The Heat of Nuts and Snack Foods
Chem IH

Theory: Formulas used will be heat = MTS or q= mcΔT, 1 Cal = 1Kcal = 1000 "energy" calories, 1 cal = 4.18 J, % efficiency (experimental value-KJ/g divided by accepted value KJ/g x 100)

Purpose: In this experiment, you will burn several types of nuts and snack foods in order to determine their heat content per gram.

Materials:

one soda can

centigram balance, stirring rod, ring stand, iron ring

paper clip, thermometer, range to 110 degrees C, 2-3g sample of each type of nut or snack food, such as Cheetos, chips or marshmallows

Hazards: The obvious concern is for burns. Also some students may be allergic to the nuts and/ or their burning. Check with the students before proceeding. Some nuts may be substituted or omitted. Black shoot will form on the bottom of the can, which may stain clothing.

Background Info:

The value for kilojoules per gram of nut/food determined by this procedure is generally much lower than the value in the literature, but they are proportionally lower for each type of nut/food tested. Students can be challenged to make a more efficient calorimeter. The operation of a bomb calorimeter can also be explained in a closed system where the food is literally "blown up" and all the heat energy is accounted for. The literature value for the heat content of raw almonds is 28.4 kJ/g, Brazil nuts = 30.1 kJ/g, pecans = 31.6 kJ/g, pistachios = 27.6 kJ/g and peanuts = 23.6 kJ/g.

Procedure: (remember to draw the apparatus setup)

1. With a bottle opener, punch two triangular holes at the top of the soda can so that a stirring rod can be slid through the holes. Mass out 100 g of water in the soda can.
2. Measure the initial temperature of the water. You can use the TI-inspire temperature probes.
3. Mass out approximately 3.00g of the nut/food sample.
4. Construct a nut/food burner by piercing the nut/food with one end of the paper clip and forming a support base with the other end. Place a piece of aluminum foil under the clip to catch any ash or burning food.
5. Place the soda can on the ring clamp over the nut/food burner, using the stirring rod to support the can. A wire mesh is not needed and would only lower results. Position the can approximately 3-4 cm above the nut/food.
6. Ignite the nut with a wooden splint, and allow it to heat the water inside the can, while stirring continuously with another stirring rod.
7. After the nut/food burns completely, record the final temperature of the water, and determine the actual mass of nut/food that has burned. Repeat the procedure, using a different type of but/food sample.

Data: Record all observations (include appearance before and after experiment).

(BEFORE LAB) Set up 2 Tables: Table 1 (for YOUR 2 samples) ----observations before & after experiment for 2 items, mass of the water, initial and final mass of nut/food, and the initial and final temperatures of the water, mass of burned nut/food. 2nd data table: Table 2 - Class Data table to include: snack food's energy content with 4 trials (KJ/g) and average of all trials for each snack food.

Disposal: Discard the ash in the wastebasket.

Calculations: Show all work by each question and tell what you are solving for:

1. Calculate the change in temperature of the water.
2. Calculate the heat absorbed by water **Note: 1 calorie/g x degrees C or 4.84 J/g deg C is the specific heat of water.*
3. Calculate the joules released per gram of nut/food that burned. Heat lost by the food was gained by the water. Convert J to kJ**. (experimental value)**
4. Examine the "Nutritional Value Information" found on the package of one of the food samples. Note that 1 food calorie(C) is equivalent to 4.184 KJ of heat energy. Use the information to determine the **"accepted value"** (see hints for calculations) for the heat content per gram of snack food. What is the percent efficiency for your experiment? (remember:

Error Analysis:

Conclusion: