



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Daniel Kuai	Project Number S0511
Project Title Crazy for Catalase: The Effects of Temperature and Concentration on Enzyme Reaction Times	
Objectives/Goals To find out how temperature, enzyme concentration, and substrate concentration affect the activity of the enzyme catalase on hydrogen peroxide.	
Abstract Methods/Materials I created the catalase (enzyme) solution by mixing crushed ice, 50 grams of peeled, cut potatoes, and distilled water and filtering the solution into a large glass jar chilled in an ice chest. For the temperature experiment, I dropped a cut coffee filters, using plastic forceps, that were soaked in 100% enzyme into 3% hydrogen peroxide (substrate) stored in baby food jars that were cooled or heated to -11, -7, 21, 30, and 40 degrees Celsius and measured the reaction times (i.e. time it took for the filters to rise to the surface) with a stopwatch. For the enzyme concentration experiment, I dropped filters soaked in 100%, 80%, 50% and 20% enzyme solution into jars of 3% substrate solution held at room temperature and measure the reaction times. For the substrate concentration experiment, I dropped filters soaked in 100% enzyme solution into jars of 3%, 1.5%, 0.75%, and 0.375% substrate solutions and measured the reaction times. I repeated these procedures three times for each experiment and calculated the average reaction times for each.	
Results For the temperature experiment, the filters rose an average of 29, 18, 18, 14, and 13 seconds at -11, 7, 21, 27, and 40 degrees Celsius respectively. For the enzyme concentration experiment, the filters rose an average of 29, 14, 10 and 9 seconds at 20%, 50%, 80%, and 100% enzyme concentration respectively. For the substrate concentration experiment, the filters rose an average of 49, 30, 17, and 9 seconds at .38%, .75%, 1.5%, and 3.0% substrate concentration respectively.	
Conclusions/Discussion The higher temperatures resulted in faster average reaction times and lower concentrations of enzyme and substrate resulted in slower average reaction times. The faster reaction times at higher temperatures is expected since energy increases as temperature rises. The faster reaction times at higher concentrations of enzyme and substrate can be explained since there is more enzyme and substrate to break down and be broken down. This experiment is beneficial to society since it demonstrates how to break down hydrogen peroxide quickly, a chemical that can be toxic to the human body. One way is to increase body temperature through exercise. Another way is to consume more fruits and vegetables which naturally have high concentrations of catalase.	
Summary Statement Higher temperatures and higher enzyme concentrations more quickly breaks down hydrogen peroxide, a chemical that can be toxic to humans.	
Help Received Father helped take pictures; mother helped with matting and laminating.	