

HEAT TRANSFER - CONDUCTION

Heat can be transferred from particle to particle - directly in contact with each other.

Heat transfers only in one direction - from areas of greater kinetic energy (more thermal energy) to areas of lesser kinetic energy (less thermal energy).

Materials that allow this type of heat transfer to occur readily are called conductors, while materials that inhibit this type of heat transfer are called insulators.

HEAT TRANSFER - CONVECTION

Particles having a lot of kinetic energy (thermal energy) rise and then fall as they lose thermal energy creating circular patterns called convection currents.

Convection currents occur in liquids and in gases (because of the space the particles can move into).

In the air, convection currents are often referred to as thermals.

HEAT TRANSFER - RADIATION

Radiation does not rely on particle movement. Radiation is the transfer of thermal energy by invisible waves (called infrared waves) that travel through empty spaces.

This type of energy transfer is referred to as radiant energy.

When this radiant energy comes in contact with particles of matter the energy is absorbed or reflected by the particles, depending on the specific properties of the particles.

NATURAL SOURCES OF HEAT

The Sun is a natural source of thermal energy, often referred to as solar energy.

The Earth is also a source of thermal energy, which originates in the core and is released as geothermal energy.

Fire converts the chemical energy found in fuels (wood, oil, natural gas, coal) into thermal energy.

The process of decomposition also produces thermal energy.

SOLAR HEATING - ACTIVE/PASSIVE

Passive solar heating reduces heat loss by insulating and designing structures with appropriate materials to maximize heat gain and prevent heat loss at appropriate times in the year.

Active solar heating systems include collectors (solar panels), storage units and a distribution system to move the heat around the structure.

Solar energy can also be converted into electricity by arranging solar cells into arrays.

HEATING TECHNOLOGIES

A thermostat has a bimetallic strip switch which is used to control heating systems indoors as well as adjust the temperature of appliances.

Localized heating: space heaters, fireplaces, wood stoves.

Central heating: the two types commonly used:

- Forced-air (central heating)
- Hot water heating

Both of these systems rely on convection currents to move the heat throughout the space in the structure.

INSULATION (R-VALUE)

Insulation is used to limit heat loss to the outside environment or heat gain from the outside.

Material thermal conductivity represents its ability to transfer heat by conduction.

Insulators are given a rating called an R-value. It represents the degree the insulation is able to prevent heat loss or gain.

A thermogram is used to visually represent where thermal energy is in a structure.

ENERGY CONSUMPTION

Home - reduce energy use by energy efficient appliances.

Transportation uses fossil fuels extensively - reduce use by limiting use and using alternative fuels.

Industry - reduce waste with an energy audit to identify problem areas.

Cogeneration involves producing two different forms of energy with one energy source.

ENERGY CONSERVATION

Renewable thermal energy resources are those that can be replaced (Sun, plants, wind).

Non-renewable thermal energy resources cannot be replaced (fossil fuels).

Fossil fuel consumption has benefits and drawbacks. Benefits include easy access and transportation, while the biggest drawback is that eventually they will be used up.

Alternatives can reduce our dependence on fossil fuels.