



CALIFORNIA STATE SCIENCE FAIR 2004 PROJECT SUMMARY

Name(s) Anson F. Stewart	Project Number S0110
Project Title The Effect of Temperature on the Angle of a Fluid Stream's Deflection Resulting from the Coanda Effect	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This project was designed to investigate fluid dynamics, specifically the Coanda effect. Research was conducted to answer the question "What is temperature's influence on the Coanda effect?" A setup was designed to test the hypothesis that the Coanda effect, driven by viscosity (which is inversely related to temperature in liquids), would more noticeable at lower temperatures and less noticeable at higher temperatures.</p> <p>Methods/Materials Water, a pitcher, food coloring, plastic tubing, a protractor a small plastic cylinder, a plastic support base, and a Teflon bailer for use as a valve were all gathered. A setup was devised in which water flowed vertically downward tangent to a small cylindrical plastic container. A protractor was attached to the front of the container, to allow angle measurements. Water, heated or cooled to different temperatures, flowed down from a valve, and the angle at which it departed from the plastic after adhering to it was recorded. This was repeated a minimum of four times for every test condition. Video recordings and playback of the experimentation allowed for accurate observations.</p> <p>Results Water at about 2 degrees Celsius, 20 degrees Celsius, and 36 degrees Celsius had similar numerical outcomes. The two coolest test conditions (water at 2 degrees Celsius and 20 degrees Celsius) were very close together in angles of deflection. The warm water (36 degrees Celsius) was the only test condition in which the stream consistently wavered between flowing straight down without deflection and curving, so this test condition is overrepresented by its numerical outcome. The hot water (79 degrees Celsius) clearly had the lowest deflection.</p> <p>Conclusions/Discussion No results of the experiment indicated that the mechanisms causing the differences in the influence of the Coanda effect were different than hypothesized. Though viscosity, density, and shear forces were not directly measured, no other forces were clearly identifiable based on the Background Research. The water was deflected much less efficiently in the warm test condition, though this is not evident numerically. The peak in the data could be related to water's peak density at 4 degrees Celsius. It is clear from this experiment that significantly increasing the temperature of a fluid diminishes the deflection from that fluid's original course, as caused by the Coanda effect.</p>	
Summary Statement Using a plastic cylinder and streams of water at various temperatures, it was determined whether the temperature of a fluid stream would affect its angle of deflection resulting from the Coanda effect (wall attachment principle).	
Help Received Sister (age 13) helped with some test procedures. Mother helped glue/tape papers to backboard. Father helped obtain the Teflon bailer and provided assistance by proofreading the research paper.	