Name: _____

The "How *Do* They Calculate Those Calories, Anyway?" Lab

Introduction:

Food Calories are determined by burning food products in a piece of equipment called a bomb calorimeter. The amount of heat needed to completely burn the substance is called its heat of combustion. **Please note: A "scientific" calorie (lower-case c) is different than a nutritional Calorie (upper-case C). There are 1000 calories in 1 Calorie. Yes, it is confusing – sorry – if it were up to me I would change it, but that is the way it is!**

Today you will be burning different food items to determine their Calorie content. The heat from burning your food product will go into warming up a soda can full of water. Measuring the temperature change and the mass of the water will allow us to calculate the heat released by the food product. In effect, the heat lost by the food product is equal to the heat gained by the water in the soda can.

After completing this experiment, you should be able to determine the number of Calories in a serving of salted peanuts or macadamia nuts.

Safety

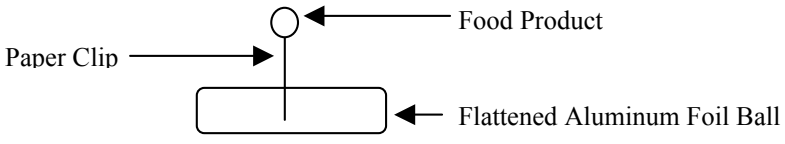
Wear safety goggles at all times during this experiment. After your food item is lit, NO SITTING ALLOWED! Just in case your food tips over while on fire, we don't want a fireball in your lap!

Procedure

1. Get the mass of one piece of your assigned food product using the electronic balance. Write down the starting mass of your food product in your data table.

2. Make a ball about the size of a golf ball out of a piece of aluminum foil. Stick a paper clip through your piece of food. Stick the other end of the paper clip into your aluminum foil ball. If your food product breaks when you put the paper clip in, get a new piece and get the new mass of your new piece of food. (See the picture below for clarification).

3. Flatten the bottom of your aluminum foil ball so that it can "stand" on its own.



4. Obtain an empty soda can. Get the mass of your soda can and record that number in your data table.

5. Insert a glass stirring rod through the ring of a soda can. Support the can by the stirring rod on the iron ring and ring stand as demonstrated by your teacher. Lower the ring so that while your can is dangling from it, it will be approximately 2 inches above your food product. Remove the soda can and the stirring rod from the iron ring.

6. Pour approximately 100 mL of H_2O into the can.

7. Get the mass of the soda can (with the water in it) and record this value in your data table. Read and record the exact temperature of the water in the can in your data table, too. *(This will be considered the "initial temperature" of your water).*

8. Light your food product! ☺ **SITTING IS NO LONGER ALLOWED! WE DON'T WANT A FIREBALL TO END UP IN YOUR LAP IF YOUR FOOD ACCIDENTALLY GETS KNOCKED OVER!** Immediately position the can of cold water on the iron ring so the flame is just touching the can.

9. Heat the water until your food product burns itself out. **Do not just leave the thermometer in the can – hold it up a bit or else it will be measuring the temperature of the can and not the water.**

10. Monitor the temperature of your water and watch until the maximum temperature is reached. Record this temperature. *(This will be considered the "final temperature" of your water).*

11. Allow your remaining food product to cool. Then get the new mass of the food product and record this value in your data table.

12. Clean all equipment (including the outside and bottom of the soda can). Return all equipment to your teacher.

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Data Table

Beginning Mass of Food Product (g) (Before Heating)	
Mass of Empty Soda Can (g)	
Mass of Soda Can And Water (g)	
Temperature of Water in step #7 (Your "initial temperature") (^{0}C)	
Temperature of Water in step #10 (Your "final temperature") (^{0}C)	
Exact Mass of Burnt Leftover Food Product (After Heating) (g)	

Calculations: <u>Show all work!</u>

1. What is the mass of the water in the can?

2. Calculate the number of scientific calories of heat absorbed by the water in the can. (Hint: You will need to look up the specific heat of water on your chart).

3. Convert the "scientific" calories answer you have in number 2 into "nutritional" Calories. (Hint: Remember that 1 Calorie = 1000 calories).

4. Determine how many nutritional Calories were released by your food product. DON'T THINK TOO HARD! Ask Mrs. Carlson for help if you can't figure this one out in a matter of seconds! ☺

5. Calculate the mass of food product burned during the lab.

6. Determine how many nutritional Calories are released per gram of food burned.

7. There are 28.3 grams in 1 ounce. Convert your answer from #6 to Calories per ounce.

8. Look at the Nutrition label for your product. How many Calories are there "supposed" to be per ounce?

9. Using your answers from #7 and #8 below, find the percent error for your experiment using the following equation:

$$\%Error = \left| \frac{Theoretical - Experimental}{Theoretical} \right| \times 100$$

Post Lab Questions

1. Compare your answer to calculation #6 to people who did the other food product.
    a. Which food product released the most Calories per gram?

    b. Which food product released the least Calories per gram?

2. Did this lab demonstrate an endothermic or exothermic reaction? Explain.

3. Was all of the heat released by your food product absorbed by the water? If not, where did some of the heat go?

4. Suppose another peanut is burned. Enough energy is released to raise the temperature of 500 grams of water by 10 ^{0}C.
    a. How many scientific calories are absorbed by the water? (Hint: You will need the specific heat of water off of your chart).

    b. How many scientific calories of heat were released by the peanut, then? (Don't think too hard)! ☺

    c. How many nutritional Calories are contained in a peanut?