

Thermal Energy Transfer: How is Thermal Energy Transferred From One Substance to Another?

NO LAB REPORT FOR THIS LAB! Instead you will be drawing models and explaining each of the three methods of thermal energy transfer.

Introduction

Understanding how energy is transferred from one object or substance to another is an important concept within science. Many common events involve a transfer of energy, such as heating a pot of water on the stove or when a car engine burns gasoline. In the first example, heat energy is transferred from the stove to the pot of water, and the water absorbs the heat energy and will eventually begin to boil. In a car, the chemical energy stored in the gasoline is released when it is burned in the engine; that chemical energy is ultimately converted to kinetic energy and results in the motion of the car.

The law of conservation of energy indicates that energy is not created or destroyed, only converted from one form to another. There are many different types of energy that can be transferred between objects. When two objects are at different temperatures, it is possible for heat or thermal energy to transfer from one object to the other. If you place a cold pot of water on a hot stove burner, for example, thermal energy will transfer from the stove to the water and the water will get warmer. Heat energy always moves from objects with a high temperature toward objects with a lower temperature.

When we measure the temperature of an object, we often use the Celsius scale. On the Celsius scale water freezes at 0°C and boils at 100°C . The temperature of a substance is a measure of the average kinetic energy of the particles of that substance. Water molecules in a cold sample of water at 10°C have less kinetic energy than water molecules in a sample of hot water at 50°C . In this example, the water molecules at 50°C will be moving faster. If these two samples of water with different temperatures are mixed together, the fast- and slow-moving particles will transfer energy until eventually the molecules all have similar amounts of kinetic energy. When molecules with higher kinetic energy bump into molecules with lower kinetic energy, the faster-moving particles transfer kinetic energy to the slower particles. The transfer of energy will result in the water mixture having a temperature that is in the middle of the starting temperatures, which is called an equilibrium temperature—in this example, perhaps about 30°C .

Whenever substances at different temperatures come into contact with one another, thermal energy will be transferred from the hotter object to the cooler object until an equilibrium temperature is reached. The method by which that thermal energy is transferred from one substance to another, however, is based on several factors. One of those factors is the properties of the specific substances. In this activity, you will investigate how thermal energy is transferred from one substance to another.

Your Task

Use what you know about thermal energy and the relationship between structure and function to create a visual model and a written summary that explains how thermal energy is transferred from one object to another. To complete this task, you will need to explore an online interactive called *Thermal Energy Transfer*. Once you understand the three modes of energy transfer you will create an explanation and a visual model that explains each of the three methods as well as specific examples of each.

The guiding question of this investigation is: **How is thermal energy transferred from one substance to another?**

Materials

You will use the following link for the *Thermal Energy Transfer* interactive during your investigation:
<https://www.pbslearningmedia.org/resource/lps07-sci-phys-thermalenergy/thermal-energy-transfer/#.XpylZ5NKg0o>

Getting Started

First, go through the interactive once to understand the difference between conduction, convection, and radiation.

Next, go through the interactive again, taking notes on the three modes of energy transfer.

Then, create a visual model (labeled diagram) of each of the three methods of energy transfer. Include a written summary of 5-7 sentences for each mode of transfer. Include several examples in each explanation.

Rubric

Your models include:

Conduction

- ❑ A labeled diagram explaining CONDUCTION (4 points)
- ❑ A written summary of CONDUCTION (at least 5-7 sentences), including several examples (5 points)

Convection

- ❑ A labeled diagram explaining CONVECTION (4 points)
- ❑ A written summary of CONVECTION (at least 5-7 sentences), including several examples (5 points)

Radiation

- ❑ A labeled diagram explaining RADIATION (4 points)
- ❑ A written summary of RADIATION (at least 5-7 sentences), including several examples (5 points)

You can draw your labeled diagram on paper, then take a picture and upload it to your Google Doc or you can make your diagram using the drawing tools on Google Docs. You may NOT just upload a diagram from the Internet.

If you would prefer to upload a video of you explaining the three methods of energy transfer using props or pictures and giving examples, that would work, too!