic contamination in cemeteries has been unexplored and this investigation can lead to more experiments with the cemetery soils to clean the environment of arsenic contamination.	
Summary Statement My project seeks to investigate arsenic contamination in older cemetery soil, in addition to investigating their effect on daphnia.	
Help Received Mother paid for materials.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Rachel E. Bickert; Kelli M. Van Wandelen	Project Number S0804
Project Title Kelli and Rachel's Excellent Beach Adventure: Sand, Waves, and Storms	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of monitoring the profile of Seabright Beach is to gather data about and information about Seabright Beach, and to make evaluations based on our data.</p> <p>Methods/Materials The materials are brass 2X hand level, rod level, fiberglass metric stadia rod, computer, Microsoft Office, tide book, thermometer, Kestrel, and compass. We go to the beach and survey across the beach from North to South until we reach the ocean, gathering height every two meters. We then cumulate the data and graph it.</p> <p>Results So far, our results have shown what we hypothesized. When we began gathering data, the beach had a summer berm. As we begin transitioning into winter, the beach has followed its trend of becoming flatter.</p>	
Summary Statement In this project, we observed how the profile of Seabright Beach in Santa Cruz, CA responded to changing wave, season, and climate conditions and compared those changes to data from previous years.	
Help Received Used equipment of San Lorenzo Valley High school, consulted with Dave Schwartz of Cabrillo College	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Elizabeth C. Brajevich	Project Number S0805
Project Title Just Ducky? The Harsh Effects of Torrance Runoff on Madrona Marsh	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To use various forms of science including biochemistry and microbiology to preserve Madrona Marsh a vernal marsh in Torrance, California from harsh contaminants in local runoff.</p> <p>Methods/Materials Mock Marshes, Zinc Chloride, Lead Nitrate, Chromium sulfate, Ammonia, Gasoline, Compound light microscope, Balance, GC/MS, seperatory funnel, dichloromethane, NaCL Aqueous solution, Ethanol, Sodium sulfate, safety equipment, droppers, Madrona marsh water, Torrance street runoff, 300 ml distilled water. I obtained permission to use the UCLA GC/MS facility and Madrona Marsh water. I collected marsh and runoff water. Then with the assistance of Dr. Jane Strouse and co-workers, I prepared and analyzed samples of marsh water and runoff using a Gas Chromatography Mass Spectrometer to look for similarities in the marsh and runoff to prove runoff contaminants were entering the vernal marsh when it rained. I researched and chose chose 5 prominent toxins to test on protozoa. I used the protists as an indicator species I set them up in six mock marshes and tested each toxin in the miniature marsh. I counted the amount of protozoa living after 2 weeks and established lead nitrate as the most lethal toxin. I found a filtration system to remove all five toxins from the marsh, a salmon saver Enviro-drain.</p> <p>Results Lead Nitrate had the most lethal effect on the protozoa. In a miniature pond previously containing 525 protozoa viewable (100x magnification, 5 minutes), it had only 60 protozoa viewable. An Enviro Drain system can restore the marsh, the top tray filters particles and a natural cellulose fiber absorbs oil and gasoline substances, the bottom tray, filled with activated carbon, neutralizes pesticides and removes lead nitrate as well as the other prominent toxins. My chi-square results prove there is a significant difference between each set of data.</p> <p>Conclusions/Discussion My hypothesis was valid because lead nitrate was the most lethal of the five toxins (lead nitrate, zinc chloride, chromium sulfate, ammonia, and gasoline). This means that by removing Lead Nitrate alone, 88.5% more protozoa would survive. When adding each toxin to the mock marshes I used the PPM by mass ratio that each toxin is present in the marsh. I counted protozoa accurately, counting how many I could view in 5 minutes on 100x magnification. I counted Six times, per container and averaged those numbers.</p>	
Summary Statement I detetmined the five most prominint toxins in Madrona Marsh then tested them on protozoa determining Lead Nitrate as the most lethal and found a filter that efficiently removes these polutants fron Madrona Marsh in Torrance California.	
Help Received Due to age restricitons in UCLA sample preperatory labs, Dr. Yves Rubin directed assistants to prepare samples for the GC/MS using a method we had agreed on. Dr. Jane Strouse helped, running the GC/MS machinery, asisiting me most in finding the data on the correct software so that i could analyze the	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Evelyn Chang	Project Number S0806
Project Title An Investigation of the Potential Impact of Liquefaction-Induced Lateral Spreading on a Populated Urban Setting	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The main objectives of this project was to: a) clarify the existing definition of a "free face" in the currently vague and ambiguous lateral spread criteria and b) to provide a map of the City of Irvine with clear outlines of the specific areas that require attention to lateral spreading. In specific, the contours of equal lateral spread magnitudes will be established on both sides of the "free face" channel to highlight the potential extent of damage that may be associated with lateral spreading in an urban setting.</p> <p>Methods/Materials The model setup consisted of two main elements: the soil in its container, and a working shake table. A model slope was constructed with either bare earth, rip rap covering, concrete-paving, or a reinforced concrete retaining wall, and placed under seismic agitation to determine its lateral spread potential. The model was prepared by the filling of a soil box with the essential soil and carving out the slope based upon a contour drawn alongside the box. The entire box, along with the soil, was then set on a shake table and placed under a seismic force of about 0.25g. The movement of the box was captured with a camcorder and analyzed digitally. The map was created through usage of Youd's equation for calculating lateral spread displacement. The points generated from the equation was then used to plot the contour of lateral spread displacement on the Tustin Quadrangle seismic hazards map.</p> <p>Results The rip rap slope and the concrete lining slope displayed many characteristic damages associated with lateral spread, including the subsidence, or slumping, of the crown point and back edge, the heaving of the toe, the tension cracks, and extensive ground fissures. On the other hand, the retaining wall seemed to resist the forces of lateral spread, merely displaying some typical damages associated strictly with liquefaction: the "floating" on the liquefied soil and the loss of contact between the wall and the soil.</p> <p>Conclusions/Discussion In conclusion, the rip rap slope and the concrete lining slope should clearly be characterized as "free face" slopes, while a retaining wall should remain outside the category. This calls for the importance of new reinforced designs and the need to retrofit current slopes with further reinforcement.</p>	
Summary Statement This project clarified the existing definition of a "free face" in the currently vague and ambiguous lateral spread criteria and provides engineers with a map with clear outlines of the areas that require attention to lateral spreading.	
Help Received Used lab equipment at Associated Soils Engineering, inc. under supervision of my Dad	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Emily Cheng; Aakriti Jain	Project Number S0807
Project Title The Effect of Variable Microorganisms and pH on the Efficiency of a Microbial Fuel Cell	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals In light of depleting fossil fuels and their harm to the environment, there has been development in renewable sources of energy. The microbial fuel cell (MFC) is one such development; it is unique in that its only byproduct is water, and it uses microbes to generate energy. Our goal was to optimize this system's electrical output and stability, and to do so we tested MFCs with varying microorganisms and pH levels in the anode.</p> <p>Methods/Materials To determine the effect of these variables on the efficiency of microbial fuel cells, we built and tested 6 MFCs in six independent trials: using <i>E. coli</i>, <i>S. cerevisiae</i>, or <i>I. galbana</i> as the microorganisms, under pH conditions of 6, 6.5, or 7. Half of the cells had a cathode solution of H₂O with dissolved oxygen, while the other half used H₂O₂, in order to account for the limited amount of dissolved oxygen in the cathode half-cell of our trials. The cells were assembled accordingly and the electrical potential (voltage) was measured daily using a multimeter.</p> <p>Results Our results show that <i>S. cerevisiae</i> produced the most stable voltage, with the least day to day fluctuation as compared to the other trials. In terms of generating the highest voltage, all three microbes produced a similar range of voltages; however, there was a global trend based on pH level: as pH increases, voltage decreases, indicating that a more acidic anode solution results in a higher voltage</p> <p>Conclusions/Discussion This experiment shows that in terms of stability, the yeast fuel cells are the most stable, whereas achieving a high voltage output depends more on the environment the microorganisms are in, rather than the type of microorganism themselves. Therefore, in future studies of microbial fuel cells, it may be helpful to focus on altering the solutions in the anode half-cell, rather than the microbe, in order to optimize the efficiency of microbial fuel cells.</p>	
Summary Statement An experiment manipulating the microbe type and the pH level to determine an optimal efficiency of a microbial fuel cell in terms of voltage output and stability.	
Help Received Physiology teacher, Ms. Alonzo, supervised us when we cultured our microorganisms.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) <p align="center">Arthur J. Clark</p>	Project Number <p align="center">S0808</p>
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Project Title

Wave Power

Abstract

Objectives/Goals
 The goal is to convert ocean waves into electricity and make more energy then solar panels.

