



**CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY**

Name(s) Joshua D. Bates	Project Number S0601
Project Title Fizzy Relief: An Investigation of the Effects of Temperature, Surface Area, and Pressure on Rates of Reaction	
Objectives/Goals One of the most used medications for common illnesses are those that are dissolved in water. One of the most widely known medicines of this type is Alka-Selzer. The three main components of Alka-Selzer are aspirin, sodium bicarbonate, and citric acid. When the tablet is dropped into water, the sodium bicarbonate and citric acid react to produce carbon dioxide. This project was designed to test three variables that affect the rates of this chemical reaction; temperature, surface area, and pressure.	
Abstract Methods/Materials Alka-Selzer from the same lot number and the same type of bottled drinking water were used for the tests. Also, in each test, sample consisted of one tablet dissolved in two ounces of water with the reaction timed until the tablet was dissolved and the reaction complete. The first tests performed were for the effects of solvent temperature on the rate of reaction. Ten trials were done at seven separate water temperatures. Crushed ice was used to lower water temperature for the cold tests and water was heated for the hot tests. For the second tests, the effects of changing the surface area of the tablet were looked at. There were three tests done; using whole tablets, tablets cut in half, and tablets cut into quarters. The final tests were performed to examine the effects of pressure on the rate. For these tests, a small pressure chamber connected to an air data test set was used. As the altitude on the air data test set was changed; the pressure in the chamber would change correspondingly. A tablet delivery system was designed, built, and mounted over the water container. The delivery system was activated, dropping the tablet into the water. There were ten sample tests done at each of seven separate pressures from sea level to 6,000 feet above sea level.	
Results The rate of reaction increased as the temperature increased in a non-linear fashion until the temperature was at 65.5 degrees C then it started to decrease. The rate of reaction increased non-linearly as the surface area increased. The rate of reaction increased linearly as the pressure decreased until 5,000 feet above sea level then it decreased.	
Conclusions/Discussion Increasing the surface area has the greatest effect on the rate of reaction, followed by increasing temperature, and finally decreasing the pressure. The temperature at which the greatest reaction rate occurs, 65.5C, is about the temperature of a warm to hot cup of tea.	
Summary Statement This project is an investigation of the effects of temperature, surface area, and pressure on rates of reaction.	
Help Received Father assisted in administrative tasks. Used pressure chamber equipment at Edwards Air Force Base Instrumentation Laboratory after training.	