



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Amelia G. Gleixner	Project Number J1312
Project Title Polymer Properties	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this project was to test the plastic deformation of polymers made from different amounts of borax, glue, and water. My hypothesis was that the more glue added, the more plastic deformation the polymer would have.</p> <p>Methods/Materials I designed a set of experiments with different ratios of borax and glue. I mixed the chemicals and then let them sit for two minutes. Then I rolled them into a ball. I tested to see if I could make polymers that could be plastically deformed by the force of gravity, but gravity wasn't strong enough. Instead of gravity I stretched the polymer continually until it broke. Also, some of the mixtures of borax and glue weren't practical because there was some borax or glue not mixed in. I tested all of the ratios of borax and glue in my design of experiment and found three that worked. I realized that the borax was still not all mixed in so I decided to heat the borax in water in the microwave for 15 seconds, and then mix it into the glue. The three mixtures that worked became Chemistry A, B, and C. I did each of these five times, still mixing the borax with water and then heating it in the microwave for 15 seconds. For each polymer, I measured the size of the ball before stretching. I timed the rate I stretched it and recorded the length at breaking.</p> <p>Results Of the three chemistries that worked, there were definitely some differences. Chemistry A which had a ratio of borax:glue:water of 1:2:0.6 and chemistry C which had a ratio of borax:glue:water of 2:3:1.3 stretched the farthest before breaking. Chemistry B which had a ratio of borax:glue:water of 1:3:0.6 was hard to stretch. My pull rates varied with all the samples. I think this happened because the stretching was not entirely consistent, this is also the reason there was so much scatter in my data.</p> <p>Conclusions/Discussion I concluded that it is better to have more borax, since the two chemistries that had higher ratios of borax had the most plastic deformation. I believe the borax may have made longer polymer chains but the chains weren't cross-linked. Therefore the polymer chains could untangle and slide past each other before breaking. My hypothesis was wrong, because I had hypothesized that the polymers with more glue would have more plastic deformation. I accomplished my goal to find the polymer mixture with the largest plastic deformation.</p>	
Summary Statement My project was to find the polymer chemistry with the most plastic deformation before breaking.	
Help Received Mother acted as assistant in taking the measurements.	