

Riverton Street Charter School
Class: _____

Name: _____
Date: _____

The Transfer of Thermal Energy

The heat source for our planet is the sun. Energy from the sun is transferred through space and through the earth's atmosphere to the earth's surface. Since this energy warms the earth's surface and atmosphere, some of it is or becomes heat energy. There are three ways heat is transferred, into the atmosphere:

- Radiation, conduction, convection

Radiation

If you have stood in front of a fireplace or near a campfire, you have felt the heat transfer known as radiation. The side of you nearest the fire warms, while your other side remains unaffected by the heat. Although you are surrounded by air, the air has nothing to do with this transfer of heat. Heat lamps, that keep food warm, work in the same way. Radiation is the transfer of heat energy by electromagnetic radiation.

Most of the electromagnetic radiation that comes to the earth from the sun is in the form of visible light. Light is made of waves of different frequencies. The frequency is the number of instances that a repeated event occurs, over a set time. In electromagnetic radiation, the frequency is the number of times an electromagnetic wave moves past a point each second.

Our brains interpret these different frequencies into colors, including red, orange, yellow, green, blue, indigo, and violet. When the eye views all these different colors at the same time, it is interpreted as white. Waves from the sun which we cannot see are infrared, which have lower frequencies than red, and ultraviolet, which have higher frequencies than violet light.

Most of the solar radiation is absorbed by the atmosphere and much of what reaches the earth's surface is radiated back into the atmosphere to become heat energy. Dark colored objects such as asphalt absorb more of the radiant energy and warm faster than light colored objects. Dark objects also radiate their energy faster than lighter colored objects.

Conduction

Conduction is the transfer of heat energy from one substance to another or within a substance. Have you ever left a metal spoon in a pot of soup being heated on a stove? After a short time the handle of the spoon will become hot. This is due to transfer of heat energy from molecule to molecule or from atom to atom. Also, when objects are welded together, the metal becomes hot (the orange-red glow) by the transfer of heat from an arc. This is called conduction and is a very effective method of heat transfer in metals.

Convection

Convection is the transfer of heat energy in a fluid. This type of heating is most commonly seen in the kitchen when you see liquid boiling.

Air in the atmosphere acts as a fluid. The sun's radiation strikes the ground, thus warming the rocks. As the rock's temperature rises due to conduction, heat energy is released into the atmosphere, forming a bubble of air which is warmer than the surrounding air. This bubble of air rises into the atmosphere. As it rises, the bubble cools with the heat contained in the bubble moving into the atmosphere.

As the hot air mass rises, the air is replaced by the surrounding cooler, more dense air, what we feel as wind. These movements of air masses can be small in a certain region, such as local cumulus clouds, or large cycles in the troposphere, covering large sections of the earth. Convection currents are responsible for many weather patterns in the troposphere.

Conductors and Insulators

A material can either be a conductor or an insulator. A conductor transfers thermal

energy well while an insulator does not transfer thermal energy well.

A material that conducts heat well is a conductor. Metals such as silver and stainless steel are good conductors. A metal spoon conducts heat better than a wooden spoon. A good conductor such as a tile floor feels cool to the touch because it easily transfer heat away from your skin.

A material that does not conduct heat well is called an insulator. Wood, wool, straw, and paper are good insulators. So are the gases in the air. Clothes and blankets are insulators that slow the transfer of heat out of your body.

A well insulated building is comfortable inside whether it is hot or cold outdoors. Insulation prevents heat from entering the building in hot weather and from escaping in cold weather. Much of the heat transfer in a building occurs through the windows.

Questions:

1. What is the heat source of our planet? _____
2. What are the three ways in which heat is transferred? _____

3. How is energy transferred during convection? _____

4. What type of energy can travel through space? _____
5. What does it mean by frequency?

6. How do our brains interpret the different frequencies of visible light?

7. What color do we see when we see all the different spectrum or colors at the same time?

8. Which can absorb more radiant energy dark colored objects or light colored objects?

9. What is conduction?

10. How is heat transferred in conduction?

11. What is responsible for the weather patterns in the troposphere?

12. What type of substances are good conductors?

13. An insulator is something that prevents or slows the transfer of heat. List three insulators. _____