Methods/Materials

1 Boogie Board (Styrofoam board)	1 Flat wood board
A shake up flashlight	1 Screw
Water	2 dowels
2 insulated wires	1 Marker (red)
Water sealant (putty)	1 Compass
Voltmeter	Super glue
Pencil	1 Rope
Measuring tape	1 Metal pipe
String	1 Tub, (32# long x 18 1/2#wide x 18# high)
Duct tape	

Results
 My results were that the wave machine did make more power then the solar panel, but I did not know if the power of the Swell fuel machine was hourly or something else.

Conclusions/Discussion
 In my experiment, the results seem to be random. If someone tries this experiment they probably couldn't get my results, because waves are unpredictable, unless you use one of those wave-making machines. I found out that the board did not correlate with the angles because I had to make the waves and then quickly look at the angle. When I was making the waves, the board kept hitting my wave maker (which is the wooden board and dowel) causing it to go back and forth instead of up and down. This caused the light to move in the way it wasn't supposed to, which means I should have put the light vertical instead of horizontal on the board. For now, I proved my hypothesis because I did some calculations that showed wave power makes more energy then solar power. Solar made 155 watts, (How stuff works) while a wave power machine can make 900 watts per hour (Swell fuel). I think this machine will be the partial answer to our future energy needs and that it has great potential because there is a lot of power in the ocean. This experiment is important because it's clean energy, waves are plentiful through out the world, and the machine won't get in the way of construction as solar panels would. The machine can be moved to different places and it can work 24 hours, seven days a week. It can work in stormy or sunny weather. We depend on energy so much these days and this is another way to make energy that is clean and does not

Summary Statement
 My project is about finding new ways to use renewable energy sources.

Help Received
 Father helped editing and calculations, phone conversation with original inventor(Christopher Olson)



