



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

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| <b>Name(s)</b><br>Nicholas S. Franks   | <b>Project Number</b><br><br>38711 |
| <b>Project Title</b><br>Optimizing of Electrolysis of Water through Variations in Electrolyte Concentration  |                                    |
| <b>Abstract</b><br><b>Objectives/Goals</b><br>The purpose is to measure and describe the effects of electrolyte concentration on the rate of reaction of the electrolysis of water. The results obtained can help to develop new industrial methods for producing hydrogen gas, a form of alternative energy.<br><b>Methods/Materials</b><br>Various concentrations potassium hydroxide (KOH) were used as electrolyte solutions in an electrolytic cell. The cell - which was obtained from my school - consisted of a 6-volt current, inert graphite electrodes, and constant environmental factors. Hydrogen and oxygen gas production at the two electrodes was measured, and rate of reaction was calculated for each concentration.<br><b>Results</b><br>Increasing the concentration of the potassium hydroxide electrolyte increased rate of reaction in a strong, linear manner. Although predicted, rate of reaction did not reach some maximum value, indicating that this trend might continue for higher concentrations.<br><b>Conclusions/Discussion</b><br>In order to achieve the fastest rate of reaction for the production of hydrogen gas, the maximum amount of electrolyte should be used. This method would have to be applied to other types of electrolytes and a wider range of concentrations in order to gain a broader overview of electrolysis. Additionally, economic models would have to be considered to determine the feasibility of industrial electrolysis for hydrogen production. |                                    |
| <b>Summary Statement</b><br>Through the manipulation of the electrolyte concentration of an alkaline electrolytic cell (i.e. potassium hydroxide concentration), I showed that electrolyte concentration and rate of reaction are directly, linearly proportional.   |                                    |
| <b>Help Received</b><br>My chemistry teacher provided assistance in obtaining materials and taught me the basics of electrolysis in class. All supplies were provided by my school's science department. All additional research and development was done independently.   |                                    |