CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
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Project Number
S0817

Project Title
Intrigues of the Universe: The Effects of Extreme Conditions on Earthly Power Sources

Abstract

Objectives/Goals
Original Study: For my project, I chose to study the capacity of a dry cell battery to survive at extreme temperatures, in particular, the temperature of Mars, -120 degrees Celsius, the temperature of the North Pole, -60 C, and the temperature of the Mojave Desert, 50 C. Although the planets as well as certain locations on Earth have extreme conditions, institutions such as NASA create magnificent rovers and probes that are capable of surviving such conditions. Hence, I hypothesized that batteries function better at room temperatures than at extreme temperatures.

*Extended Study: For the CA State Fair, I plan on gathering results about energy sources other than the dry cells, including lithium batteries, solar cells, and secondary cells.

Methods/Materials
The four brands of dry cells tested were Duracell, Energizer, Eveready, and Panasonic. Through a thermal chamber, four sets of batteries, one for each temperature, were exposed to their respective temperatures and were then placed inside the flashlights, which were then left to discharge. I then measured the time each flashlight took to discharge. Another four sets of batteries, one for each temperature, were placed in the flashlights, which were then turned on and exposed to their respective temperatures. I then measured the respective discharge times again.

Results
Overall, Duracell and Energizer exhibited longer lifespans than Panasonic and Eveready. Generally, all the batteries, regardless of the brand, discharged faster at lower temperatures. Flashlights tested within the thermal chambers turned off faster than flashlights tested outside the chamber, although the batteries had not yet discharged.

Conclusions/Discussion
After observing the set of batteries that were placed in the flashlights which were then exposed to the extreme conditions within the thermal chamber, I concluded that the time a battery takes to discharge is not unanimous with the time a flashlight takes to stop producing light, for after the flashlights stopped producing light at -120 C, they began to again emit light as the chamber approached room temperature, thereby signaling that they had not completely discharged. Thus, the flashlights did not turn off because the batteries had run out of the chemicals to convert chemical energy into electrical energy, but because they could not supply enough energy to satisfy the demand of the flashlights.

Summary Statement
For my project, I studied the capacity of earthly power sources to survive at extreme temperatures, in particular Mars (-120 degrees Celsius), the North Pole (-60 degrees Celsius), and the Mojave Desert (50 degrees Celsius).

Help Received
Used thermal chamber at JPL under supervision of Dr. Rajeshuni