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Kelsey Cole; Emily Hornstein	Project Number S0809
Project Title Got Pb?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Our study focused on testing the drinking water of three Ventura high schools to determine its lead content. We sought to prove that the highest lead levels would be found in the drinking water at Ventura High School (the oldest high school in the district).</p> <p>Methods/Materials 20 containers; Labels[date, time and location]; Water from three Ventura high schools; Negative control (Aquafina water); Positive control (25 ppb lead in distilled water); Capco Analytical Service, Inc. # a commercial lab in Ventura, California; Using consistant technique, we filled 200 cc of drinking water per container, on 2.25.09 at 7AM. Outside temp:66F; Prior to filling the containers, we ran the water for ten seconds. This was done to test the water from the water line instead of testing the faucet water. We transported the water to the commercial lab within 30 minutes.</p> <p>Results Ventura High School(ppb): 1.tennis court- 2.7 2.boys# bathroom- 2.9 3.track- 0.51 4.teachers# lounge- 4.4 5.kitchen- 0 6.gym- 0 7.auditorium- 0.58 16.hallway- 3.4 17.Reynosa#s classroom- 0 19.principal#s office- 0.58 20.New Building- 0 Buena High School: 8.snack bar- 0 9.bathroom- 0 10.teachers# lounge- 7.5 11.kitchen- 6.7 12.cafeteria- 11 Foothill High School:</p>	
Summary Statement Our study focused on testing the drinking water of three Ventura high schools to determine its lead content.	
Help Received Used lab equipment and staff of Capco Analytical Service, Inc.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Emily Engle; Quinn Rogers	Project Number S0810
Project Title Biomonitoring: Water Quality with the Use of Benthic Macroinvertebrates	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of monitoring the Benthic Macroinvertebrates of the San Lorenzo River at Henry Cowell State Park is to determine the health of the river by analyzing biodiversity at two sites.</p> <p>Methods/Materials We got a DFG Scientific Collecting Permit from the DFG License and revenue Branch. Once we received our permit we chose the sites to collect our samples from. We choose 3 riffles within the river roughly 3 meters away from each other. Begin sampling by placing a net directly on the substrate and make sure the net is perpendicular to the flow of the stream. After placing the net into the water, begin to rub the substrate within a 1X2 foot area in front of the net. Do this by rubbing rocks by hand under the water in front of the net; the flow of the water will carry the materials into the net. After exposing the net to the substrate for 1 minute, remove the net from the river and remove all large debris and inspect for any BMI's. Label a jar with the site name, location, and date. Then place the sample into the jar no more than 2/3 of the way full, and then fill the jar the rest of the way with ethanol. We then cleaned our sample to ease the sorting process. Then using the Measuring the Health of California Streams and Rivers manual we sorted the BMI's into their taxonomic groups.</p> <p>Results We found that our Downstream site's sample had: 1 Acari , 10 Amphipoda , 2 Hirundinea , 1 Oligochaeta, 1 Ephemeroptera, 7 Plecoptera, 10 Trichoptera, 20 Diptera, 19 Coleoptera, 3 Odonata, and 3 Hemiptera. Our Upstream site had: 3 Acari , 4 Amphipoda, 2 Gastropoda, 2 Pelecypoda, 1 Plecoptera, 19 Trichoptera, 42 Diptera, 20 Coleoptera, and 2 Odonata.</p> <p>Conclusions/Discussion Overall the San Lorenzo River at Henry Cowell State Park has good water quality according to our combined site's score of 2.45. This means that the pollution levels from human populations are minimal. This score also means that the dissolved oxygen levels are adequate to support aquatic life, such as Ephemeroptera (Mayfly), or Plecoptera (Stonefly). These results also suggest that there is no pollution introduction between the upstream and downstream sites, since the quality increased from the upstream site to the downstream site.</p>	
Summary Statement Using Bentic Macroinvertebrates we are determining the health of the San Loerzo River.	
Help Received	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Erica Fine; Sonya Sidhu; Gunnar Thordarson	Project Number S0811
Project Title The Potential for Vegetable Oil Based Fuels as a Substitute for Diesel	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals</p> <ol style="list-style-type: none">1. Compare the trade-off in performance between petroleum based Diesel and Vegetable Oil based fuels in Diesel Engines in terms of Emissions(CO₂; CO;NO_x; Hydrocarbons),Carbon Footprint,Miles per gallon and Economics.2. Test the performance of different Fuels in our converted Mercedes Research Vehicle:Vegetable Oil(Soy,Canola,Peanut,Corn);Waste Vegetable Oil(Soy);Bio-Diesel;and Diesel.3. Evaluate the potential for Vegetable Oil based fuels to play a greater role in our Energy Economy. <p>Methods/Materials</p> <p>We converted a 1987 Mercedes diesel to run on a variety of fuels. A special test tank,fuel pump and heat exchangers were installed. Each fuel was tested on an 11.4 mile test course and the MPG determined. Each fuel was also tested for emissions using calibrated smog equipment.</p> <p>Results</p> <p>In terms of emissions,vegetable-oil based fuels were clearly superior over diesel in its impact on greenhouse gases(CO₂),but did show higher levels of nitrous oxides(NO_x)and hydrocarbons.In terms of performance,Diesel has the highest BTU/gal and we expected to see a 13% drop in MPG for vegetable oil. We measured a reduction of only 5.6% which may be due to more efficient combustion. When we compared a number of vegetable oils, we found the best performance with Waste Soybean Oil and Canola Oil. We believe the higher performance is due to the lower levels of saturated fats. The economics of fuels was determined on a cost per mile.Waste Vegetable oil was the cheapest at \$0.03 per mile. Pure vegetable oil based fuels were about 40% more than diesel. This gap could be reduced if vegetable oil was produced at greater scale. Waste vegetable oil will only ever provide about 0.5 B gallons of fuel compared to a need for 63 B. We considered how high-oil yielding plants such as castor beans, jatropha, coconut and palm oil could be leveraged to displace a greater quantity of diesel. The highest oil producing plant on a gal/acre/yr basis is algae which could be scaled to displace petroleum based diesel.</p> <p>Conclusions/Discussion</p> <p>If we were to take 10% of the 243 m gas vehicles off the road and substitute high MPG diesel cars (+75 mpg), we would displace +10 B gallons of fuel, more than any other energy conservation effort. With a greater number of cars burning diesel, algae oil and plant based oils could be scaled. Substitution of these fuels will benefit the environment, reduce our dependence on imported oil and potentially reduce energy costs.</p>	
Summary Statement Our project considers the trade-offs in performance, emissions and economics of vegetable oil based fuels as compared to petroleum based diesel and looks at how we can reduce greenhouse gases and our dependence on imported oil.	
Help Received This project was conducted by our team. Mr Laity (parent mentor) and Mr. Robertson (chemistry teacher) each helped critique our work and challenge us with questions and issues. This project was completed as a team as the research vehicle had to be driven by one of us as others noted data, road conditions and time.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Avenlea Gamble; July Perreault	Project Number S0812
Project Title Acid Rain, Minus the Acid	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this experiment was to find a solution to two questions: how does acid rain affect soil and does Tums, Alka-Seltzer, or Zantac 75 absorb the most acid?</p> <p>Methods/Materials Materials: pH strips, glass jars, soil, sulfuric acid, water, rocks, ect.</p> <p>Method:Day 1- Setup and Addition of Acid Rain: 1. Wash jars with filtered water, then dry. 2. Label the 4 experiment jars: Jar 1, Jar 2, Jar 3, and Control Jar. 3. Wash all the rocks thoroughly with filtered water. 4. Layer the bottom of each jar with a layer of rocks so that there is drainage for excess fluids to escape to. 5. Test the pH of the soil and record it. 6. Measure 3 cups of soil into each jar on top of the rocks. 7. Mix acid with filtered water in a beaker and measure the pH of the mixture. 8. Test the pH of the mixture and record it. 9. Pour mixture (50 mL) into a spray bottle. 10. Spray soil in Jar 1, Jar 2, and Jar 3 with mixture 15 times. 11. Cover all 4 jars with plastic wrap. 12. Place all 4 jars on shelf for 24 hours.</p> <p>Day 2- Addition of Antacids: 1. Test pH of the soil in all 4 jars and record it. 2. Fill 3 beakers with 25 mL of filtered water. 3. Dissolve 3 tablets of Tums in one beaker, 3 tablets of Alka-Seltzer in another beaker, and 3 tablets of Zantac 75 in the third beaker by stirring them with a different pipet for each beaker. 4. Pour the mixture of Tums into Jar 1, pour the mixture of Alka-Seltzer into Jar 2, and pour the mixture of Zantac 75 into Jar 3. 5. Cover all 4 jars with new plastic wrap and place them back on the shelf.</p> <p>Day 3- Collection of Results: 1. Find pH of soil. 2. Repeat all previous steps for 3 more tests.</p> <p>Results In all 4 experiments, the acid brought the soil from a neutral 7 to an acidic 6. In all of the experiments, the 3 antacids (Tums, Alka-Seltzer, and Zantac 75) brought the pH of the soil back up to at least a 7, if not an 8. Test 1: Tums-7, Alka-Seltzer-8, Zantac 75-7 Test 2: Tums-7, Alka-Seltzer-7, Zantac 75-8 Test 3: Tums-7, Alka-Seltzer-8, Zantac 75-7 Test 4: Tums-7, Alka-Seltzer-7, Zantac 75-7</p> <p>Conclusions/Discussion The conclusion of this experiment is that acid rain makes the soil pH more acidic, and all three of the</p>	
Summary Statement This project is about how acid rain affects the pH of soil and which of Tums, Alka-Seltzer, and Zantac 75 absorbs the most acid from the soil?	
Help Received	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Geena Garabedian; Taylor Wright	Project Number S0813
Project Title Aquatic Herbicides: The Effects of Copper Sulfate on Non-Target Organisms and Food Chains	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Many kinds of pollutants enter lakes, ponds, streams because of our industry and agriculture, even chemicals that we use around the house. What happens when these substances enter the water where desirable living things exist? Can these pollutants actually come back to us? For instance, we add chlorine and fluorine to purify water and fight cavities. Copper sulfate is added throughout North America, and the world, to kill unwanted water "weeds". We proposed a hypothesis, and an experiment, that aquatic herbicides like these may do more harm than expected.</p> <p>Methods/Materials What we wanted to know was how these additives, in this case copper sulfate, effect living things by testing: a) the effect of various concentrations of copper sulfate on pea seed respiration rates during germination. We did this by building a respirometer. (This could show larger effects because useful aerobic organisms use oxygen and respire in a similar way) and b) to see if copper sulfate could be absorbed into the food chains of biological communities. We did this by measuring the amount of copper sulfate absorbed by invertebrate animals and water plants. This effect was measured with colorimetric analysis using a spectrophotometer.</p> <p>Results In phase one, observed respirometer rates, for example 2ppm copper sulfate, consistently reduced pea seed gas exchange rate over controls with no copper sulfate. In phase two, the spectrometer showed lowered values of ppm copper sulfate in solution after 24 hours of exposure with test organisms compared to little or no change in copper concentration if no organisms were present in controls.</p> <p>Conclusions/Discussion Respirometer data suggests our initial hypothesis may be supported. Since many desirable organisms respire, copper sulfate may be hurting more organisms when added to natural systems at about the same concentrations we used. And, uptake is suggested by the spectrophotometer data. Once into lower food levels the copper could enter the food chains of ecosystems. Bio-amplification would be a significant follow-up study. In conclusion, data suggests copper sulfate, a widely used aquatic herbicide, may do more harm than just killing "weeds"</p>	
Summary Statement Does copper sulfate, a widely used aquatic herbicide, actually do more harm than just kill "weeds"?	
Help Received High school use of spectrometer and glassware. Father drove us to river site. Mother helped proof read report	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Windy Graham; Codi Hirsch	Project Number S0814
Project Title Photovoltaic Performance: SunEye vs. Pathfinder	
Abstract Objectives/Goals Which of the two different instruments, the SunEye or the Pathfinder, more accurately predicts the photovoltaic array performance of a shell panel system consisting of 930 watts? Methods/Materials Materials: A Solmetric SunEye, A Solar Pathfinder, An MX60 Charge Controller, A full solar array system consisting of: 6 Shell SQ80 panels, 6 Shell SP75 panels. Results SunEye first predicted that a total of 227.28 kilowatt hours were going to be produced. The Pathfinder predicted that a total of 209.48 kilowatt hours were going to be produced. The Shell panel system actually produced 126.60 kilowatt hours. Our data logging system recorded daily kilowatt production but did not come close to either predicted amounts. Conclusions/Discussion After completing our experiment with two different popular solar instruments that predict solar outputs, we cannot say which instrument was more accurate. Weather is the main factor when recording daily solar output. Because we conducted our experiment in two of the worst months of the year (weather-wise), we did not have enough data to show which instrument was more accurate. We would need to take data for an entire year instead of for two months to show an accurate conclusion.	
Summary Statement Which instrument, the SunEye or the Pathfinder, more accurately predicts photovoltaic array performance?	
Help Received Father helped me set up the instruments	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Alicia I. Guerra	Project Number S0815
Project Title Supplementary Analysis of the Adjudication of Competence of a Greywater Mechanical Filtration/Reuse Complex	
Abstract Objectives/Goals The prospect of this investigation is to ascertain whether an autochthonous greywater reuse and filtration complex can minimize unfavorable indicators of water quality (e.g. alkalinity, pH) and yield surpassing height lengths and biomasses of basil plants compared to those of untreated greywater. Methods/Materials Greywater is salvaged from the washer and transported outdoors to be filtered through mechanical processes (including sand filtration). Treated greywater (experimental), untreated greywater (control) annexed before filtration, and tapwater will be measured for levels of water quality determinants and each water sample will be used to water 10 plants each to compare biomasses and height. Results Ocimum basilicum grown in treated greywater had height lengths and biomasses almost duplicate to those of tapwater, while plants watered in untreated greywater languished in root damage and lagging heights. Conclusions/Discussion Accordant results after ten trials manifest cogency of a small-scale, cost-efficient greywater treatment system and connote arbitration of greywater constrained to being filtered for the scope of watering plants.	
Summary Statement The levels of antagonistic water quality determinants were reduced by greywater treatment ; filtration of greywater leads to an improvement in growth and root development of ocimum basilicum.	
Help Received Water testing kits/ laboratory equipment from BVHS used under supervision of Dr. Michelle Mardahl. Questions answered by Otay Water District chemist Patricia Ortega. Family aided with board/ material expenses.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Shelby Haase; Saumya Shah	Project Number S0816
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Project Title
Riverside, How Clean Are Your Creeks? Field Analysis of the Impact of Urban Runoff on Water Quality of Sycamore Creek

Abstract

Objectives/Goals
THIS PROJECT WAS CONDUCTED TO DETERMINE THE IMPACT THAT URBANIZATION HAS ON SYCAMORE CANYON CREEK IN THE CITY OF RIVERSIDE. IT WAS PREDICTED THAT THE CONCENTRATIONS OF ALKALINITY, CHLORIDE, DISSOLVED OXYGEN, ELECTRICAL CONDUCTIVITY, HARDNESS, NITRATE, pH, PHOSPHATE, SALINITY, AND TOTAL DISSOLVED SOLIDS (TDS) WOULD INCREASE IN DISTANCE THROUGH THE CITY.

