Measuring Calories...Calorimetry Lab

Energy Content of Food

# Introduction

All human activity requires “burning” food for energy. How much energy is released when food burns in the body? How is the caloric content of food determined? Lets investigate the caloric content of different snack foods such as hot fries.

# Concepts

\* Combustion reaction \* Calorimetry

\* Nutritional calorie \* Caloric content of foods

# Background

What does it mean to say that we burn food in our bodies? The digestion and metabolism of food converts the chemical constituents of food to carbon dioxide and water. This is the same overall reaction that occurs when organic molecules—such as carbohydrates, proteins, and fats—are burned in the presence of oxygen. The reaction of an organic compound with oxygen to produce carbon dioxide, water and heat is called a *combustion reaction.* The chemical equation for the most important reaction in our metabolism, the combustion of glucose, is shown in Equation 1.

**C6H12O6 + 6O2 🡪 6CO2 + 6H2O + heat** *Equation 1*

Within our bodies, the energy released by the combustion of food molecules is converted to heat energy (to maintain our constant body temperature), mechanical energy (to move our muscles), and electrical energy (for nerve transmission). The total amount of energy released by the digestion and metabolism of a particular food is referred to as its *caloric content* and is expressed in units of nutritional Calories (note the uppercase C). The caloric content of most prepared foods is listed on their nutritional information labels.

Nutritionists and food scientists measure the caloric content of food by burning the food in a special device called a calorimeter. *Calorimetry* is the measurement of the amount of heat energy produced in a reaction. Calorimetry experiments are carried out by measuring the temperature change in water that is in contact with or surrounds the reactants products. (The reactants products together are referred to as the system, the water as the surroundings.)

**Purpose**

The purpose of this experiment is to determine the amount of heat released when Hot Fries are burned.

**Materials:**

Balance Matches

Calorimeter (Soda Can) Hot Fries

Paper clip Thermometer

Graduated cylinder, 50-mL Water

**Procedure**

1. Place a food sample on the food holder. Measure and record the combined mass of the food holder and sample. Place the food holder on a ring stand.

2. Obtain a clean, empty soda can. Measure and record its mass.

3. Add about 50 mL of tap water to the can and measure the combined mass of the can and water.

4. Bend the top tab on can up and slide a file through the hole. Suspend the can on a ring stand using a metal ring. Adjust the height of the can so that it is about 2.5 cm above the food holder.

5. Insert a thermometer into the can. Measure and record the initial temperature of the water.

6. Light the food sample and center it under the can. Allow the water to be heated until the food sample stops burning. Record the maximum (final) temperature of the water in the can.

7. Measure and record the final mass of the food holder and sample.

8. Clean the bottom of the can and remove any residue from the food holder. Repeat the procedure with a second food sample.

**DATA TABLE:**

**Table 1 – First Hot Fries Data**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Food Sample** | **Mass before burning (g)** | **Mass after burning (g)** | **Change in Mass (g)** | **Initial Temperature** (°C) | **Final Temperature** (°C) | **Change in Temperature** (°C) |
| **Hot Fries**  **Trial 1** |  |  |  |  |  |  |
| **Hot Fries**  **Trial 2** |  |  |  |  |  |  |

**CALCULATIONS:**

1. To estimate the calories in the food sample you will need the mass of the water you heated.

The **20.0 mL** of water you used is **20.0 g**.

Calculate the amount of energy transferred to the can in terms of calories. Then, convert to kcal.





Hot Fries Trial 1:

Hot Fries Trial 2: