HU GK-12 Activity

TITLE: It's Gettin' Hot in Here! Mechanisms of Energy Transfer

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DCPS STANDARDS: E.7.2, E.7.1

GOALS:

1. Scholars will be able to diagram and explain three mechanisms by which heat moves throughout (to, through, and out) Earth's system.
2. Scholars will be able to explain the Law of Conservation of Energy.

OBJECTIVES:

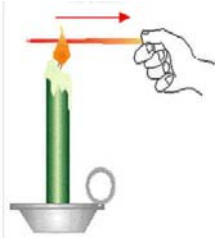
1. Given an explanation of the Law of Conservation of Energy, Scholars will design three distinct experiments that test the verity of conduction, convection and radiation.

PREREQUISITE KNOWLEDGE:

Background

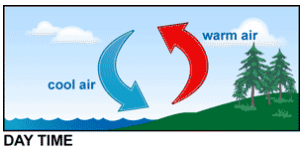
One of the laws of physics states that energy cannot be created or destroyed. Energy can, however, be changed from one form to another. The storage, transfer, and conversion of energy are the driving forces behind all life on Earth. For example, the energy in the food you eat once came from the sun. There are three mechanisms of energy transfer on Earth, conduction, convection, and radiation.

Conduction occurs when heat energy is passed through a material from one particle to another. The particles at the warm end of a metal for example move faster and hit the particles next to them causing them to move faster. In conduction, the vibration and movement of atoms transfer heat. Materials that are poor conductors are called insulators because they create a barrier that does not allow (or minimally allows) heat to pass. Examples of insulators include, glass, wood, plastic, rubber, water, and air.

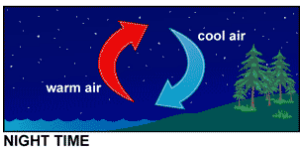


Convection occurs when particles in a gas or liquid (because these molecules are free to move) become warm. When particles become warm they expand and become less dense than the cold particles nearby. The warm particles then rise as the cooler particles fall into the space left behind by the warm particles. The occurrence of rising and falling of warm and cool air is called a convection current, and it is the cause of rain on Earth. Convection

only occurs in liquids and gases because particles in a solid are not free to move from place to place.

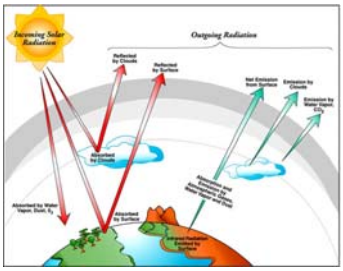


DAY TIME



NIGHT TIME

Radiation is a method of heat transfer that takes place without the need for a material to pass through (it can happen where there are no particles). For this reason we do not see the suns rays. Radiation is the way the Earth receives heat energy from the sun. The heat energy from the sun is transferred as waves.



ESSENTIAL QUESTIONS:

1. Why are some metals better conductors of heat energy than others?
2. Why does convection only occur in liquids and gases?
3. Why are most ice cream tubs white?

LABORATORY MATERIALS:

Materials for the written list include: copper, aluminum, iron, and steel rods, wax, water, water heater, test tube, ice, gauze, test tube holder, plastic wrap, hot iron (used to iron clothes), white paper, black paper, and light bulb.

DIFFERENTIATING INSTRUCTION:

English language limited scholars will be paired with bilingual (Spanish/English speaking scholars). A separate set of instructions will be delivered to the Spanish-speaking scholars. Thomas Hardy will write the directions in Spanish. Learning disabled scholars will be integrated into groups with accelerated learning scholars for group balance. Each group member will be required to contribute ideas to the experimental design.

RATIONALE:

This activity is designed to demonstrate the three mechanisms of energy transfer and how they differ.

RESEARCH ACTIVITY:
Separate class into seven groups of three scholars each.

1. Distribute a written list of materials that can be used to test the occurrence of conduction, convection and radiation.
2. Each group of three Scholars will design three distinct experiments that demonstrate the processes of conduction, convection and radiation.
3. Each group must diagram how their experiment will work to physically show these processes are actually occurring.

EVALUATION AND ASSESMENT:
1. Scholars will diagram radiation, convection, and conduction and will explain how they function as heat transfer mechanisms in Earth's system.
2. Scholars will write a paragraph explaining the Law of Conservation of Energy.