Lab: What is heat? What is energy? What is work? What's the difference?

Background: This planet is heating up! Fast!

One of the central ideas in science is Thermodynamics which is how heat flows from one object or system into another. Understanding the differences between heat, temperature and energy is central to being able to understand how and why the Earth is changing, and what to expect in the future. Additionally, many fields of science and engineering are centered on understanding how heat flows from the many Data Centers that are springing up around the country, to making for efficient cars and batteries.

Objective: Students will burn Corn chips and capture the heat released with a known amount of water. From the change in temperature of the water and through several trials, students will estimate the energy density of these chips in units of joules/gram.

Directions

1. ***Use a graduated cylinder to measure out a quantity of water in mL*** _____
2. ***Take initial temp of H_2O (in Celsius!)*** _____
3. Light the chip on fire.. let it burn until done.
4. ***Record the final temperature of the water.*** _____
5. ***Determine the Change in temperature of the water ($\Delta T = T - T_0$)*** _____

In the space below, use the Specific Heat Equation to determine heat, measured in joules, absorbed by water from the burning corn chip. $\Delta Q = m \cdot \Delta T \cdot Cp$

⇨ *Note: FOR WATER ONLY.. the value of Cp is 4.2 joules/gram/C*

<u>WHAT TO HAND IN!</u> *On a separate sheet of paper.. create an artistic poster which captures each of the topics described here.*

- It should include an introduction describing how the planet is heating up and what we know from the past, geologic record. (short: we will be discussing in greater detail throughout the semester).
- There should be a section describing how the concept of ***<u>Heat i</u>***s different from the concept of ***<u>Temperature</u>*** and how we measure both as well as what the concept of ***<u>Specific Heat Capacity</u>***, C_p is.
- The next section should describe ***with pictures and words***, how we performed the experiment and what your ***<u>final result was for the total amount of heat</u>*** that was captured by your 'can of water'.
- The next section should describe the different **<u>units of energy</u>** (joules, calories and Food Calories..also called KiloCalories), what their origins are and when we use them. Also in this section, you should calculate how many science calories were captured as well as how many Food Calories were captured.
- Final section you should reflect on how your understanding of heat has changed since this series of lectures and activities.

Grading Rubric for all lab based assignments.

Did you complete the assignment? All of the required steps? Did you go beyond?	5	4	3	2	1
How well did you communicate your ideas? Using words, pictures, diagrams?	5	4	3	2	1
Was your data/analysis accurate? Is the calculations/descriptions correct?	5	4	3	2	1
Were you creative in your writing? Drawings? Organization?	5	4	3	2	1
Does your final product/report/poster look clean, organized and professional?	5	4	3	2	1

5 = really impressive! One of the best in the class!

4 = good job (you get a pat on the back) .. like placing 4th at the track meet.

3 = you understood the directions but only did the minimum job to 'check off the box'

2 = You did it.. but things were missing, the effort was poor..

1 = Well.. you did put a title on a piece of paper.

Note: The grade you get is based on scoring all 4's = 20 pts total = 88%

In order to earn an A on a project, you MUST score a 5 in at least ONE of the categories.

(Therefore, your score is out of 23 pts. = 100%)