



**CALIFORNIA STATE SCIENCE FAIR  
2003 PROJECT SUMMARY**

<b>Name(s)</b> Emily Olewiler	<b>Project Number</b> <b>J1216</b>
<b>Project Title</b> <b>Hydroharmonics: Is There a Formula?</b>	
<b>Abstract</b> <b>Objectives/Goals</b> It is long known that musical notes can be created by striking a glass of water filled to various heights. Is it possible to mathematically calculate a musical note based upon the geometrics of a glass? <b>Methods/Materials</b> Procedure-Line up the glasses in an order with all necessary materials on the counter. Fill each glass up about half way with regular drinking water using the pitcher of water. Strike the first glass with the knife having the tuner in. If the note is flat or sharp, alter the amount of water with the syringe changing the pitch closer to Bb. *Note: Upon initially striking the glasses it was determined that it didn't matter where the glass was struck or what part of the knife was used or with what force it was struck. Repeat step #3 for all glasses tuning them to the note Bb. Record the following measurements of each glass: the amount of water, the weight of the water, the weight of the glass, the diameter of the surface, and the total volume of the glass. Randomly select formulas involving the data from each glass. Record the formulas and the calculated results for each glass looking for numbers that are consistently close together. Look for numbers that are within 1 or 2 percent with each other across the chart or graph. If a close occurrence is found, apply the formula to an additional glass for additional data based upon the calculations. Materials-6 different types of glasses, Chromatic-20 Tuner, Pelouze 2 lb scale, 100ml Beaker, Metric ruler, Calculator, Syringe, Water, Knife. <b>Results</b> After randomly selecting various formulas or combinations of the data I found a series of numbers that varied approximately 1%. This provided close enough data to prove that one of my formulas was quite accurate. This formula was interpreted as the amount of water divided by the total volume of the glass. Values ranged from .61 to .62. To prove my theory I added two additional different glasses, calculated their maximum volumes, and filled them 62%. I struck them with the instrument and verified the note on the tuner. As my calculations proved, the notes produced both were Bb. <b>Conclusions/Discussion</b> To tune a glass of water to a Bb, simply calculate the maximum volume of the glass and then fill it 62%. Therefore it is possible to tune a glass to a Bb based upon the geometrics of the glass.	
<b>Summary Statement</b> I have proven that there is a formula to mathematically tune a glass of water.	
<b>Help Received</b> My father assisted me in coming up with the project idea.	