

Transferring Heat Energy

Heat energy has the capability of being transferred from one place or object to another. There are three different ways in which heat energy can be transferred. They are: conduction, convection, and radiation.

Conduction is the transfer of heat energy by which moving particles make other particles move. A good example of this is a cup of hot tea that is stirred with a metal spoon. As heat flows from the tea to the immersed part of the spoon, that section of the spoon becomes hot. The atoms begin to vibrate rapidly. The immersed atoms are tightly connected to the neighboring atoms along the handle of the spoon. As a result, these atoms also begin vibrating. Their vibrations cause the molecules in your fingertips to vibrate, which creates the feeling of warmth. Some materials are better conductors than others. For example, if you replace the metal spoon with a wooden spoon, the wooden spoon conducts much less heat.

Convection is the transfer of heat that occurs in fluids. A fluid is a liquid or gas that can move or flow. Convection is caused by the fact that warm fluids are lighter than colder fluids. As an example, you can think of a pot of water boiling. A pot of water on a stove becomes heated because of both conduction and convection. The metal bottom of the pan conducts heat from the burner to the bottom layers of water. As the water expands, it becomes less dense than the cooler water. The heavier water, which is the colder water, sinks to the bottom of the pan and pushes the lighter (or hotter) water to the top of the pan. The hot water is displaced by convection. Since the cooler water is now at the bottom of the pan, conduction now heats this water, and the cycle continues until the entire pot of water has been heated.

Radiation is the transfer of heat by waves that can go through empty space. A good example of radiation would be to consider the waves of light that come from the sun. You can feel the heat that radiates from the sun on a sunny day. Radiation is the only way that heat can be transferred through a vacuum. Most of our solar system is made up of empty space. Energy travels through this vacuum to us from the sun. When this radiation hits an object, the matter is heated. Surfaces that are highly polished can reflect back some of this radiation in the same way that a mirror reflects light.

A thermos illustrates how conduction, convection, and radiation can be minimized. A thermos is designed to reduce heat transfer to or from the liquid stored inside of it. A thermos can help keep a cold drink cold or keep a hot drink warm. A thermos uses mirrors to line the inside of the thermos cavity. The bottle also has a vacuum between the inner compartment and the outer shell. Because of the empty space between the inner and outer walls, conduction and convection are minimized. The mirror in the thermos reduces the radiation transfer of heat.

Name _____

Date _____

Transferring Heat Energy Questions

List the 3 different ways in which heat energy can be transferred:

1. _____
2. _____
3. _____

Matching:

- | | |
|---------------------|--|
| _____ 4. Conduction | a. Is the transfer of heat that occurs in fluids. |
| _____ 5. Convection | b. Is the transfer of heat by waves that can go through empty space. |
| _____ 6. Radiation | c. Is the transfer of heat energy by which moving particles make other particles move. |

True or False:

- _____ 7. A thermos illustrates how conduction, convection, and radiation can be minimized.
- _____ 8. All three ways (conduction, convection, and radiation) can be used to transfer heat through a vacuum.
- _____ 9. All materials conduct heat with the same intensity and capacity.
- _____ 10. A pot of water on the stove is heated by both conduction and convection.

Name _____

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Transferring Heat Energy Answers

List the 3 different ways in which heat energy can be transferred:

1. Conduction
2. Convection
3. Radiation

Matching:

- | | |
|------------------------|--|
| <u>c</u> 4. Conduction | a. Is the transfer of heat that occurs in fluids. |
| <u>a</u> 5. Convection | b. Is the transfer of heat by waves that can go through empty space. |
| <u>b</u> 6. Radiation | c. Is the transfer of heat energy by which moving particles make other particles move. |

True or False:

- T 7. A thermos illustrates how conduction, convection, and radiation can be minimized.
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