CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
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Project Number
J0604

Project Title
Q=mc(deltaT) Using the Specific Heat Capacity of Water and a Calorimeter to Measure and Compare Thermal Energy

Abstract

Objectives/Goals
Understanding the world through scientific and mathematical laws can be overwhelmingly difficult. But the laws don't change, and there are constants that act like anchors that keep things grounded. For this project, I worked with a formula with a universal constant, c, the specific heat of water, and performed a well-designed experiment to see if I can get reliable scientific results. Using Q=mc(deltaT), I compared theoretical vs. experimental thermal energies expressed in Cal/g that are released from burning nuts. I wanted to conduct a practical experiment to and to help with understanding the formula Q=mc(deltaT).

Methods/Materials
I used a simple calorimeter to measure the thermal energy released from burning nuts. My methods include the consistent assembly of the calorimeter for each trial run. Looking at the formula Q=mc(deltaT), the factors that will affect Q are m and delta T, so I employed methods to accurately measure the mass of water and its change in temperature. In addition, I needed to calculate Q, the thermal heat energy absorbed by the water, in Cal/g so accurate measurements in the change in mass of the nuts were also taken.

Results
I hypothesized that if I can get the calorimeter to perform consistently, I will be able to calculate results using Q=mc(deltaT) that will allow me to know, in order, which nuts have the least to the most amount of Cal/g. Of the 7 nuts tested, my results show that I was able to differentiate between nuts that had the least and the most Cal/g, however, I was not able to correctly put all 7 nuts in order of increasing Cal/g. 4 out of the 7 nuts had Cal/g values that were too close in theoretical values. I should have tested nuts that had significant differences in Cal/g values because my calorimeter was not sensitive enough to detect small differences in heat released.

Conclusions/Discussion
The percent error values for all the samples tested fell within a small range from 50.46% to 54.70%. Although these values were high, I didn't need the experimental Cal/g values to be close to the theoretical values because I knew that the calorimeter was not 100% efficient. A significant amount of heat released is lost in the surroundings. I just needed the calorimeter to perform consistently so I can make an accurate comparison between the Cal/g values. Applying scientific laws and universal constants to an experiment makes it easier to understand how it works!

Summary Statement
I used Q=mc(deltaT) to measure and compare thermal energies released from burning nuts.

Help Received
I received help with brainstorming of the experimental design, plotting of data graphs, taking pictures while conducting the experiment, printing pictures for my poster, and review and proofreading of final school report from Miriam Baca.