Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Calorimetry Lab: Burning a Potato Chip

**Introduction:** The evening before a marathon, runners are advised to eat a huge plate of pasta. Why? Because pasta, a carbohydrate, is a terrific source of energy (fuel) for the body. Different foods contain varying amounts of energy, which is calculated and marked as Calories on a nutrition label. In other words, Calories are a convenient way to measure the energy you get from the food you eat.

In this activity, you will find out how Calories on nutrition labels are measured, as well as how the scientific energy unit (Joule) is calculated. You will use the methods of calorimetry to do this. You will calculate the amount of heat energy (in Joules) and food energy (in Calories) contained in a potato chip! The burning of a potato chip releases heat stored in the carbohydrates and fats making up the potato chip. When you eat a potato chip, your body performs the chemical reactions necessary to release the energy stored in the carbohydrates and fats. In lab, however, you will actually light the potato chip on fire and burn the potato chip so that the hydrocarbons in the carbs and fats undergo combustion! The heat from the potato chip will be absorbed by the water in a calorimeter. Remember: Energy is always conserved as stated by the Law of Conservation of Energy! Therefore, the energy given off by the potato chip equals the energy gained by the water! Pretty simple!

**Materials Needed**:

Potato chip

Ring Stand w/ Ring

Soft Drink Can

Graduated Cylinder

Thermometer

Matches/lighter

Balance

Goggles

Wire Gauze

**Safety Precautions:** Wear safety goggles and tie back long hair because you will be working with an open flame! Do not touch the can or evaporating dish with your hands because hot objects may not appear to be hot! Never eat any items used in lab!

**Procedure:**

1. Put on your goggles
2. Set-up a ring stand and a ring as shown in the picture above.
3. Measure the mass of an evaporating dish and potato chip and record it in the data table.
4. Place the potato chip and the evaporating dish on the metal base of the ring stand. Position the ring and wire gauze (if needed) so that they will be 4-5 cm above the top of the potato chip.
5. Measure 50.0 mL (same as 50.0 grams) of water into a graduated cylinder. Pour the water from the graduated cylinder into an empty soft drink can. **Record** both volume of water and the mass of water in the data table.
6. Use a thermometer to measure the initial temperature of the water as accurately as possible. **Record** this initial temperature of the water in the data table. Note: make sure the temperature has stopped rising/falling before making your temperature reading!
7. **Carefully** use a match to ignite the potato chip itself. Lab members: Be ready with another match in case it does not light with one match.
8. AS SOON AS the potato chip stops burning, carefully stir the water with the thermometer, and measure the final temperature of the water to the nearest °C. Remember to make sure the temperature has stopped rising before taking a reading. **Record** the final temperature of the water in the data table.
9. Allow the potato chip residue (ashes) to cool, and then measure the mass of the potato chip ash and evaporating dish. **Record** this mass of potato chip residue in the data table. Note: **Do not set the black potato chip residue on the balance!**
10. Calculate the mass of the potato chip that actually burned. **Record** this mass in the data table.

**Clean Up Checklist:**

 Place potato chip ashes into the trashcan.

 Wash the evaporating dish and put it back on the orange table.

 return lighters to the table.

 Pour the water from the soda can down the sink drain. **DO NOT** throw the soda can away. Replace the soda can on the ring stand with stir rod.

 Clean up around station (wipe down station and dry).

 Wash your hands when clean up is complete.

 Get teacher initials for clean up!

**Data Table:**

|  |  |
| --- | --- |
|  | **Measurement** |
| Mass of potato chip and evaporating dish before burning (grams) |  |
| Mass of potato chip ash and evaporating dish after burning (grams) |  |
| Mass of Potato chip that actually burned (grams) |  |
| Mass of Water (grams) |  |
| Volume of Water (mL) |  |
| Initial Temperature of Water °C |  |
| Final Temperature of Water °C |  |

**Conclusions/Analysis: Separate Sheet of Paper!!**

1. Was burning the potato chip an exothermic or endothermic process?
2. Was the water heating up an exothermic or endothermic process?
3. The SI unit for heat energy is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Another commonly used heat energy unit is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The unit for *food energy* is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
4. What is the specific heat of water? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. The heat energy from the burning potato chip was transferred to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Thus, we assume the heat energy given off from the potato chip equals the heat energy gained by the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. We know this because of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
6. Calculate how much heat (in joules) that the water absorbed from the burning potato chip. q=mc∆T

m= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ c= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Tf= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ti =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

∆T = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ q= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Convert joules to calories.
2. Convert calories to dietary calories (kcal or Calories)
3. Calculate the number of kilocalories per gram of the potato chip burned in lab.
4. Is this the experimental or accepted value? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Using the potato chip can label, determine the Calories per gram of the potato chip.
6. Is this the experimental or accepted value? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. Compare your experimentally calculated Calories per gram with the accepted value of Calories per gram on the peanut can’s label. Using this information, calculate the percent error for your lab group.

 \_\_\_\_\_\_\_\_\_\_\_

1. Was all of the heat that was released by the burning potato chip actually collected by the water in the calorimeter? Explain.
2. How can the experiment be improved to decrease the percent error? List two ways.