CHAPTER–No-9 TRANSFER OF HEAT

Transfer of Heat: -

Heat is a form of energy and it transfer from a hot body to cold body. This is called transfer of heat. There are three ways by which transfer of heat take place.

a) Conduction b) Convection c) Radiation

Conduction: -

The mode of transfer of heat by vibrating atoms and free electrons in solids from hot to cold parts of a body is called conduction of heat.

Convection: -

Transfer of heat by actual movement of molecules from hot place to a cold place is known as convection.

Radiation: -

Radiation is the mode of transfer of heat from one place to another in the form of waves called electromagnetic waves.

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Thermal Conductivity: -

The rate of flow of heat across the opposite faces of one meter cube of a substance maintained at a temperature difference of one Kelvin is called the thermal conductivity of that substance.

Explanation: -

Consider a solid block of cross – sectional area ‘A’. The solid block is heated at temperature ‘T_1’, after some time ‘t’ the heat (‘Q’) flows along its length to the opposite face at temperature ‘T_2’.

Rate of flow of heat: -

The amount of heat that flows in unit time is called the rate of flow of heat.

$$\text{Rate of flow of heat} = \frac{Q}{t}$$

Rate of flow of heat depends upon three factors.

a) Cross – sectional area of the solid b) Length of the solid c) Temperature difference between ends

From different experiment to has been found that the rate of flow of heat is directly proportional to

cross – sectional area of the solid .

$$\frac{Q}{t} \propto A \longrightarrow (1)$$

Rate of flow of heat is inversely proportional to length of the solid.

$$\frac{Q}{t} \propto \frac{1}{L} \longrightarrow (2)$$

The rate of flow of heat is directly proportional to the temperature difference between ends of the solids.

$$\frac{Q}{t} \propto (T_1 - T_2) \longrightarrow (3)$$

From (1) (2) and (3)

$$\frac{Q}{t} \propto \frac{A(T_1-T_2)}{L}$$

$$\frac{Q}{t} = (\text{Constant}) \quad \frac{A(T_1-T_2)}{L}$$

Constant = K

So, $$\frac{Q}{t} = \frac{A(T_1-T_2)}{L}$$

Here ‘K’ is constant and it is known as thermal conductivity of the solid. Its value depends upon nature of the substance.

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<u>Uses of conductors and non conductor</u>: -

Following measures may be taken to safe energy.

i) Hot water tanks are insulated by plastic or foam lagging.

ii) Wall cavities are filled with plastic foam or wool.

iii) Ceiling of rooms is covered by insulating materials (false ceiling)

iv) Double glazed window panes are used. These window panes have air between glass sheets that provide good insulation.

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Q. Why Styrofoam boxes are used to keep food hot or ice cream for a long time?

Ans: - Styrofoam boxes are used to keep food hot and ice cream cold for a long time because Styrofoam is a bad conductor of heat. It does not allow heat to enter or leave the box easily. Therefore food remains hot or ice cream remains cold for a long time.

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Q. What causes a glider to remain in air?

Ans: - A glider looks like a small aeroplane without engine. Glider plots use upward movement of hot air currents due to convection of heat. These upward moving air currents are called thermals. Gliders ride over these thermals. The upward movement of air currents in thermals help a glider to stay in air for a long time.

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Q. How do thermals help birds to fly for hours without flapping their wings?

Ans: - The upward movement of hot air currents due to convection of heat are called thermals. The birds stretch out their wings and circle in these thermals. The upward movement of hot air currents help birds to climb up. Due to this upward movement of hot air currents birds are able to fly for hours without flapping their wings. Eagles, Hawks and vultures are experts thermals climbers.

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Q. How does the temperature in a green house can be maintained?

Ans: - The sunlight contains thermal radiations of long wave length (Infra red) as well as radiations of short wave lengths (ultra violet radiations). Glass and transparent polythene sheets allow radiations of short wave length to pass through easily but does not allow radiations of long wave lengths to pass through them. Therefore a green house becomes a heat trap. The radiations from the sun pass easily through glass or transparent polythene sheets and warms up the object in a green house. The object inside a green house gives out radiations of long waves length. Glass and transparent polythene sheets do not allow the radiation of long waves length to pass through them. As a result the temperature in a green house is maintained.

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Q. Why metals are good conductor of heat?

Ans: - Metals have free electrons. These free electrons move with every high velocity within the metal object. Due to their high velocity metals carry energy at very fast rate from hot to cold parts of the body. Hence we can say that metals are good conductor of heat.

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Q. Explain why a metal feels colder to touch than wood kept kept in a cold place?

Ans: - We know that metals are good conductors of heat. Therefore when a metal is placed on a cold place then coldness flows through the metal body due to its free electrons. As a metal feels colder to touch. Whereas wood is a bad conductor of heat therefore it does not allow the coldness to pass through it.

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Q. Explain why double walled glass vessel is used in thermos flask?

Ans: - In thermos flask double walled glass vessel is used to prevent the conduction of heat. In these thermos flask air is present between glass vessel. We know that air is a very bad conductor. Therefore this air present in double walled glass vessel helps to maintain the temperature inside the flask.

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Q. Explain why deserts soon get hot during the day and soon get cold after sunset?

Ans: - Deserts have sand and we know that sand has very small specific heat. Therefore it soon get hot and soon get cold. Therefore during the day when sunshine's then due to small specific heat of sand deserts soon get hot. But when sunsets then the sand of the desert soon get cold. Hence deserts soon get hot during the day and soon get cold after sunset

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