Methods/Materials
IN ORDER TO CONDUCT THIS EXPERIMENT, TITRATION KITS, VACUETTE KITS, AND ELECTRODE METERS WERE USED. THE TITRATION KITS WERE USED TO DETERMINE ALKALINITY, CHLORIDE, AND SALINITY LEVELS. DISSOLVED OXYGEN, HARDNESS, NITRATE, AND PHOSPHATE LEVELS WERE FOUND VIA VACUETTE KITS. FINALLY, CONDUCTIVITY, pH, AND TDS WERE GATHERED BY THE ELECTRODE METERS. FOUR LOCATIONS ALONG SYCAMORE CANYON CREEK WERE USED AS TESTING SITES FROM WHICH WATER SAMPLES WERE COLLECTED. THESE SAMPLES WERE THEN TESTED AT HOME.

Results
FOR MOST OF THE ELEMENTS TESTED, THE TRENDS SHOWED THAT THE LEVELS INCREASED AS THE CREEK PROGRESSED DOWNSTREAM; HOWEVER, THE DATA OF SITE 4, INSIDE RIVERSIDE COMMUNITY COLLEGE, BROKE THE INCREASING TREND. PHOSPHATES, NITRATES, TDS, CONDUCTIVITY, AND ALKALINITY FOLLOWED THIS PATTERN. DISSOLVED OXYGEN, CHLORIDE, PH, AND HARDNESS, DID NOT FOLLOW A UNIQUE DEVELOPMENT AS THE CREEK PROGRESSED THROUGH RIVERSIDE. SALINITY WAS THE ONLY ELEMENT THAT FOLLOWED THE HYPOTHESIS, CONSTANTLY INCREASING FROM SITE TO SITE.

Conclusions/Discussion
BASED ON THE AVERAGE DATA FOR EACH OF THE COMPONENTS, THE HYPOTHESIS WAS DISPROVEN FOR ALL THE ELEMENTS TESTED, EXCEPT SALINITY. FOR THE MAJORITY OF THE WATER COMPONENTS, THERE WAS A LINEAR INCREASE FROM SITE 1 TO SITE 3; NONETHELESS, THE LEVEL SEEMED TO DROP AT SITE 4. RUNOFF FROM DIFFERENT SOURCES MIGHT HAVE DILUTED THE CONCENTRATIONS OF THE ELEMENTS, CAUSING THE DROP AT SITE 4. SOME HUMAN ERRORS MAY HAVE CAUSED FLUCTUATIONS IN THE

Summary Statement
THIS PROJECT WAS DESIGNED TO DETERMINE THE IMPACT OF URBANIZATION ON THE WATER QUALITY OF SYCAMORE CANYON CREEK IN RIVERSIDE.

Help Received
GRANDMOTHER PROOFREAD THE REPORT FOR GRAMMATICAL ERRORS; PARENTS DROVE US TO COLLECT SAMPLES EVERY MONTH; SCIENCE FAIR ADVISOR SUPPLIED THE TEST KITS.



