



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Samarth (Sam) E. Kadaba	Project Number J0609
Project Title Better Batteries: A Study of Galvanic Cells	
Abstract Objectives/Goals The experiment I am conducting consists of testing the amount of voltage produced by different materials in galvanic cells as well as the best way to connect the parts that form a galvanic cell (whether a porous cup or ionic salt bridge). My hypothesis predicted that if a galvanic cell was made of a copper cathode and lead anode then this particular combination would produce the most voltage. When I set up the cell, it would contain a two half cell connected through a salt bridge. I will repeat these combinations however I will use porous materials to establish how two half cells can be connected without the need of a salt bridge. This experiment will test the best combination of half cells as well as the effect of porous cups in comparison to salt bridges. Methods/Materials The materials I am using include copper and copper sulfate, aluminum and aluminum sulfate, zinc and zinc sulfate, magnesium and magnesium sulfate, and lead and lead nitrate. For the porous barrier I am using terracotta pots, whereas for the salt bridge I constructed my own through the use of plastic tubing, salt water, and cotton swabs to hold the solution within the bridge. Results My results disproved my hypothesis. I found that a Magnesium and Copper combination produces the most voltage in a galvanic cell with a salt bridge. I recognized that the top four combination of half cells all used magnesium as an electrode. I also found that porous cups tend to decrease the voltage produced by a cell by about 24.6% rather than a salt bridge. However, interestingly, the porous cup augmented the voltage in a magnesium and aluminum cell demonstrating that magnesium is augmented in voltage by porous cups. Conclusions/Discussion Knowing that conventional batteries are made of zinc and copper or aluminum, my experiment identified a flaw in modern battery engineering. With the need for clean, powerful sources of energy gradually overtaking society, my project addresses a progressing field in modern day sciences. With the results of my project, I have established that there are more efficient ways to engineer batteries with new and unique materials.	
Summary Statement My project addresses how different materials can affect the voltage produced by a galvanic cell; it is centered around two main focus questions that ask which combination of metal electrodes and solutions would produce the most voltage and	
Help Received Los Cerritos Middle School- provided the chemicals, Mrs. Armstrong	