



## CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

Name(s) <b>Sophia Watson</b>	Project Number <b>J0630</b>
Project Title <b>Bang! The Chemistry of Black Powder</b>	
<b>Abstract</b> <b>Objectives</b> The science procedure that I will be testing is does size and distribution of reactants affect efficiency of a combustion reaction? The hypothesis I have created to go with this science experiment is, if I test six different samples of black powder, then the sample that is ground finest (has smallest surface area) and has the most even distribution of ingredients will burn most efficiently. <b>Methods</b> After preparing appropriate amounts, size, and distribution of potassium nitrate, charcoal, and sulfur, each reactant was placed in aluminum foil dishes. A Bunsen burner was used in a chemical hood to light the reactants on fire. The times it took to start burning, how long they burned, and the beginning and final weights of the experiments are recorded. There were six different experiments ran: coarsely ground reactants that are poorly mixed and well mixed, medium coarsely ground reactants that are poorly mixed and well mixed, and finely ground reactants that are poorly mixed and well mixed. <b>Results</b> The results showed that the coarsely ground reactants that were well mixed burned slower and more efficiently, and had less left over product.  For each of the six experiments, the well mixed solutions burned most efficiently. Course reactants burned better with left over product 20% less when well mixed versus poorly mixed. Medium course reactants burned better with left over product 5% less when well mixed versus poorly mixed. Finely ground reactants burned better with left over product 12% less when well mixed versus poorly mixed. <b>Conclusions</b> The results, which only partially supported my hypothesis, showed that there is direct correlation between size and distribution of reactants. Although my results are not perfectly in line with the results of published studies, most likely due to the inferior grade of charcoal used in my experiment, it was very instructive for me and allowed me to answer my questions that arose from watching a fire works show.  The more efficient a combustion reaction is, the less left over material will be introduced into the environment. The better the understanding we have of the chemicals used to launch fireworks, such as black powder, the less environmental impact incurred.	
<b>Summary Statement</b> This is a study of the efficiency of burn during a combustion reaction of black powder that analyzes the effect of the size and distribution of reactants.	
<b>Help Received</b> My mother, Professor Devlin at CSUSB assisted me in my project by igniting my combustion reaction in a chemical hood at the University.	