

FOOD ENERGY
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Have you ever counted Calories?

Food energy is measured in Calories (upper case C)

- It takes 1000 calories to make up a Calorie (kilocalorie=kcal)

Example: A standard French fry serving contains 220 Calories of food energy.
How many calories are present?

220 Calories x 1000 cal/Cal. = 220,000 calories

It takes 1 calorie to raise the temperature of 1 g of water 1°C

Simplified formula may be used: calories = grams of water x (final °C – initial °C)

This is determined by the burning of food under controlled conditions (calorimetry) using an instrument called a calorimeter.

Problems:

1. You want to raise the temperature of 250mL of water from 22 °C to 99 °C. How much thermal energy will be needed?
Use equation calories = grams of water x (final °C – initial °C)

2. How much thermal energy will be needed to raise 4 containers of the above water under the same conditions?

EXPERIMENT: FOOD CALORIES

Procedure

1. Obtain a cheese puff or Cheeto®. Record it's mass.
2. Remove both ends of a large can. The can will serve as a chimney to minimize heat loss during the experiment.
3. Remove one end of a small aluminum can. Punch two holes in the sides of the can near the top. The holes should be opposite each other.
4. Pour exactly 100 mL tap water into the aluminum can. Record the temperature of the water in the can.
5. Insert a rod through the holes in the sides of the aluminum can. Use the rod to balance the small can within the large can.
6. Place the cheese puff or Cheeto® on a nonflammable surface, and ignite it with a match. Immediately place the large can over the burning puff. The aluminum can containing the water is above the puff.
7. Allow the puff to burn until it goes out.
8. Record the water's highest temperature.
9. Record the mass of charred puff.

CALCULATIONS AND QUESTIONS

Answer these questions on a separate sheet of paper.

1. Calculate the calories of heat from the burning puff. The 100 mL water has a mass of 100 g (for all practical purposes the density of water is 1 gram/mL) and the specific heat of water is one calorie/degree Celsius/gram. Use the following equation to make the calculation.

calories = grams of water x temperature change x specific heat of water

2. Divide the calories from question 1 by the change in mass of the puff. This determines the calories released per gram of puff burned. Record your answer in Kcal or Calories.
3. Multiply the measured Calories by the number of grams in a serving size, obtained from nutritional panel.
4. Compare your Calorie results to the nutritional panel.
5. Calculate your percent error.

$$\frac{(\text{actual} - \text{measured Calories per serving}) \times 100}{\text{actual Calories per serving}} =$$

6. Why do you suppose the calculated values for calories per gram are less than the actual values listed?

DATA TABLE

Kind of Food	Mass			Temperature		
	Original	Final	Change	Original	Final	Change

NOTE: measuring calories in this manner does not take into consideration differences in digestibility of different substances (i.e. starch vs. cellulose), or the way in which different substances are metabolized (lipid vs. carbohydrate vs. protein)