

# RADIATION



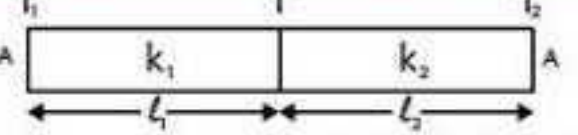
# CONDUCTION

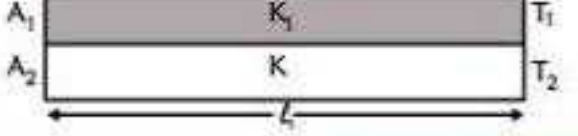
## Law of Heat Transfer

The rate at which heat is transferred or conducted through a substance is directly proportional to the

- Area of the surface (A) perpendicular to the flow of heat.
- Temperature gradient  $\frac{\Delta T}{x}$  along the path of heat transfer.

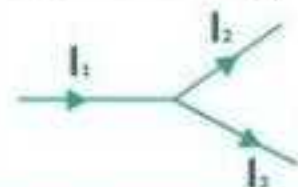
## Slabs in Parallel and Series

$T_1$   $T$   $T_2$   
  
 $\frac{dQ}{dt} = \text{constant}$   $k_m = \frac{l_1 + l_2}{\frac{l_1}{K_1} + \frac{l_2}{K_2}}$   
 $T = \text{varies}$

$A_1$   $K_1$   $T_1$   
 $A_2$   $K$   $T_2$   
  
 $\frac{dQ}{dt} = \text{different}$   $K_m = \frac{K_1 A_1 + K_2 A_2}{A_1 + A_2}$   
 $T = \text{same}$

## Junction Law

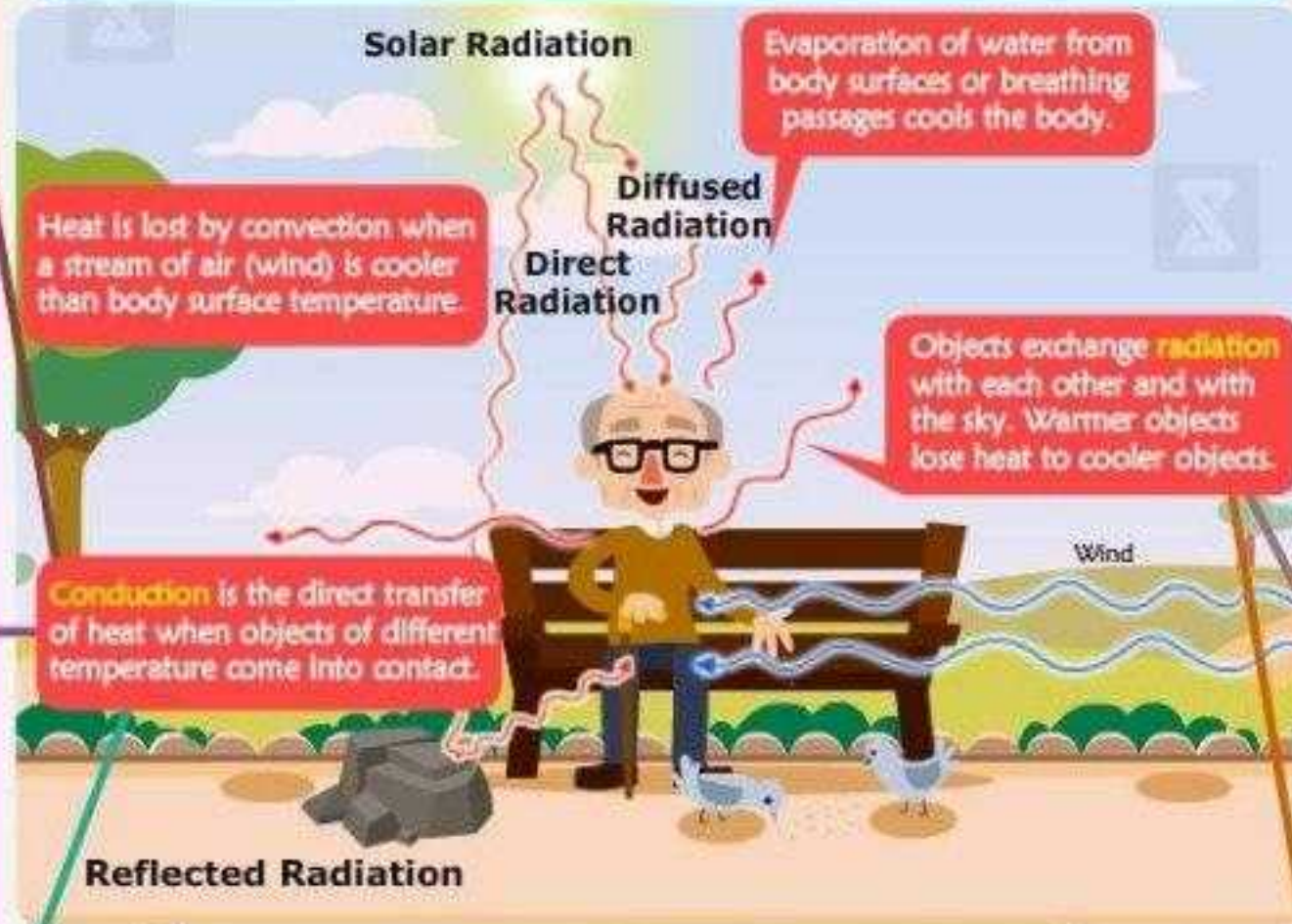
Rate of heat flow entering = Rate of heat flow exiting



