



**CALIFORNIA STATE SCIENCE FAIR  
2008 PROJECT SUMMARY**

<b>Name(s)</b> <b>Elly J. Shao</b>	<b>Project Number</b> <b>J1931</b>
<b>Project Title</b> <b>Fighting Hard Water Deposits</b>	
<b>Objectives/Goals</b> The objective of this project is to find out what solution is most effective in removing hard water deposits on glass.	
<b>Abstract</b> <b>Methods/Materials</b> Hard water deposits are mostly calcium carbonate. The solutions included in the experiments were 10% acetic acid, vinegar, Vinegar Windex#, Lime Action# Windex#, and 10% hydrochloric acid. I conducted my experiments by adding the solutions to calcium carbonate and seeing how long it took to dissolve, if it did so at all. Then, I applied the solutions to cotton balls and toothbrushes and rubbed them against a piece of glass covered in hard water deposits. Finally, I put 0.2 gram of calcium acetate, calcium carbonate, and calcium chloride in test tubes with water and timed how long it took for them to dissolve.	
<b>Results</b> My results showed that the hydrochloric acid solution reacted with calcium carbonate quickest. Calcium chloride, the product formed when hydrochloric acid reacts with calcium carbonate, also dissolved the quickest. The acetic acid solution and vinegar could also react with the calcium carbonate, but the reaction was slower than the hydrochloric acid solution. Calcium acetate also dissolved slower than calcium chloride in water. The other liquids were not noticeably effective in reacting with calcium carbonate or in removing hard water deposits.	
<b>Conclusions/Discussion</b> Compared with the other solutions I tested, hydrochloric acid fights hard water deposits most effectively.	
<b>Summary Statement</b> In this project, I studied the chemical principles of the reactions, and compared the effectiveness of various solutions, including commercial cleaners, in removing hard water deposits on glass.	
<b>Help Received</b> Mrs. Usher, my science teacher, provided guidance and feedback to my project report. My mother took the pictures while I was doing experiments. She also helped me to borrow books from the libraries.	