CALIFORNIA STATE SCIENCE FAIR 2009 PROJECT SUMMARY

Name(s) Matthew Heydeman; Matthew Stanton	Project Number S0817
Project Title Building a Model to Optimize Solar Water Heating Requirements Given a Site's Observed Solar Flux	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The goal of this project was to develop a computational model which would evaluate the effectiveness of a solar water heater in preheating water for hot tub or home hot water use, based on year-long timeseries of local solar irradiance and air temperature data.</p> <p>Methods/Materials The MATLAB program first read the short wave, long wave, and air temperature values for each sample interval in the year. Next, the program looped through each 10 minute interval, and, using the environmental data, the physical constants specific to the solar collector, and the solar collector temperature calculated in the last interval, calculated the incoming solar energy, incoming black body radiation, the conductive loss of the collector, and the black body losses of the collector to determine the change in temperature of the collector and hot tub/water storage unit for the current interval. The heat in the collector was mixed into the tub/hot water storage unit when the collector exceeded the storage temperature by two degrees. At the end of the solar day the amount of energy which would be necessary to bring the stored hot water to the desired temperature was calculated. This value was stored for each day and used in the economic analysis of the model.</p> <p>Results The program showed reasonable temperatures for the collector, heat losses and gains, and estimated required energy costs throughout the year long sample period. Net losses or gains due to black body radiation tended to be small in the day and dominant at night, however at a time when the system wasn't active. The data showed clear seasonality in heating savings and temperatures of the collector, as the collector contributed much more energy to the hot tub/ water heater in the higher solar irradiance summer months.</p> <p>Conclusions/Discussion The program predicted an optimum number of solar collectors, which was two for the solar collectors and consumption model used in this study, for both the hot tub and hot water models. The model provided a means of assessing the collector / storage system throughout an annual cycle accounting for air-temperature-dependent conductive losses, and cloud dependent long wave losses for the solar collector / storage systems. Overall, the program made useful predictions for the optimal number of collectors for the chosen coastal site in Monterey, California based on local environmental observations.</p>	
Summary Statement The project uses a year long environmental dataset to determine the optimal number of solar water heating collectors to heat water for a hot tub and domestic hot water use in a given location.	
Help Received A local meteorologist, Dick Lind, provided the sample dataset that we used.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Jennifer J. Hines	Project Number S0818
Project Title Oily Situation	
Objectives/Goals Oil spills are dangerous to the environment and should be taken very seriously; there are never enough solutions to cleaning up the residue. This project is an attempt to find the most efficient oil absorber out of 5 commonly known substances. The results may be useful to an environmental scientist or even an ordinary person, looking to clean up an accidental spill. If 5 different commonly used materials: sawdust, kitty litter, dirt, ventilation filters, and charcoal are tested for their ability to absorb oil from water, then the kitty litter will extract the greatest amount of oil.	
Abstract Methods/Materials Six nylons were suspended in each trial, each containing a different test material. These materials included 1 cup of kitty litter, 1 cup of sawdust, 1 cup of dirt, 4 charcoals, 3 filters, and an empty nylon (used as a control). 125 milliliters of water and 125 milliliters of vegetable oil were poured together into the nylon opening. The nylons were then tied to a chair and suspended for five minutes. Separate collecting measuring cups were placed under each of suspended nylons. After five minutes had passed, (when most of the contents stopped dripping completely), the nylon was untied and disposed of. The measuring cups were then placed on a level surface for accurate measuring. The measuring cup increments were in 50 milliliters, thus some of the initial results were rounded to the nearest 5th milliliter. There were 10 trials for each substance.	
Results Absorbents Oil H2O Sawdust 71 ml 46.5 ml Kitty litter 58.5 ml 81.5 ml Dirt 49.5 ml 59 ml Filter 43 ml 33.5 ml Charcoal 13 ml 28 ml	
Conclusions/Discussion The amount of water absorbed was not the primary objective in this experiment; however it was included in the results because the substance that absorbed the most water did not absorb the most oil. Based on the results, the highest average amount of oil absorbed was sawdust which absorbed the average of 71 milliliters out of 125 milliliters of oil. Sawdust absorbed 12.5 millimeters more than kitty litter, which had the second highest amount. For such a small amount of oil used in this experiment, this difference did appear significant. According to this experiment, sawdust would be the most efficient way of absorbing	
Summary Statement Testing the effectiveness of potential absorbents by their ability to extract lubricant from H2O	
Help Received	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Robert C. Hollar	Project Number S0819
Project Title Maximizing Solar Energy	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of the project is to use a parabolic mirror to maximize solar energy. Another goal of the project is to use the heat absorbing properties of black paint to further potential solar thermal energy output</p> <p>Methods/Materials The project will be conducted as follows: a parabolic mirror will be built using the formula of a parabola and an aluminum sheet. The aluminum will be chemically treated in order to increase its reflective properties. Four 5in long 1in diameter cylinders will be cut out of PVC two of which will be painted black and two of which will be painted white. These cylinders will then be filled with water and placed along the focus of the mirror. One cylinder of each color will be placed directly above the mirror and one of each color will be placed off the reflective surface. The vertex of the mirror will then be pointed towards the sun and the temperatures of the water in each cylinder will be recorded.</p> <p>Results Up until this point, the tests have been conducted with a mirror that has not been chemically treated. However, when the mirror is treated to increase reflectiveness, it should affect all the cylinders equally thus, not affecting the basic results. In these tests, the hypothesis has been proven true with the black mirrored cylinder absorbing the most heat followed by the white mirrored, black off mirror, and white off mirror respectively.</p> <p>Conclusions/Discussion The parabolic mirror was correctly constructed as shown by the fact that all light reflected back to a relatively thin focus. This light increased the amount of heat energy available to the two cylinders above the mirror. This explains why both of the cylinders above the mirror absorbed more heat than those to the side. Furthermore, the theory on black paint was also correct. Something appears black when it absorbs all or almost all light. Because it absorbed all light, the black cylinder also absorbed almost all heat. On the other hand, something appears white when it reflects almost all light. This caused the white cylinder to reject the vast majority of heat energy.</p>	
Summary Statement this project focuses on utilizing both the reflective properties of parabolic mirrors and the absorbing properties of black paint to maximize solar energy.	
Help Received worked in school engineering lab	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Thomas K. Houser	Project Number S0820
Project Title Using the Wasted Heat of a Car with Thermoelectric Modules	
Abstract Objectives/Goals The objective of my project was to see how much power could be generated by placing a thermoelectric module on the exhaust pipe of the car. From the data recorded I could then see if enough power was generated to replace the car's alternator. If it could replace the alternator it would increase the fuel efficiency of the car. Methods/Materials The first thing I did was measure different surface temperatures of the car to determine the best place to put a thermoelectric module. Based on the temperatures recorded I ran a test using an electric skillet set to the recorded temperatures to see what the possible voltage produced would be when the module was on the car. Using a clamp I strapped a thermoelectric module to the exhaust pipe of my car and ran wires in through the base of the passenger side door. This way I could record data while the car was in motion with my thermocouple reader and multimeter. Results Based on my calculations, the most effective setup is with aluminum foil on the exhaust pipe, which increased the heat flow to the thermoelectric module. The maximum power that I generated with my thermoelectric module was 0.258 watts. The highest average power that was generated was about 0.1 watts. This means that it would take about ten hours for the module to produce about one watt hour of power. That is the power that only one module can generate. An exhaust pipe that is 75 inches long (the length of my car's exhaust pipe) can hold up to 50, 1.5 inch thermoelectric modules. With all of those modules connected in series, there could be a constant flow of 5 watts of power and a maximum of 13 watts. If the exhaust pipe was flat, it could produce about five times as much power. That would mean there would be a constant flow of about 25 watts of power and a maximum of 65 watts. To utilize this power, you would also need a DC-DC power converter, which keeps the power flow at a constant current. Conclusions/Discussion It is evident that the thermoelectric module at this point in its development would not be a complete and economical source of electrical power for a car. Still, it does produce a reasonable amount of energy to power some smaller devices. As further advances are made in the technology and as it becomes less expensive and more efficient in design, it could definitely be used as a future energy provider.	
Summary Statement My project is about using thermoelectric modules to capture the wasted heat energy of a vehicles exhaust system and convert it into usable electricity.	
Help Received Dad assisted with driving the vehicle while i recorded data and developing procedures.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Annemarie R. Kelleghan	Project Number S0821
Project Title An Investigation of Radioisotopes and E. coli Levels at Santa Monica Beach	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The goal of this project was to determine how water circulates through the Santa Monica beach and how rain effects this circulation. The radium levels are a marker for coastal water circulation. Salinity was studied as a supplement to the other components. E. coli bacteria levels were measured using water samples taken from the pore water and the water column.</p> <p>Methods/Materials Water samples, both pore water and water column, were collected at four points along the Santa Monica Beach during dry and wet weather. Water samples were filtered through a manganese cartridge which was attached to a RaDeCC coincidence counter that measured for the presence of Radium 223 and Radium 224. Ten milliliters of the water samples were placed on Coliscan Easygel petri dishes to grow E. coli bacteria colonies. Salinity of all water samples was measured using a conductivity meter.</p> <p>Results E.coli bacterium was only present in the water samples taken immediately during or after rainfall. The Pico-Kenter storm drain had extremely high levels of E.coli bacteria during the rainfall. High bacteria concentrations were found during periods of rainfall. The concentration of 223Ra was highest at the storm drain outlet. It was determined that rainfall does not have an effect on the radium. 223Ra and 224Ra were used to calculate the pore water residence time. The residence time of the different sample sites ranged from 0.4 to 2.2 days. This is a fast and dynamic exchange for the bay that may account for the wide distribution of bacteria throughout the water column after rainfall. The salinity of the storm drain was considerably lower than that of the water column.</p> <p>Conclusions/Discussion Radium, E.coli, and salinity were measured. 223Ra and 224Ra were studied because their short half-lives make it possible for their decay to be detected by a time-delayed counter, RaDeCC. Radium can be used as a clock to determine how long it has been since the water left contact with the beach. E.coli produces both β-galactosidase and β-glucuronidase. The former enzyme turns a colony pink, and the later turns a colony blue when the colonies are grown on the Coliscan easygel plates. Colonies with both of these enzymes will turn purple. Since E.coli is the only bacteria that produces both enzymes, these colonies are the only colonies that turn purple. It has been shown that there is no correlation between bacterial concentration and radium levels.</p>	
Summary Statement I studied the circulation of water at the Santa Monica beach utilizing radioactive decay, salinity, and bacterial count.	
Help Received The Southern California Academy of Science provided financial support and a research training program that allowed me to work with Professor Doug Hammond in the Radium Lab in the Geochemistry Department at the University of Southern California. Dr. Hammond who was my project mentor and Rick	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Ayan Kusari	Project Number S0822
Project Title An Electrolytic Approach to Ocean Water Restoration	
Abstract Objectives/Goals The major objectives were to determine: I. Exactly how much activated CaSiO ₃ (and thus HCl) and how much NaOH [electrolytic components] would be needed to neutralize multi-current system ocean water to pre-industrial acidity levels. (And consequently whether the figures obtained would fit into the NSG-habitable bracket.) II. How this amount varies throughout the three non-polar ocean systems based on average pH (carbonic acid-titrated ECmII) Methods/Materials Indian, Atlantic, and Pacific ocean current systems were isolated in a gas infusion chamber for the H ₂ CO ₃ genesis to the correct molarity to yield desired pH. Salinity was titrated and confirmed using refractometer readings. Titration conducted first with NaOH and second with globulated CaSiO ₃ . Measurements checked 4X to confirm data: standard variation found to be reassuringly minimal. Data successfully replicated, data extrapolation revealed volumes in habitable bracket. Results Pacific Simulation (200mL) 0.121 mL CaSiO ₃ 0.312 mL NaOH Atlantic Simulation (200mL) 0.261 mL CaSiO ₃ 0.574 mL NaOH Indian Simulation (200mL) 0.310 mL CaSiO ₃ 0.665 mL NaOH Conclusions/Discussion "Electrolytic" approach still feasible, but given proximity to upper end of HB, especially NaOH, likelihood of application if action not taken immediately is dismal. Global warming's slow advance is largely due to the global ocean's capability to sequester CO ₂ . With acidification (H ₂ CO ₃ formation), however, this sequestration capability is greatly diminished. With an implementation of the electrolytic approach in either a biological or strictly chemical strategy, much of the worst effects of increased atmospheric CO ₂ can be kept at bay until anthropogenic carbon emissions diminish significantly without adversely affecting marine biota.	
Summary Statement My project explores a possible way to neutralize ocean water carbonic acid without damaging marine ecosystems and simultaeneously sequester atmospheric CO ₂ .	
Help Received Used lab equipment at Penner Lab (Bldg. 402, UCI)	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Lindsey Lewis; Kaitlin Wright	Project Number S0823
Project Title Wind Breakers: A Study of Wind Barrier Effectiveness	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To compare barrier effectiveness of 7 realistic barrier designs based on sand obstruction, amount of sand deposited, and wind speed variation.</p> <p>Methods/Materials A wind tunnel generating wind speeds to 35mph was constructed using plywood, Plexiglas, a swamp cooler, indoor/outdoor carpet (agricultural field simulation), and a series of PVC pipes to evenly distribute wind. The tunnel tested the effectiveness of 7 barrier designs constructed of solid pine, wood shingles, and conifer tree branches to represent commonly used solid, semi-porous, and porous barriers. 3500 grams of playground sand was spread between the wind source and the barrier. Wind was generated and sand was blown for 3 minute periods. Sand was collected separately in front of the barrier and from two 27" segments behind the barrier using a shop vac. Wind speed and mass of sand deposited on each segment were recorded for all 16 trials. Changes in pressure and wind flow patterns were observed using a homemade tuft and a series of longer strands of yarn attached to a rod.</p> <p>Results The solid barrier/plants in front blocked 73% (2571.2g) of the initial sand, the fence barrier/plants behind blocked 73% (2537.5g), the solid barrier/plants behind blocked 71%, the solid barrier blocked 67%, the fence barrier blocked 58%, the fence barrier/plants in front blocked 44%, while the plant barrier blocked only 25%. The fence barrier decreased wind speed 17.0mph, the solid barrier decreased wind speed 16.7mph, the fence barrier/plants behind decreased wind speed 13.7mph, the solid barrier/plants behind decreased wind speed 13.0mph, the fence barrier/plants in front decreasing wind speed 12.7mph, the solid barrier/plants in front decreased wind speed 11.7mph, and decreasing wind speed the least was the plant barrier by only 9.0mph.</p> <p>Conclusions/Discussion The control showed that the most damage from both wind and sand will be done if no barrier exists. The most sand (2571.2g) was blocked by the solid barrier/plants in front (73%). The most sand was deposited (1325.3g) on the crop area when the plant barrier was used. The fence alone was the best windbreak, as it decreased the wind speed most significantly (17mph), but its sand blocking capabilities were not of equal caliber as it was ranked 5th blocking only 58% of the initial sand. The three most effective sand barriers were combinations of barriers and were within 2% efficiency of each other.</p>	
Summary Statement To compare barrier effectiveness between 7 realistic barrier designs based on sand obstruction, amount of sand deposited, and wind speed variation.	
Help Received Father instructed and supervised use of all power tools.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Patrick G. Maguire	Project Number S0824
Project Title Photodegradation of the Antimicrobial Triclosan in Aqueous Solution	
Abstract Objectives/Goals Triclosan, the active ingredient in antibacterial soap, may be harmful to the environment. There have been studies illustrating the development of toxic chemicals under ultraviolet light in water and the affects of the chemical on ecosystems and certain organisms. The main objective of this project was to determine whether ultraviolet light affects the antimicrobial triclosan in different aqueous solutions. A failure of triclosan to degrade will be a hazard to the environment. Methods/Materials I took a relatively quantitative approach in the determination of triclosan in three different solutions. I wanted to determine if triclosan degradation is significantly different in certain solutions over a 24 hr period. The triclosan samples were exposed in an exposure chamber with an ultraviolet light source. Triclosan was detected by enzyme linked immunosorbent assay (ELISA). To measure the absorbance for ELISA, I analyzed the samples with a spectrophotometer. Results The data illustrated degradation of triclosan in each of the three aqueous solutions. There was no difference at a significance level of $p < 0.05$ in the degradation of triclosan in the different types of solutions, although there were trends in the data. The rate of disappearance of triclosan averaged 29.42 ng/ml. Conclusions/Discussion In order to show significance in the degradation of triclosan between solutions, there would have had to be more replicates. Triclosan does degrade under ultraviolet light. What happens if an aquatic ecosystem does not receive much ultraviolet light or if the products of the degradation are toxic? Precautions should be taken in these areas to promote a healthy environment.	
Summary Statement My project strived to determine whether triclosan, the active ingredient in antibacterial soap, degrades under ultraviolet light in water solutions.	
Help Received Shirley Gee mentored and guided me through project; Used lab equipment at UC Davis under supervision of Shirley Gee; Parents provided supervision at home and their continued support.	



