



**CALIFORNIA STATE SCIENCE FAIR  
2003 PROJECT SUMMARY**

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| <b>Name(s)</b><br><b>Doraly Espinoza</b>  | <b>Project Number</b><br><b>S0506</b> |
| <b>Project Title</b><br><b>Determination of Avogadro's Number</b>   |                                       |
| <b>Objectives/Goals</b><br>Create a monolayer of oleic acid. Calculate total number of moles of acid by using measured volume and known concentrations. Calculate Avogadro's number by dividing the number of molecules by the number of moles.   |                                       |
| <b>Abstract</b><br><b>Methods/Materials</b><br>Oleic Acid(C <sub>18</sub> H <sub>34</sub> O <sub>2</sub> ), watch glass, micro pipette, bottled water, Isopropyl Alcohol 99%, chalk dust, 25ml beaker, plastic gloves, face mask, timer.<br>Investigation One: Diluting Oleic Acid<br>The goal is to achieve a solution that is 1% oleic acid in 25 ml. There are one million micro liters in a liter and one thousand micro liters in a ml(using formula $M_1V_1=M_2V_2$ ).<br>Investigation Two: Time for Alcohol to Evaporate<br>Determine the time between drops on a water surface, so that the alcohol has time to evaporate.<br>Investigation Three: Determine Avogadro's Number(dividing total number of molecules by total number moles in the layer). |                                       |
| <b>Results</b><br>Estimated Value of Avogadro's number: $5.0 \times 10^{19}$<br>Percent Error: 99.99%<br>Information needed: density of pure oleic acid(g/cm <sup>3</sup> ), number of moles, volume of acid in layer, thickness of acid monolayer, number of molecules(assuming acid occupies cubical space).<br>Avogadro's number is the number of particles in exactly one mole of a pure substance. Avogadro's number is $6.022 \times 10^{23}$ and is rounded to $6.022 \times 10^{23}$ .  |                                       |
| <b>Conclusions/Discussion</b><br>Results of experiment were not accurate. The estimated value of Avogadro's number is $5.0 \times 10^{19}$ . Far from Avogadro's true number( $6.022 \times 10^{23}$ ). Percent error was high at 99.99%. Avogadro's ideas explain the relationship between mass and the number of atoms.<br>Possible Mistakes: dilution of oleic acid too drastic, use of different solvent(for dilution), volume of drops used per trial, number of trials.   |                                       |
| <b>Summary Statement</b><br>Calculate a value of Avogadro's number by spreading a film of oleic acid one molecule thick over a water surface.   |                                       |
| <b>Help Received</b><br>My chemistry teacher and my mom helped me to get my materials.  |                                       |