



**CALIFORNIA STATE SCIENCE FAIR  
2017 PROJECT SUMMARY**

<b>Name(s)</b> <b>Jude T. Lifset</b>	<b>Project Number</b> <b>J2116</b>
<b>Project Title</b> <b>Reducing Hot Water to Safe Drinking Temperatures Using Phase Change Materials</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> I recently learned that even though drinking coffee and tea is said to have health benefits, consuming these beverages at high temperatures might be unhealthful. A recent study showed that drinking hot beverages above 65°C (149°F) is related to esophageal cancer. So I found two products, the Just Right Joe temperature regulators and the Coffee Joulies, that were said to lower the temperature of beverages quickly and hold that temperature for a prolonged period of time. This is accomplished through a material called a phase change material (PCM).</p> <p><b>Methods/Materials</b> In my project, I evaluated a total of 572 data points. In two separate trials consisting of five tests each, I performed ten total tests. In these tests, I used five containers: ceramic, covered ceramic, Styrofoam, metal and paper. In the first test, the control, I added no PCM to the containers. In the next two tests, I placed one of each PCM product in the containers. Finally, in the last two tests, I used two of each PCM product but only the metal and Styrofoam containers.</p> <p><b>Results</b> The PCM products were designed for two purposes: lower the temperature of your beverage, and keep it at that temperature for a prolonged period of time. In tests with the Coffee Joulies and the Just Right Joe Coffee Regulators, the water temperature decreased to a safe temperature (65°C (149°F)) faster than with no added PCM. The PCM products were designed to keep a hot beverage at a desired temperature (65°C to 55°C) for a prolonged period of time; this effect was seen in the metal container only. The water temperature in the metal container with the added PCM stayed between 65°C and 55°C for 10 and 15 minutes longer than the control.</p> <p><b>Conclusions/Discussion</b> According to my findings, the phase change material products tested did reduce temperature of hot liquids to a safe drinking temperatures in a shorter period of time compared to control, thereby reducing the risk of burns of the esophagus and tongue. This may help lower the risk of esophageal cancer. The products are also marketed to keep beverages at a desired temperature (65°C-55°C) for a longer time, and I found them to be not as effective in doing this, except in the case of the metal beverage container.</p>	
<b>Summary Statement</b> The goal of this project was to investigate whether phase change material products were effective at lowering the temperatures of hot beverages to safe temperatures, and maintain those temperatures for a prolonged period of time.	
<b>Help Received</b> My father and mother provided me with most of the materials along with my science teacher, who additionally helped me develop my project.	