Name _____ Period _____

Lab 4 – Energy Content of Snack Foods

Introduction

In this lab we are going to explore one of the applications of heat and energy, the energy content of food. Using calorimetry we will burn snack foods to release the heat energy, and use that energy in a tin can calorimeter to add the food's heat to water and indirectly determine the energy content of the food.

Organic Product Heat Content

All organic substances, from fossil fuels, crop food sources, to food source animals, produce energy when the structure of these foods break down over time. This energy is produced through the combustion reaction type:

$$\text{Food} + O_2(g) \rightarrow CO_2(g) + H_2O(g) + \text{Heat}$$

Food + Oxygen forms Carbon Dioxide Gas + Water Vapor + Energy

The heat (*q*) produced by the food makes the food exothermic (*producing heat*). That heat is then used to *power* functions in biological organisms (*animals, humans, plants, etc*.) and other applications requiring heat. This heat can be measured through the standard calorimetry process:

$$q_{Food} = -\, q_{water} \quad q_{water} = c_{water} \cdot m_{water} \cdot (T_{final} - T_{initial})$$

The change in temperature (ΔT) is measured due to the heat transfer, and along with the mass and specific heat of the water the heat of the water (q_{water}) , thus the heat of the food (q_{food}) can be calculated. To find the heat per gram for a food source the following equation is used:

$$q_{Food/g} = q_{Food} / Mass_{Food}$$

Food sources are often measured in Calories per gram, where Cal is measured as kilocalories (*kCal*)

Lab Procedure

Setting Up Metal Can Calorimeter

1. Obtain a ring stand with ring attached, metal can (*with holes near top*), a stirring rod, thermometer, and a pair of beaker tongs. Do not touch area on metal can around hole… SHARP!
2. Put stirring rod through holes in metal can;
3. Place can and stirring rod on balance and tare the balance (*set it to zero*);
4. Add about 1in (2cm) height of water into the can and measure mass. Exact volume is not required, just the mass is needed. Record mass on the data table;
5. Place can with stirring rod over the ring and slide the can through. The can should be supported by the stirring rod and the ring. It is important that the can does not touch the ring if possible.

Performing the food heat analysis

6. Obtain 3 – 5 Doritos (*or similar*) chips from the bag. Do not eat the chips… we are testing the energy content, not how tasty the chips are!
7. Weigh the chips on the balance and record the mass of the chips on the data table;
8. Record the temperature of the water (T_{ini}) with the thermometer and record on the data table;
9. Pinch the Dorito chips between the tongs and hold the chips under the can. Use a match to light the chips on fire… do not light anything else on fire including your hair, papers, or other students;
10. As soon as the fire stops record the new water temperature (T_{final}) and record on data table;
11. Repeat the entire procedure (6 – 10) two more times, allowing different group members to burn the chips. Let the water cool down for 2 – 3 minutes after each trial. Remember to record the new T_{ini} and chip mass for each trial!

Data Table

Trial	Mass Water	Mass Chips	$T_{initial}$	T_{final}	q_{water} (*J*)	q_{chips} (*cal/g*)
Trial 1						
Trial 2						
Trial 3						
Average						

Calculations

q_{water}: $q_{water} = c_{water} \cdot m_{water} \cdot (T_{final} - T_{ini})$

q_{metal}: $q_{metal} = -q_{water}$ 1cal = 4.184J (*use t-chart*), $q_{chips} = q_{cal} / m_{chips}$

Average: (Trial 1 + Trial 2 + Trial 3) / 3

Trial 1	Trial 2	Trial 3
q_{water} *Heat of Water*	q_{water} *Heat of Water*	q_{water} *Heat of Water*
q_{metal} / q_{chips} *Heat of Metal* (*cal*)*, Heat of Chips*	q_{metal} / q_{chips} *Heat of Metal* (*cal*)*, Heat of Chips*	q_{metal} / q_{chips} *Heat of Metal* (*cal*)*, Heat of Chips*