

## Chapter 10: Energy Balance

# ENERGY EQUILIBRIUM

Did you know that the food we eat provides us with energy?



We use energy 24 hours a day, seven days a week. Each person needs a different amount of energy, and that amount changes throughout our lives. The idea is to consume just enough energy for our bodies to function; not too much or too little. We need to find a balance between energy burned and energy consumed because excess energy is stored in our bodies as fat.

The energy we consume is measured in **kilocalories** (kcal). A kilocalorie is defined as the amount of energy required to raise the temperature of a liter of water one degree Celsius. You may have heard of calories instead of kilocalories. The term **calorie** refers to a unit of food energy. This energy is expressed in 1000-calorie metric units, known as a kilocalorie; one kilocalorie equals 1000 calories. On food labels, kilocalories (kcal) are called calories, but in actuality the number reported represents kilocalories. For example, a food label may state one serving contains 110 calories,

which means the food really contains 110,000 calories. However, food labels in the United States use Calories (capitalized), which is the same as kilocalories. Internationally, the energy measurement of **kilojoules** is used. It is another way to measure the same item. One kilojoule is approximately equal to 0.25 kilocalories.

To find out exactly how many calories are in food, scientists can use a **bomb calorimeter**. A bomb calorimeter measures the heat released when food is burned, which provides an estimate of potential energy in the food. The amount of energy an object possibly has is known as **potential energy**. The bomb calorimeter is used because it mimics the method our body uses to break down food. When the food is heated in the calorimeter, the carbon and hydrogen bonds break, releasing energy in the form of heat. These reactions result in the formation of carbon dioxide and water. The calorimeter measures the rise in temperature with a thermometer. A

calorie is equal to each degree the temperature rises for 1 gram of water. For example, if the temperature of 100g of water changes from 17 degrees Celsius and to 44 degrees Celsius while the food is being burned, the food is around 2700 calories or 2.7 kcalories. You will learn more about these units of energy in the *Food Explorations Lab* of this chapter.

Another method used to determine the calorie content of a food is to calculate kilocalories based on **macronutrient** content. There are three macronutrients; carbohydrates, protein, and fat. Carbohydrates and proteins contain 4 kcal per gram, while fat contains 9 kcal per gram. For example if a food contains 15 grams of carbohydrates, 2 grams of protein, and 11 grams of fat it will have  $(4 \times 15) + (4 \times 2) + (9 \times 11) = 167$  kcal. To find the kcal in food you need multiply the gram weight (number of gram) by the kcal per

gram. For example, the kcal from carbohydrate in the food above can be found by multiplying 15 grams by 4 kcal per gram ( $15 \times 4 = 60$ ).

Understanding the nutrient content of foods is very important for our health. While a food may be low in calories, those calories may be loaded with fat or sugar. These foods have very few nutrients in the form of protein, vitamins, and minerals. We need these nutrients for a healthy body. There are many different sources in which we can find information about what we should be eating, but choosing the right one may be tricky. Try looking for sources from the United States Department of Agriculture (USDA). Practicing healthy eating habits is very important for our health. Let's find out how different foods may affect our bodies based on their composition!



## Think About It

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1. The energy needed to raise 1 liter of water 1 degree Celsius is a           kilocalorie          .
2. How many kilocalories would it take to raise 10 liters of water 1 degree Celsius?           10
3. How many kilocalories would it take to raise 5 liters of water 2 degrees Celsius?           10
4. What is the difference between a kilocalorie and a calorie?

*A calorie is a smaller unit of a kilocalorie (1 kilocalorie = 1,000 calories)*