CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
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Project Number
J0705

Project Title
The Effect of Temperature on an Electromagnet

Abstract

Objectives/Goals
Does temperature affect the strength of an electromagnet?

Methods/Materials
A. I wrapped 22 gauge copper wire around a 14 centimeter iron nail 100 times to make the electromagnet.
B. I heated or cooled the electromagnet in the freezer, dry ice, room temperature, and at three different temperatures in the oven for 10 minutes each.
C. I laid out 300 staples and connected my electromagnet to a 9 volt DC battery.
D. I hovered the electromagnet over the staples and picked up as many as possible.
E. I disconnected the electromagnet from the battery and counted the staples that were picked up.
F. I wrote down my data and graphed it on a chart. I conducted each test 3 times in each of the temperatures so that I would have accurate results.
G. I measured the temperature with a digital thermometer in Fahrenheit and I measured the nail with a ruler in centimeters.

Results
The average results of the three tests in each temperature were: In the dry ice at -109 degrees, the electromagnet picked up 158 staples. In the freezer at -3 degrees, 170 Staples. In room temperature at 74 degrees, 185 staples. In the oven at 140 degrees, 193 staples. In the oven at 210 degrees, 238 staples, and in the oven at 285 degrees, 282 staples. I believe I got these results because the electromagnet could take on a stronger charge in the heat rather than the cold, creating a stronger magnetic field.

Conclusions/Discussion
My results show that my hypothesis should be accepted because the electromagnet picked up an average of 128 more staples in the heat at 285 degrees than in the cold at -109 degrees.
During my experiment, as I increased the temperature of the electromagnet, the resistance of the circuit increased. According to Ohms Law, the current decreased. From my research I learned that as the current increases in an electromagnetic circuit the magnet becomes stronger. In my experiment the strength of the electromagnet increased even though the current decreased. This contradiction may have been caused because the iron core was able to take on a stronger charge at higher temperatures, even though the current decreased.

Summary Statement
How temperature affects the strength of an electromagnet.

Help Received