CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
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Project Number
31841

Project Title
Steel Stays Hot While Other Metals Do Not

Abstract

Objectives/Goals
After an experience in the kitchen with a skillet, I wanted to test four common metals and their resistance to a change in temperatures. My hypothesis is that the cast iron would cool the slowest due to my experience in the kitchen and the aluminum would cool the fastest.

Methods/Materials
I warmed four metal blocks in the oven to a steady temperature. I took them out of the oven and measured the temperature at the center of the blocks as they cooled in three different environments: still air, in front of a high speed fan and in an ice bath. I measured the block temperature with a thermocouple and a digital thermometer every two minutes and then two readings at the end of each experiment at 10 minutes each. I conducted multiple tests and average the results. The blocks were the same size and volume, but different mass and different heat constants. I also calculated m x C for each metal, which allowed for some interesting interpretation and prediction of the graphed data. The metals tested were copper alloy, aluminum alloy, stainless steel and cast iron.

Results
The stainless steel remained hot the longest, showing the most thermal inertia while aluminum showed the least. The cast iron and copper graphs were very close to one another between the aluminum and the stainless steel graphs.

Conclusions/Discussion
Once the blocks came out of the oven, they were governed by the first and second laws of thermodynamics. An example of the first law is the heat transferring from a hot skillet to the food in it even though the gas is turned off. A common example of the second law comes from the laundry. No matter how long the drier runs, none of the laundry coming out of the dryer will be neat, even though that outcome is theoretically possible. And anyone who has done the laundry will tell you that it does require work to make the laundry neat after coming out of the dryer.

Stainless Steel demonstrated the most thermal inertia, Resistance to temperature change and aluminum the lowest. So if you want to have food cooking after the gas is turned off, stainless steel is the best material. But, when mom cooks a big meal and the kitchen gets very hot (Dad is reluctant to turn on the air conditioner), aluminum might be a good material selection for pulling the that waste heat out of the kitchen and putting it into the hot water heater. If we did this, we would use less gas to heat the hot water for my bath.

Summary Statement
I heated four blocks of dissimilar metals and measured their temperaturs as they cooled in three enviorments.

Help Received
mom and dad helped measure the temperatures and watch the timer. My teachers helped me with the basic science behind my project.