

## 7<sup>th</sup> – Temperature & Heat II



### Transfer of heat:

Heat is transferred by conduction, convection and radiation.

**1. Conduction** - Transfer of heat from one particle to the adjacent particle is known as conduction of heat. In solids, heat is transferred by the process of conduction. In this process, the transfer of heat takes place through adjacent molecules.

Example: When one end of an iron rod is put over flame then part which is nearer to the flame is heated first and heat is gradually transferred to the other end of the rod. This happens because particles of iron rod which are nearer to the flame receive the heat and transfers this to the adjacent particles. Subsequently, the adjacent particles transfer the heat to the next adjacent particles. This process continues and heat reaches to the other end of the rod. Thus, heat transfer in solid takes place through conduction.

### Conductor and Insulator:

Materials which allow heat to pass through it are called conductor or good conductor of heat, such as iron, copper, aluminium, etc. All metals are good conductors of heat. Since, mercury is a metal and found in liquid state at room temperature, that's why it is used in thermometer.

Since metals are the good conductor of heat that's why kitchen utensils are made of metals or alloys of metals.

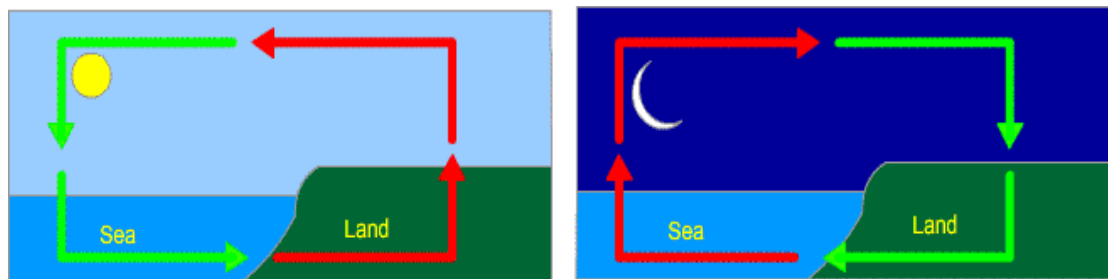
Materials which do not allow heat to pass through them are called bad conductor or poor conductor of heat. They are also called insulators. Example: rubber, wood, plastic, etc. This is the cause that handles of frying pan or other kitchen utensils are made of plastic.

### **Application Of Conduction And Insulators**

- Cooking utensils are made of good conductors of heat. Such utensils get heated quickly. Food can be cooked efficiently in a shorter time. Hence the utensils are generally made of copper, brass, steel or aluminum.
- The base of an electric iron conducts heat which in turn helps in ironing the clothes effectively. Had the base been made of an insulator, the clothes wouldn't have got ironed due to lack of conduction of heat.
- The handles of kettles and utensils are made of insulators such as wood, plastic or ebonite. They help us in holding the utensils comfortably as they do not get heated.
- Woolen clothes are bad conductors. They do not allow heat to transfer from our body to the external environment and thus keep us warm.
- Building materials like brick, asbestos, mud and grass are insulators of heat. They do not permit heat or cold to pass through the walls of the bricks. They keep the houses warm in winters and cool in summers. Roof sheds are made of asbestos for the same reason.
- Hair and the fur of animals are bad conductors of heat. They protect them from cold.
- Vehicles carrying inflammable materials such as petrol are covered or coated with insulators. Otherwise, the petrol can get heated up and catch fire.

**2. Convection** - The transfer of heat because of movement of the molecules of the medium; via mass transfer; is called convection or convection of heat.

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Land Breeze

Sea Breeze

Water and air are bad conductors of heat. But they do become hot, in spite of being bad conductors. Heat transfer in fluids takes place through convection.

**Convection in water:** When water is heated in a pan, the particles of water which are near the source of heat; get heated first. Because of heating, they become light; and rise in water. The gap which is created because of rise of hot particles is filled cold particles of water from the surrounding area. Thus a cyclical movement of particles begins and ends up heating the whole water of the pan. The cyclical movement in fluids because of heating is called convection current.

**Convection in air:** Air gets heated because of convection; the way water gets heated. Air near the source of heat gets heated and rises above. This leaves a gap; which is filled by the colder air from the surrounding. The convection current thus starts in air which results in heating up of air.

When you place your palm above a flame you will feel the hotness of the flame. But when you will place your palm below the flame the area will be colder. This shows how the colder air from below moves up; due to convection current.

### Land and Sea Breeze:

**Sea Breeze:** In coastal areas, the breeze that moves from sea surface to the land is called sea breeze. This happens because, during daytime, land gets heated more quickly than water. As a result, warm air from land rises up; leaving a gap. To fill that gap, colder air from the ocean surface rushes towards the land. This phenomenon continues and a continuous flow of cold air keeps coming towards the land. This gives rise to the phenomenon which is called the sea breeze. Because of this, people living in coastal areas prefer to live in a sea facing house.

**Land Breeze:** In coastal areas, the breeze which moves from land towards the sea is called land breeze. In the night, the land cools down more quickly than the ocean surface. This makes the air over the water surface warmer than air over the land surface. Warmer air over the water surface rises in the air and air from the land rushes towards the water surface to fill the gap. This phenomenon continues which creates a flow of air from land to the sea. This phenomenon is called land breeze.

### Application Of Convection

- The air which we breathe out is warmer and lighter. It moves up in the room to go out of the ventilators, made near the ceiling. Fresh air comes through the windows and doors. It is cool and takes the place of the exhale air.

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- In winter, hotels and other building are centrally heated on the principle of convection.

- Land and sea breezes arise due to convection.

**3. Radiation** - All hot bodies emit heat by the process of radiation. Radiation of heat does not require a medium. Sunlight comes to the earth because of radiation as there is no medium present between the atmosphere of the earth and the sun.

One can feel the heat of bonfire by standing around it. We get warmth from the room heater because of radiation.

### **Application Of Radiation.**

- Electric room heater works on the principle of radiation.

- Solar cooker cooks food as the result of reflection of heat radiation coming from the sun with the help of a mirror. At times, it is painted black so that most of the radiation can be absorbed leading to the overall increase in the temperature which leads to the rapid cooking of food

- Solar water heater heats water by absorbing heat radiation from the sn.

- The principle of heat radiation emitted by living organism can be used in infrared photography.

**Reflection And Absorption Of Heat:** When heat falls over an object some of the heat is absorbed by the body and some of the heat is reflected. The temperature of an object increases because of absorption of heat.

In conventional room heater you can see the reflector attached with it. The reflector of the room heater reflects the heat towards the person sitting or standing near the room heater.

Reflection is the cause that umbrella is used to protect from heat of the sun in summer. Dark colour absorbs more heat while light colour reflects most of the heat. That's why wearing light coloured clothes is preferred in summer, dark coloured clothes are preferred in winter.

Dark clothes absorb more heat and keep one comfortable in winter. On the other hand, light clothes reflect most of the heat and keep one comfortable in summer.

Now-a-days many kitchen utensils come in black colour, since utensils of black colour absorb more heat and thus cooking becomes faster.

**Woolen Cloth:** Woolen clothes are used in winter season. Wool is a poor conductor of heat. In addition to it; air gets trapped in woolen fibre to further increase the poor conductivity of wool. This prevents the radiation of heat of our body to the surrounding and prevents the cold from surrounding to affect our body. Thus, wearing woolen cloth makes one comfortable in winter season.

