



**CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY**

Name(s) Maxwell O. Dawson	Project Number J1306
Project Title Insulation Innovation: Putting Phase Change Materials to the Test	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The inspiration to do this project came to me because my mother is always cold, and I wondered if there was a way to amend that. The purpose of this project was to see how PCMs can compare to conventional insulation, and if PCMs could replace the insulation we use every day. A phase change material (PCM) is a material that absorbs and releases large amounts of heat at its melting point. My hypothesis was that a double layer of PCM would insulate more effectively than a single layer. I also hypothesized that a liquid PCM with a low melting temperature around a solid PCM with a higher melting point would not be efficient at insulating an object.</p> <p>Methods/Materials For my experiment, I used three clear plastic boxes of concentric size. I used two sets, but the experiment could be done with one. I used about 0.5 kg of three microencapsulated PCMs with melting temperatures of 6 C, 24 C, and 37 C. I used two digital thermometers with probes, silicone, a drill and 0.635 cm drill bit, and safety goggles. I used a notepad to record results during the experiments. I placed a thermometer probe inside the inner box, through the holes in the tops of the boxes. After filling each box with the appropriate PCM, I filled the inner box with water. I recorded data every five minutes for one hour.</p> <p>Results I recorded a total of 192 readings from 16 different experiments. I performed eight experiments at each ambient temperature. In the -18 C environment, the PCM 37 around the PCM 24 insulated the water most effectively. In the 55 C environment, the double layer of PCM 24 insulated the water most efficiently.</p> <p>Conclusions/Discussion In general, my hypotheses were supported by my results. PCM 37 around PCM 24 resulted in the least temperature change with exposure to -18 C. I also discovered that a double layer of PCM insulated more effectively than a single layer. I believe more tests should be performed to confirm my results. From packaging to clothing to electronics to building materials, PCMs have many applications that have yet to be explored.</p>	
Summary Statement I tested a new material called a PCM and its properties.	
Help Received Dawn Mantz at Microtek Labs donated PCMs; Father supervised; Mother purchased supplies; Science teacher guided me.	