Measuring Calories in Foods

Furnished as a Free Service to Home Educators
By
The Backyard Scientist
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The following experiment from the Backyard Scientist was developed expressly for use in newsletters serving home educators. This experiment is NOT contained in the award-winning *Backyard Scientist* books and science kits. As in the *Backyard Scientist* books, it is designed to be simple, fun, and of course to teach an important scientific concept.

CAUTION: ADULT SUPERVISSION IS REQUIRED. YOU WILL BE USING A FLAME AND HANDLING HOT MATERIALS. USE THE TONGS/INSULATED GLOVES FOR HANDLING HOT MATERIALS. WEAR SAFETY GOGGLES.

Gather the following supplies:

- Coffee can (12 to 16 oz. size)
- Soup or vegetable can
- Can opener
- A few marshmallows, peanuts, walnuts.
- 50 ml tap water at room temperature
- Sewing needle
- A cork (wine bottle)
- Hammer
- Nail
- Pliers
- Wire coat hanger
- Thermometer (Celsius scale)
- Long, wood matches
- Kitchen tongs
- Safety goggles
- Insulated gloves or pot holder
- Metal baking pan or cookie sheet
- Paper and pencil for recording your observations.

Adult supervision is required when using a flame. Wear safety goggles. Use tongs or insulated gloves.

Begin experimenting.

Part 1, Assemble Your Calorimeter.

1. Remove the tops and bottoms of the large can and just the bottom of the small can.
2. Punch two holes on opposite sides of both cans.
3. On the large can, punch a few additional holes at the other end.
4. Use the pliers to straighten the coat hanger.
5. Thread the coat hanger through the two holes in each can so that the small can hangs inside the large can (center as close as possible).
6. From this point forward, all work should be done on the baking pan or cookie sheet.
7. Use the pliers to carefully push the eye end of the sewing needle into the cork. Don't stick yourself.
8. Place the marshmallow on the pointed end of the sewing needle.
9. Place the cork assembly directly under the small can.

Part 2, Using Your Calorimeter.

1. Pour the 50 ml of water at room temperature into the small can.
2. Use the thermometer to measure the temperature of the water.
3. Record your initial measurement.
4. Use a match to set the marshmallow on fire.
5. Let the marshmallow burn out.
6. Use the thermometer to measure the temperature of the water.
7. Record your second observation.

Part 3, Calculate the number of calories in the marshmallow (and other tested food items. (The mass of H_2O at 4^oC is 1 gr/ml.)

1. Mass of water (grams) times heated temperature of water minus original temperature water equals number of calories divided by 1000 equals the number of food Calories.
2. Repeat Parts 2 and 3 using different food samples. Use a new supply of water for each food tested.

Can you answer the following questions from your observations?

1. Were you able to measure the difference in starting temperature of the water and the ending temperature of the water when the marshmallow burned?
2. Were the temperature differences of the other foods you tested larger or smaller than those observed when testing the marshmallow?
3. Why did the temperature of the water rise?
4. Is there a difference between a calorie and a Calorie?
5. Which food item resulted in the largest gain in water temperature? What does this mean?

Backyard Scientist solution to the experiment.

Yes, there is a difference between a calorie and a Calorie. A Calorie (used in measuring foods for example) is a kilocalorie or 1000 calories. So, if you looked at a food label and it said there were 120 Calories, that is really 120,000 calories. All living things require energy to survive. Animals and of course people get their energy from the foods they eat. The standard measure of heat energy is the calorie. A calorie is the amount of energy needed to heat one gram of water one degree Celsius.

The calorie content is based on the same units of heat that measure the potential energy stored within chemical bonds. As substances react, chemical bonds are broken and reformed. Foods that have high calorie content have chemical bonds that when rearranged (through combustion or digestion) give off large amounts of energy.

Scientists use a calorimeter to measure the calorie content of substances such as foods. You built a simple calorimeter. Some of the heat energy produced by the combusting (burning) was lost due to inefficiency of the design of our calorimeter. Think about ways to make a more efficient calorimeter.

Burning the marshmallow should have resulted in measurable differences in the temperature of the water from its room temperature starting point. The other food items tested will result in different ending water temperatures. The higher the ending temperature, the higher the number of calories the food contained. Which of the food items you tested contained the greatest number of calories. Does this roughly match the calorie content published in the nutrition statement on the food's container?

About the author.

Jane Hoffman, the Backyard Scientist, is the internationally known author of the award-winning *Backyard Scientist* hands on science books and science kits. The nine science books and three kits will excite, motivate and instruct any student.

Also available from the Backyard Scientist is the "Parent Guide to Teaching Science." This work covering grades
K –12 helps parents insure they are teaching the science subjects and materials their students should be learning by grade level. Her newest book, *A Science Wonderland for the Very Young* targets children ages 2-7 years.

In addition to writing and developing these exciting materials, Jane is a sought-after speaker at Home School and other educational conferences nationwide where she makes science come alive. Everyone leaves her sessions better informed as well as motivated and enthused to apply the concepts they learned. Hoffman's teacher inservice workshops for teachers are rated the best available by teachers and administrators. She has been serving the homeschool and educational markets with quality materials for more than 20 years.

For a free brochure, send a self-addressed, stamped ($.55) envelope to: Backyard Scientist, PO Box 16966, Irvine, CA 92623 or visit her on the Worldwide Web at: www.backyardscientist.com