CALIFORNIA STATE SCIENCE FAIR 2009 PROJECT SUMMARY

Name(s) Brandon D. Miller	Project Number S0825
Project Title An Analysis of the Release of Green House Gasses from Landfills	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Carbon Dioxide and Methane are green house gases that have the greatest impact because of the amount of heat that it can retain. These gases are produced from bacterial decay from organic material. In landfills the two types of landfill trash that produce the largest amount of methane are Alternative Daily Cover (ADC) and Municipal Solid Waste (MSW). In this project, the amount of methane and carbon dioxide produced from ADC must be less or equal to that of MSW to prove the hypothesis. The Environmental Protection Agency proposed to ban ADC as a cover and instead use it to produce electricity. The goal of this experiment is to prove that ADC does not produce more methane than that of MSW.</p> <p>Methods/Materials 1. Get eight standard Waste Management trash bins 2. Seal air tight with silicone and duct tape. 3. Tap and drill a hole for methane reading. 4. Go to landfill and gather contents to fill all the bins. 5. Fill Bin #1. Municipal solid waste and Alternative daily cover. 6. Fill Bin #2 Municipal solid waste (house hold waste). 7. Fill Bin #3 Commercial waste. 8. Fill Bin #4 Alternative Daily Cover (green waste). 9. Fill Bin #5 Municipal solid waste and 14 inches of water (yearly amount of rain). 10. Fill Bin #6 Municipal solid waste and 60 inches of water (yearly amount in northwest). 11. Fill Bin #7 with municipal solid waste and 12 inches of dirt. 12. Fill Bin #8 Dirt (control). 13. Leave for one week. Take CH₄, CO₂, and reading of all bins.</p> <p>Results As the methane was produced in the airtight bins, it was obvious the ADC was not producing more methane than MSW. The methane for ADC was 0.9% and then for MSW it was 1.1% which was .2% more than the ADC. As the eighth week passed the methane was almost even as all the other bins but yet the methane of the MSW was higher which did prove the hypothesis.</p> <p>Conclusions/Discussion The results that were found were that the bin with the highest methane concentration after eight weeks of monitoring was municipal solid waste or MSW. MSW is consisted of many different food types and also paper and plastic product which can consist of a large range of moisture where ADC can only have one small range of moisture. ADC decomposed faster it produced less methane. By proving this, it is shown that the Environmental Protection Agency or EPA does not have any reason to ban the use of this type of daily cover.</p>	
Summary Statement This project is about what type of waste material really is producing the harmful gasses that is emitted from landfills and what we and the Environmental Protection Agency do to help.	
Help Received Waste Management INC. El Sobrante Landfill, Nick Godfrey, Michele Hampton.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Sumit Mitra	Project Number S0826
Project Title The Effect of Denitrification on Methanogenesis in Constructed Wetlands	
Abstract Objectives/Goals The objective is to determine if the presence of nitrate can cause denitrifying bacteria to grow in wetland environments and thereby inhibit methanogenic bacteria, thereby reducing methane emissions. Methods/Materials Six free water surface wetland model ecosystems (Models A through F) were created using 30 gallon plastic containers and adding equivalent quantities of pea gravel, sphagnum peat moss, mud from San Diego Creek, dechlorinated water and <i>Scirpus americanus</i> (commonly known as bulrush) to each container. A seventh model ecosystem (Model G) was created as a control with the same quantities of sediment and water as the other models but without wetland plants. After three months, equal amounts of glucose were added to all the models while potassium nitrate (a nitrate source) was added only to Models A, B and C. About one week after chemical addition, the models were sampled for biochemical oxygen demand (BOD) and nitrate concentrations (via aqueous sampling), and nitrous oxide and methane emissions (via gas sampling). Results The addition of nitrate to Models A, B and C with added nitrate source resulted in lower average BOD concentrations as compared to Models, D, E and F which were not dosed with nitrate. Also, Models A, B and C had higher nitrous oxide emissions as compared to methane emission, while models D, E and F had higher methane emissions as compared to nitrous oxide emissions. The nitrate concentrations in Models A, B and C were also lower as compared to Models D, E and F. Conclusions/Discussion The data clearly suggested that denitrification inhibited methanogenesis in the model wetlands and reduced methane emissions to the atmosphere. If this major global warming problem can be solved, wetlands can be ready for widespread implementation and can be used as a cost effective medium for treating pollutants in wastewaters.	
Summary Statement My project is about determining if methane emissions from constructed wetlands can be reduced through addition of nitrogen	
Help Received Dr. Brian Davis of Stantec acted as my mentor/advisor; Used lab equipment at UCI under supervision of Dr. Tyler, Zachary Scott ; Dr. Stephen Lyon of CH2MHill provided the mature seedlings of bulrush; Mr. Charles McGee of OCSD and his staff helped with BOD testing; Parents helped with the supplies and	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Kemi A. Oyewole	Project Number S0827
Project Title The Role of Soil Minerals in Mitigating the Effects of Acid Rain	
Abstract Objectives/Goals The objective of this experiment is to determine if sand, soil, and lime can lessen the acidity of simulated acid rain. Methods/Materials Glass column was filled with sand (the control), lime and sand, or soil and sand. Then a 0.005 M sulfuric acid was poured into the column, and collected after passing through. The molarity of the solution after passing through the soil was determined using an acid base titration, with sodium hydroxide or sulfuric acid. The pH of the solution after passage was measured using pH paper. Stoichiometry was then used to determine the initial and final amounts of hydrogen ions. From these values the percent by which the number of hydrogen ions decreased was found. Results The lime decreased the number of hydrogen ions by about 24%, the soil by about 4%, and the control by about 1%. The pH level was 2 at the start of the experiment and passage through lime raised that number to about 10.5, the soil to about 5.3, and the control to about 5. The lime so drastically changed the pH of the solution because it is basic. Conclusions/Discussion Since regular rain has a pH of about 5.6 and the soil minerals decreased the pH of acid rain from about 2 to 5.6, these results align with existing data. Current research indicates acid rain does not affect greatly effect ground water supplies because its acidity is negated by the rocks through which the rain flows. This information should encourage conservationists to focus on the acidity of bodies of water and areas covered with thin layers of soil.	
Summary Statement This experiment aimed to find the effect of sand, lime, and soil, on the molarity of a sulfuric acid solution, which simulates acid rain. Passage through the minerals did revert the acid rain to the acidity expected in regular rain.	
Help Received Worked Ms.O'Neill my chemistry teacher's lab, Dr.Yoder at Franklin and Marshall College sent me a lab setup, My classmates helped me clean equipment	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Andrew A. Palosaari	Project Number S0828
Project Title Ultrafiltration/Nanofiltration Membrane Water Treatment for Urban Vernal Marshes	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Contaminants such as fertilizers, pesticides, pharmaceuticals, bacteria, viruses, and various salts are a significant problem for urban vernal marshes. When pollution levels are particularly high, a membrane-based water treatment system could be applied. Such a system would have to include nanofiltration (NF) membranes. The objective of this study was to determine optimal NF pretreatment processes using ultrafiltration (UF) membranes and aluminum sulfate coagulation by evaluating membrane performance (flux decline and fouling).</p> <p>Methods/Materials Flux was determined by collecting weight measurements of the permeate at constant intervals with standard coagulation dosages, using a new experimental pressurization procedure. Flux was normalized by temperature, pressure, and clean membrane flux with distilled water. In addition, a new application of pore blocking laws with membrane cleaning over multiple runs was used to identify periods of cake filtration fouling.</p> <p>Results Results show that aluminum sulfate is a suitable primary coagulant for UF membranes. The optimal 50-mg/L coagulant dosage should be decreased to 15-mg/L over the rainy season. However, coagulation is not needed as a pretreatment of UF membranes since, even without coagulation, final permeate flux is within industry standards. It was also determined that the higher resistant UF-70kDa membrane is less affected by fouling and more easily cleaned due to its reversible cake filtration blocking mechanism.</p> <p>Conclusions/Discussion This bench-scale study shows that a membrane-based water treatment system for urban vernal marsh ecosystems could incorporate UF-70kDa membranes as a pretreatment for a NF system.</p>	
Summary Statement This study determined optimal nanofiltration water pretreatment processes using ultrafiltration membranes and aluminum sulfate coagulation for environmental remediation of an urban vernal marsh.	
Help Received Anna Jawor and Dr. Eric Hoek (UCLA) provided the membranes used in my experiments along with suggestions and reference material; Dr. Kerry Howe (UNM) provided guidance on experimental methods and reference material; Mr. Robert Carr (Madrona Marsh mentor) revised report;	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Jaclyn M. Parson	Project Number S0829
Project Title Agriculture and CO(2) Emissions: An Approach to Reduce Global Warming	
Abstract Objectives/Goals To use various soil treatments with Humates as the key component in treating soil for maximum crop production - the main purpose being to reduce the amount of CO ₂ generated and emitted. Methods/Materials <ul style="list-style-type: none">*12 Mason Jars with rubber septums that were installed in the lids*100g of soil*12Kg of water*12.6Kg of DYNAMEGA soil treatment*12.36Kg of Fulvex and Micronized Dairy Compost (MDC)*Syringe plus needle*Gas Chromatograph*HP Data Integrator Results <p>After completing my experiment and analyzing all of my data, the final calculations have contradicted my hypothesis completely. I predicted that the soil treated with Fulvex and Micronized Dairy Compost would generate and emit the least amount of CO₂ while still benefiting the soil. After experimentation, the impact of the combination on the soil caused the CO₂ generated to increase by 50.9% whereas the soil treated with DYNAMEGA decreased by -6.58%. Treating the soil with water caused the generated CO₂ to increase by 20.42%</p> Conclusions/Discussion <p>What the results of my experiment have proven is that combining materials doesn't always have the most beneficial impact for soil treatments. The final outcome of my experiment proved that treatments with the main component being Humates are the most beneficial overall. Hopefully, with more expansive studies I will be able to provide growers with another powerful reason to use organic materials such as DYNAMEGA opposed to manure and urea. Growers do not realize the affect their choices have on society and the environment globally when treating soils. I was able to realize the full extent that soil treatment has in relationship to the Greenhouse Gas Effect which needs to be recognized and have attention drawn to it through continued research.</p> <p>I would greatly enjoy doing further research on this topic, while using crops grown in Monterey County to make the results more socially relevant. This, along with being approved by governing agencies and society as a whole will have a most positive impact for all to benefit.</p>	
Summary Statement To reduce the amount of CO ₂ flux (GREEN HOUSE GAS) that is emitted during soil treatment.	
