



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Pia-Maria Bododea	Project Number J1603
Project Title Surface Tension: The Relationship between Surface Tension and Density of a Liquid	
Abstract Objectives/Goals The objective of this project was to determine the magnitude of the surface tension in different liquids, and to verify if liquids with higher density have higher surface tension. Methods/Materials First, a scale was built to help measure surface tension. A stiff straw was used as a beam for this scale, a pin for the fulcrum, an aluminum pan to hold the water droplets hanging from one end of the straw, and a section of a paperclip hanging from the other end of the straw. Next, the piece of paperclip was lowered into three different liquids: Isopropyl Alcohol (IPA), simple water, and a mixture of water and detergent. Then, droplets of water were placed with a dropper into the pan to balance the scale. Finally, the droplets of water were counted to calculate the total weight of the water in the pan, which was equal to the force needed to pull the paperclip out of each liquid. The densities of these liquids were obtained from published density tables in the bibliography. Results The results showed that the average number of water droplets in the pan that were necessary to balance the scale are: for IPA = 3.8 water droplets, for water and detergent mixture = 4 water droplets, and for simple water = 6.8 water droplets. As the scale is balanced, the force of tension (F) for each liquid is equal to the gravitational force of the water in the pan (G). Since $F=2sd$, and $G=DVg$, the surface tension $s=DVg/2d$. The surface tensions calculated in N/m follow: $s(\text{IPA})=0.038$, $s(\text{water \& detergent})=0.040$, $s(\text{water})=0.069$. After the surface tension was calculated the experimental results were compared to surface tensions listed in published tables in the bibliography and they were similar. Densities of the liquids above were also found in published tables in the bibliography to determine if there is a clear dependency between surface tension and density. Conclusions/Discussion The project concluded that surface tension in each liquid is dependent on the nature of the liquid. After noting the density of each liquid it became clear that the higher the density the greater the surface tension. The experiment showed that water, the liquid with the highest density, has the highest surface tension; while alcohol, the liquid with the lowest density, has the lowest surface tension.	
Summary Statement The project allowed the investigation of the surface tension in various liquids and it provided the experimental environment to establish the relationship between surface tension and other physical parameters such as the liquid density.	
Help Received My grandfather helped set up the experimental scale and to find published tables in the bibliography. My science teacher reviewed and critiqued my results and analysis.	