$$I_1 = I_2 + I_3$$

## Kirchoff's Law

$$\text{Emissive power of black body} = \frac{\text{Emissive power of body}}{\text{Absorptive power of body}} = \text{Constant}$$



Solar Radiation

Evaporation of water from body surfaces or breathing passages cools the body.

Diffused Radiation

Direct Radiation

Heat is lost by convection when a stream of air (wind) is cooler than body surface temperature.

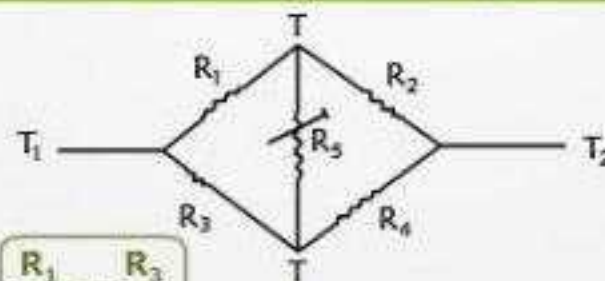
Objects exchange radiation with each other and with the sky. Warmer objects lose heat to cooler objects.

Conduction is the direct transfer of heat when objects of different temperature come into contact.

Wind

Reflected Radiation

## Wheatstone Ridge



$$\text{if } \frac{R_1}{R_2} = \frac{R_3}{R_4}$$

$\Rightarrow$  No heat flow through thermal resistance ( $R_5$ )

## Stefan's Law

- Emissive power of a black body is proportional to fourth power of Absolute temperature.

$$E = \sigma T^4$$

$\sigma$  = Stefan- Boltzmann Constant

- Emissive power of body due to heat transfer from body to surrounding.

$$E = e \sigma (T^4 - T_s^4)$$

$e$  = Emissivity

## Newton's Law of Cooling

For small temperature difference, rate of cooling due to radiation is proportional to temperature difference.

$$-\frac{dT}{dt} \propto \Delta T$$

## Wein's Displacement Law

Wavelength corresponding to maximum intensity of emission decreases with increase in temperature of black body.

$$\lambda_m \propto \frac{1}{T} \text{ or } \lambda_m T = \text{Constant}$$