Help Received UC Davis Extension Lab provided the Gas Chromatograph, and Dr. Husein A. Ajwa, Mona Othman, William Ntow	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Paul Rendon; Alisa Smith	Project Number S0830
Project Title Carbon Monoxide Emissions from Common Consumer Items	
Abstract Objectives/Goals Our goal was to test and see if common consumer items could produce unhealthy levels of carbon monoxide in an enclosed room. The items we tested were candles, incense, kerosine lanterns, a gas camping stove, a generator, a hibachi, and a propane heater. We defined 'unhealthy' as exceeding 35 ppm. Methods/Materials We set up our experiment in an enclosed storage room the size of a small bedroom where a video recorder captured the experiment for an hour. We observed the experiment on a computer in an external room where we could make sure the CO limit did not exceed 35 ppm. For the items that did exceed this limit, we stopped the experiment. Materials used: CO detector, video cameras, Final Cut Pro, thermometer, timer, MacBook Pro, hibachi, incense, propane heater, candles, generator, kerosine lanterns, gas camping stove, storage room, metal table, fans, matches, lighters, lamp oil, tripod, charcoal, and fiberglass. Results We discovered that the generator, hibachi, and incense produced unhealthy levels of CO. The heater produced some, but not up to an unhealthy limit. The candles, kerosine lanterns, and gas camping stove produced no detectable CO. Conclusions/Discussion We were surprised by some of the outcomes of our experiment, while other outcomes did not surprise us. It surprised us that incense, a seemingly innocent item, produced so much CO. It also surprised us that the gas stove produced no detectable CO, especially since it had warning labels that said it did. We figured the generator would be a heavy producer of CO, but we did not think the CO levels would rise so fast. We thought the heater would produce more CO than it did. The results from the hibachi, kerosine lanterns, and candles were not surprising.	
Summary Statement For our project, we tested common consumer items for unhealthy amounts of carbon monoxide emissions.	
Help Received Jeff helped set up the technical equipment and supervised us to ensure safety, Parents helped with graphs and board assembly.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Chiara J.E. Ricci-Tam	Project Number S0831
Project Title Eutrophication Control by Chemical Limitation of Usable Phosphorus Sources	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective is to determine whether phosphate removal (via formation of a patina on iron wool) is significant enough to limit an algal bloom and thereby serve as a potential method for the treatment of eutrophication caused by excessive phosphate concentrations. I hypothesized that if steel wool is applied to a sample of eutrophic water, it will react with the phosphoric acid present in that water to form an iron phosphate patina, thereby decreasing the phosphate concentration in the water and thus limiting the algae population.</p> <p>Methods/Materials An algae sample taken from the UC Davis Arboretum (Putah Creek) and cultured; from that original sample, four source samples were created (labeled A through D). There were tested for phosphate concentration using ammonium molybdate and stannous chloride reagents (with a spectrophotometer used to read absorbencies), then each source sample was split into two equal samples (with the variable labeled 1, and the control labeled 2). On the variable sample of each pair, a massed piece of steel wool was inserted, and in the control sample, a piece of glass wool of roughly the same mass was inserted (with all treatments lasting for 20 minutes). Afterwards, the phosphate concentrations were measured using the same method as before, and from the absorbency data collected, phosphate concentration was calculated.</p> <p>Results There was no consistent trend from the data to support the hypothesis that there would be a significant decrease in phosphate concentration. This was also evidenced by the fact that, once removed from the samples, the iron wool pieces soon rusted.</p> <p>Conclusions/Discussion The probable reason for the failure of a phosphate patina to form is that the method of iron phosphate patina formation is industrially used under conditions of high temperature, high acidity, and high phosphoric acid concentration, as well as in the presence of certain accelerating chemicals; all of these conditions were not present in the samples tested. This study would be next continued by simulating freshwater conditions (chemical concentrations, etc.) and attempting to alter them either as little as possible or in such a way that the alterations could be reversed so as to have a patina formed on some form of iron with a high surface area. If this could be achieved, the next step would then be to apply the treatment to an algal bloom sample and measure its effects on the algae population.</p>	
Summary Statement My project was designed to test whether an iron phosphate patina would form on steel wool under conditions of neutral pH, room temperature, and relatively low phosphate, with a focus on a potential application in eutrophic freshwater lakes.	
Help Received Used school lab equipment under supervision of my advisor, Mrs. Jeanette Coburn; Prof. Howard Ono, Prof. Steve Blumenshine, and Prof. David Zellmer of California State University, Fresno (CSUF) answered questions related to project design	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Leonard I. Tampkins, IV	Project Number S0832
Project Title Analysis of Magnesium Oxide Aerogel Air Filtration and Various Ways to Increase Its Efficiency	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Aerogel is simply a low density porous solid formed when the liquid in a gel is replaced with a gas; this is done by a process of supercritical drying. Aerogels can be used as a contaminant filter in fluids. Improving on such discoveries is important due to the increasing global emphasis on clean air and water. This experiment will measure the growth of airborne bacteria and is designed to discover how one might increase the efficiency of anti-bacteria air filters through the use of Magnesium Oxide Aerogels.</p> <p>Methods/Materials I used a sterilized box divided into two specific chambers, one of which is airtight. A single clean agar plate is placed into the airtight chambers. The divider in between the two chambers has a hole in it; this allows me to place a variety of filter media in-between the two chambers. I then analyze the efficiency of airborne contaminant filtration by Aerogels, as well as comparing it to the filtration efficiency of commercial filters.</p> <p>Results The data suggests that the application of Magnesium Oxide Sol-gels on a certain filter media reduces the amount of microbes that passes through that filter.</p> <p>Conclusions/Discussion A Magnesium Oxide Aerogel filtration system would be a more efficient filter, and better than regular commercial filters because: Magnesium oxide Sol-gels kill bacteria on contact, the pores in the sol-gel substructure are not more than 100 nanometers in diameter, too small for bacteria or fungal spores to pass through; Aerogels have a greater surface area than cloth filters; and sol-gel filters generally have a higher flow rate than cloth filters, meaning that more air can pass through a sol-gel filter in any given time when compared to a cloth filter.</p>	
Summary Statement This experiment was designed to discover if a magnesium Oxide Aerogel filtration system is more efficient than commercial cloth air filters (in terms of filtration of bacteria/ microbes).	
Help Received I used lab equipment to synthesize the Magnesium Oxide Aerogels at California Polytechnic University in Pomona under the supervision of Professors Alex, Dong, Paige, and the undergraduate students Noam, Jessica, and Stella.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) James D. Warner	Project Number S0833
Project Title Solar without the Sun	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Can fluorescent black lights be used with a solar panel to produce electricity without the sun?</p> <p>Methods/Materials</p> <ol style="list-style-type: none">1. Mount three 18 inch black lights on the top of a wooden box. Plug the lights into a power strip.2. Put a solar panel under the box so the lights can shine on it. Attach a volt/amp meter to the solar panel.3. Measure the volts and amps produced when the panel is put under one, two, and three lights.4. Set the solar panel out in the sun and measure volts and amps produced.5. Repeat steps 2-4 two more times. <p>Results The UV rays produced by the black lights cause the solar panel to produce more electricity under one single light than under the sun. The electricity produced by the solar panel increased with each additional light.</p> <p>Conclusions/Discussion Black lights can be used to produce electricity with a solar panel, the only problem is that the electricity produced is not more that the electricity used to power the lights in the first place. If it were possible to produce more electricity with the panel than is used by the lights than this would be an ideal method to produce electricity in places like Alaska where there is no sun for several months out of the year.</p>	
Summary Statement The use of black lights to produce solar energy without the sun.	
Help Received	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Hope Xu	Project Number S0834
Project Title The Effect of Different Soil Textures upon the Permeation Rate of Water	
Abstract Objectives/Goals The objective is to determine how different soil textures affected the permeation rate of water. Methods/Materials A device was constructed that effectively measures water permeability of soils at selected soil texture points on the soil texture triangle according to a customized Mixture DOE design. This Mixture DOE was then applied to derive a regression response surface of permeability as a function of soil textures over the Soil Texture Triangle. Results An empirical 3D surface function of water permeability in relation to soil textures by percentage mixtures of sand, silt, and clay was derived. In addition, a 2D plot was developed allowed for permeability at any soil texture to be conveniently and graphically estimated by simply locating the corresponding points on the plot for the sand, clay, and silt mixture percentages. Pure sand was found to have the greatest permeability, while pure clay had near zero permeability. Sand and clay had the greatest impact on soil permeability in opposite directions. Silt had a similar impact as clay, but to a much lesser degree. Conclusions/Discussion This project found that the water permeability of soil follows an exponential relationship with soil textures. This relationship, as found in this project, further follows a parabolic function. The 2D plot derived from the parabolic function allows for permeability to be conveniently and graphically estimated for any soil textures without the immediate need for time and cost prohibitive testing. Rather than testing discreet points to find a soil sample's permeability, the response surface regression plot also allows for an empirical and continuous estimation of soil texture permeability. The ranges of permeability for a soil region that consists of texture variations can also easily be estimated. This project also found that any slight variation in especially high sand consistencies (the sand corner region of the Soil Texture Triangle) could mean significant differences in permeability. As a result, the "sand corner" should be considered a danger zone for any applications that depend on the permeability of soil. A larger safety margin or factor may be required in these cases. The permeability did not change significantly in areas away from the three corners of the Soil Texture Triangle.	
Summary Statement This project is designed to understand the effect of soil texture upon the permeability of water, and its practical applications.	
Help Received Father helped construct setup, carry out experiment, clarify derivations and calculations, and organize data using Microsoft Excel and Minitab; Used professional references and applications from civil engineer, Zhou YouWei; Dr. Hunsicker provided due dates and guidelines.	



