

Chapter 25

Cooking Methods

Conduction and Its Uses

Directions: Read the following selection. Then answer the questions under *Thinking Critically*, and complete the activities as directed by your teacher.

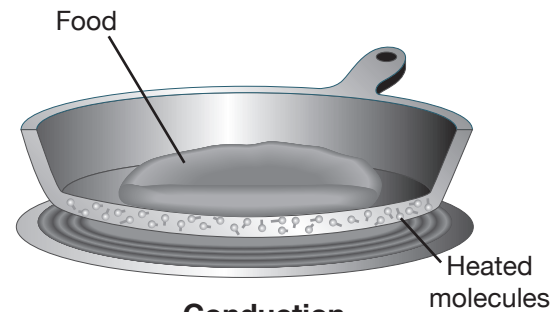
Heat is energy in transit, meaning heat that flows from one object or particle to another. As explained in Chapter 26 of your text, *conduction* is the transfer of heat by direct contact. Heat may be conducted from the warm part of a body of matter to a cooler part or from a warm object to a cooler object that is touching it. For example, when frying an egg, heat flows from the hot skillet to the egg by conduction.

An understanding of kinetic energy will help you better understand conduction. *Kinetic energy* is the energy of motion. Matter is made up of molecules, tiny particles which are in constant motion and therefore have kinetic energy. The temperature of matter is a measure of the average kinetic energy—or a measure of the motion—of its molecules. A hot skillet has molecules moving at higher speeds, or at a higher kinetic energy, than a cold skillet.

What happens when two bodies with different amounts of kinetic energy come in contact? You may have seen a fast-moving marble hit other marbles that are still or slow-moving. When the fast marble hits, the stationary marbles begin to move, the slow ones speed up, and the fast-moving marble slows down. This is an example of kinetic energy being transmitted from an object with a higher energy to one with a lower energy.

The same effect takes place on a molecular level when objects at different temperatures come in contact. Rapidly vibrating molecules in the warmer object bump into neighboring slower-moving molecules in the cooler object. Energy is transferred from the warmer object to the cooler object. The slower-moving molecules gain speed and the faster-moving molecules slow down. The cooler object becomes warmer and the warmer object becomes cooler.

The direction of energy transfer is always from warmer objects to cooler objects. In a glass of ice water, heat flows from the water to the ice, causing the ice to melt. In the process, the water loses energy and becomes cooler. Although you may think in terms of using the ice to chill the water, it's more accurate to say that the water warms the ice.



Some substances are better heat conductors than others. Metals, such as iron, silver, and copper, are good conductors. Stainless steel does not conduct as well. If you were to put a sterling silver spoon into hot soup, you would probably feel the handle grow warm immediately. The handle of a stainless steel spoon will not grow warm as quickly. Wood, plastic, and glass are not as effective as metal in conducting heat.

You can use your understanding of conduction in useful ways. For example, suppose you want potatoes to bake faster in a conventional oven. You can run metal skewers through the potatoes to conduct heat to their centers. A metal skewer can also be used to conduct heat to the center of a roast so that it cooks more evenly.

You may also want to conduct heat away from food. If you leave a few cold spoons in a hot liquid, it will cool faster.

Sometimes you want to prevent heat transfer. For example, you don't want to burn yourself on the handle of a hot pan. If you use pans with handles that do not conduct heat well, they will not become as hot as metal handles.

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Thinking Critically

1. Why must two bodies of matter be touching in order for heat to transfer by conduction?

2. If you were blindfolded and given a cup of hot water, a sterling silver spoon, and a stainless steel spoon, how could you tell which spoon was which?

3. If you took hot rolls from the oven, would they cool faster or more slowly if you transferred them from the baking sheet to a serving basket? Why?

4. Explain why putting a bottle of warm juice into a tub of ice cools the juice.

For Further Study

- ◆ Conduct an experiment to find out which foods can be cooked or melted by putting them in contact with a hot object, such as a hot skewer. How could you use this knowledge to cook foods in the wilderness on a hot day? Share your observations with the class.
- ◆ Conduct research on insulating materials used to keep foods cold or hot. What properties make them good insulators? Summarize your findings in a brief report and submit it to your teacher.