



READ and REMEMBER: Transferring Heat Energy

VSC G8.5.B.1.a, b

Heat energy is produced in every energy transformation within a system, and it can escape a system or be transferred to a different system in a number of ways.

Conduction

Conduction is the transfer of heat energy through a substance, or from one substance to another, by direct contact of atoms or molecules. The heat moves between particles of matter that are colliding. This type of transfer is most effective in solids, but can also happen in liquids.

For example, suppose a metal spoon is placed in a hot cup of coffee. The spoon rests on the bottom of the cup. The cup is heated by the hot coffee in it, and the contact between the cup and the spoon conducts heat into the spoon. Heat is also conducted directly to the spoon by the hot coffee. This conduction makes the spoon hot.



Convection

Convection is the transfer of heat energy through the movement of the heated gas or liquid. As the gas or liquid is heated, it rises away from the heat source. At the same time, cooler material sinks toward the heat source until it eventually heats up and rises in turn. The constant movement of hot material rising and cooler material sinking results in the circulation of the substance and distribution of heat energy.

This is how deep frying works. Oil is heated by heating elements at the bottom of the fryer. Hot oil rises because of convection currents “bubbling up” and carrying heat with them that cooks the food. Oil that has given up its heat sinks, where it will be heated again.

Also, in Unit 2 you studied the movement of the extremely hot material within Earth’s mantle. The hottest material near Earth’s center heats up and rises toward Earth’s surface, and then cools and sinks down again toward Earth’s center. This, too, is convection.

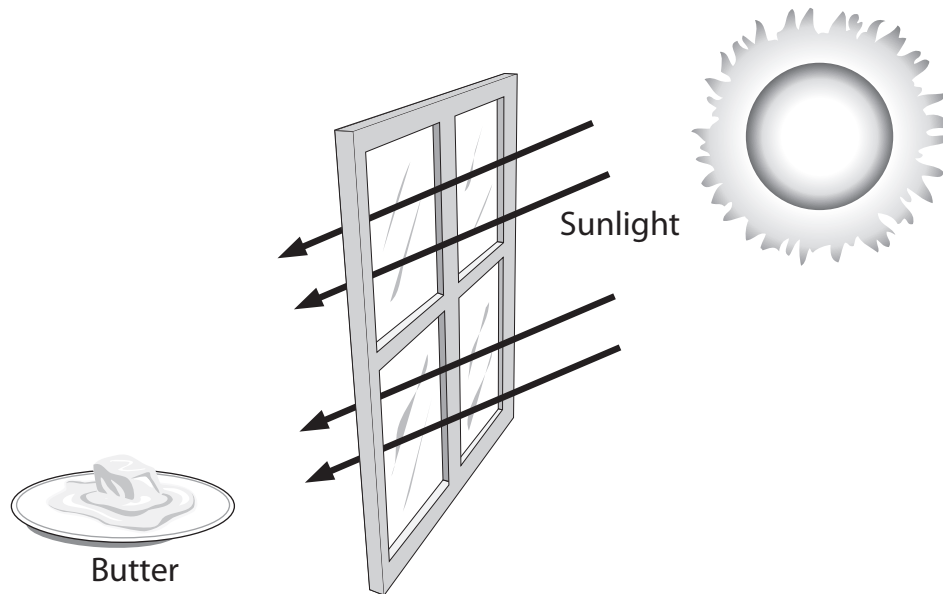




Radiation

Radiation is the transfer of heat energy through empty space or through a transparent material. Unlike conduction and convection, the transfer of heat through radiation does not require matter as a medium for the transfer. Instead, heat is transferred by electromagnetic waves, such as visible light, infrared, or microwaves. The heat energy can radiate through a transparent material (like air) and warm the solid objects it eventually lands on, such as the stick of butter in the picture below.

For example, sunlight can pass through a window to heat objects on the other side. The window might be warmed slightly, but most of the heat energy passes through it.



Microwave ovens also work by radiation: radiant energy in the form of microwaves is used to heat or cook food.