



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Ben E. Levy	Project Number J0516
Project Title Making Hydrogen Is a Blast!	
Objectives/Goals I studied electrolysis hoping to find a green method of making the hydrogen necessary for running hydrogen fuel cell vehicles. My objective was to find a favorable voltage and an electrolyte that conducts electricity well, so hydrogen could be produced in a homemade electrolysis apparatus equally or more efficiently with environmentally friendly solar cells compared to pollution-generating batteries.	
Abstract Methods/Materials Hydrogen was produced by electrolysis of water. Electricity was run through water by attaching copper wires to an energy source, and putting these leads in the water. Bubbles of hydrogen gas formed at the cathode, and oxygen bubbles formed at the anode; the gases collected under water-filled graduated cylinders placed over the leads. Recorded data included Time necessary to make 5ml of hydrogen, and Current measured during production. I varied the type and voltage of power source (6-volt and 12-volt solar cells versus batteries), electrolytes (washing soda or table salt) and gas collection method (trapping both oxygen and hydrogen versus trapping only hydrogen).	
Results The electrolysis circuit easily broke water into oxygen and hydrogen gases. I recorded data for 23 runs, measuring Voltage, Current and Time necessary to produce 5ml of hydrogen for each. Electrolytes, especially table salt, sped up gas production. Production was slowed by resistance from: glass graduated cylinders that partially blocked the current flow; warm water that heated the electrode wires somewhat; and deposits that formed on the positive lead (blue copper carbonate in washing soda trials, green copper oxide in salt trials). I then calculated the Work (in watt-hours) that it actually cost the system each time it produced 5ml of hydrogen.	
Conclusions/Discussion I found that some fast electrolysis runs wasted excessive amounts of energy, while my graph of Work versus Time showed a sweet spot where hydrogen formed reasonably quickly while energy needed for making this gas remained fairly low. The best of these optimal trials used a 6-volt battery with salt electrolyte, and the next best used a 6-volt solar cell with salt electrolyte. Clearly an efficient electrolysis system for making hydrogen has to balance speed with lower energy requirements. Although the battery set-up still has a slight advantage, the solar set-up is close enough that I believe a few refinements could make it the best choice.	
Summary Statement I adjusted voltage, electrolytes and gas collection method to produce hydrogen by environmentally friendly solar electrolysis, with a speed and energy efficiency nearly as good as those of a more polluting battery-powered electrolysis.	
Help Received My Uncle John and Grandpa Jim gave me input on building circuits. My friend Charlie Benedict helped me understand chemical reactions. Science teacher Mr. Bill Dow helped me think of ways to present my experiment. I am very grateful for their support.	