



# CALIFORNIA STATE SCIENCE FAIR 2007 PROJECT SUMMARY

<b>Name(s)</b> <b>Bolun Liu</b>	<b>Project Number</b> <b>J0116</b>
<b>Project Title</b> <b>An Experimental Examination of Fluid Viscosities</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> Viscosity is a fundamental property of fluids. The goals were to determine alt classifications of viscosity for representative fluids and to experimentally measure the viscosities against these classifications. I hypothesize the order of transit time of the fluids studied is as follows: rubbing alcohol, water, saturated saltwater (NaCl) solution, saturated sugarwater solution (so called "simple syrup"), engine oil, commercial "artificial" maple syrup, and canola oil. It was also asserted that saturated sugarwater solution and commercial "artificial" maple syrup are trixotropic fluids. It is further asserted that the engine and canola oils will are reopectic fluids. It is also believed that all other fluids examined are Newtonian fluids.</p> <p><b>Methods/Materials</b> To find the viscosity of the fluids (water, rubbing alcohol, saturated saltwater, saturated sugarwater, canola oil, engine oil, and commercial "artificial" maple syrup) I constructed an experimental test apparatus where a steel ball dropped under the influence of gravity through a l cylindrical glass tube filled with the test fluid and the transit period was timed. Each fluid trial was replicated 50 times in order to obtain statistical power. The data was statistically analyzed using a personal computer with EXCEL. Appropriate graphs of the data were constructed and statistical measures calculated to determine the average transit time. Fluid-to-fluid comparisons were made of the graphs and calculated statistics to test the stated hyotheses.</p> <p><b>Results</b> The order of the liquids being timed is: water (1.58 seconds) rubbing alcohol (1.66 seconds), saturated saltwater solution (1.68 seconds), saturated sugarwater solution (2.01 seconds), canola oil (10.77 seconds), engine oil (18.68 seconds), commercial "artificial" maple syrup (58.23 seconds). Furthermore, corn syrup and engine oil were found to be reopectic and commercial maple syrup was found to be trixotroic.</p> <p><b>Conclusions/Discussion</b> The hypotheses of the experiment were supported. The custom made exerimental apparatus performend well. However for future experiments, a revised apparatus should be developed to verify Stokes' Law. It was found that the custom designed apparatus could not support this course of experimentation. Further studies to verify Stokes' Law would use a smaller steel ball and a larger diameter cylindrical tube. The new apparatus would use computer controlled photogates.</p>	
<b>Summary Statement</b> I sought to experimentally verify viscosity theory for representative fluids.	
<b>Help Received</b> Dr. John C. Howe provided the motivation for my looking at a problem in the physics of fluids. My parents provided on-going encouragement and support.	