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Ken H. Farris	Project Number S0899
Project Title Overpowering Oysters: The Effect of pH on the Bending Moment of Oyster Shells	
Abstract Objectives/Goals The purpose of my experiment is to systematically investigate how pH influences the breaking strength of oyster shells in terms of a bending moment. I hypothesize that the lower the pH, the weaker the oyster shells become. With this research my goal is to understand what might happen to marine life in extreme oceanic pH changes. Methods/Materials The oyster shells with different thicknesses were soaked in eight different pH solutions for three days. Then, I measured the breaking force for each shell using a modified hydraulic press and computed the result in bending moment at fracture. Results The results show both acids and bases weaken oyster shells; however, the acidic pH#s weaken the shells drastically. In fact, at either pH extreme, there is less force required to break or puncture a shell. Conclusions/Discussion As declared in my initial hypothesis, lower pH#s reduce the bending moment to fracture. However, I expected the base to make the oyster stronger or not affect the shell#s breaking strength, because a shell is calcium carbonate, which is a base. My observations show that the base also decreases the strength of the shell, indicating that the strength of the shell is not entirely dependent on the toughness of the calcium carbonate.	
Summary Statement The purpose of my project is to systematically investigate how pH influences the bending moment of oyster shells.	
Help Received Mr. Neilson guided me through experimental preparations and analyses. My chemistry teacher, Mr. McLaughlin, provided me with experimental supplies.	