



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Forrest D. Csulak	Project Number J1906
Project Title The Metal Meltdown: Using Metal's Thermal Conductivity to Melt Ice Cubes	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of my science project was to see if the density of different metals has a correlation with their thermal conductivity.</p> <p>Methods/Materials To test my experiment, I constructed 18-1 cm³ cubes of various metals (aluminum, brass, copper, steel, and zinc) into blocks measuring 3x3x2 cm³. I weighed each block to determine the density of each metal. After the density of each metal was determined, I marked the surface of each block black to equalize possible radiation due to their naturally occurring color differences. I then placed an ice cube onto each block and timed how long it took the ice cube to melt completely. I performed this test eight times for each metal at this volume, also with blocks measuring 4x4x1 cm³ and 5x4x1 cm³. A control variable for each test was used by constructing blocks of wood with the same dimensions.</p> <p>Results The results of my experiment determined that the density for each metal remained consistent for differing volumes and masses. Of the metals tested, copper has the greatest density followed by brass, steel, zinc, and aluminum. The results for the time to melt ice of the 3x3x2 cm³ blocks were copper, brass, zinc, aluminum, and then steel. The results for the time to melt ice of the 4x4x1 cm³ blocks were zinc, brass, copper, aluminum, and then steel. For the 5x4x1 cm³ blocks, the results were copper, brass, zinc, steel, and then aluminum. The results for the overall average for the metals' thermal conductivity were that copper melted the ice the fastest followed by zinc, brass, aluminum, and steel.</p> <p>Conclusions/Discussion I thought that there would be no correlation between the density and thermal conductivity of the metals tested and that copper would melt the ice the fastest followed by aluminum, zinc, brass, and steel. My hypothesis was partially correct. The time it took the ice to melt did not follow the order of densities; however, it did not follow the order of researched thermal conductivities either. Additional testing and further calculations in specific heat capacity and thermal diffusivity are needed to better understand the results. In addition, further investigation is needed into water's reaction with different metals causing differences in surface tension strong enough to allow the ice to float before the water drains from the metal blocks.</p>	
Summary Statement This experiment was conducted to determine if the density of certain metals (aluminum, brass, copper, steel, and zinc) would have any correlation with their thermal conductivities by melting ice on 20cm ³ , 18cm ³ , and 16cm ³ metal blocks.	
Help Received My mom bought the materials, assisted in monitoring the stopwatches used for the timings, and helped design my board. My grandma let me use her computer with all of the printing supplies necessary and let me use her house to conduct the experiment.	