Mode of heat transfer
(i)Conduction : heat transfer through molecular collisions without any actual motion of matter.
(ii)Convection : heat transfer by actual motion of matter within the medium. Land breeze, sea breeze, trade winds based on natural convection are some examples.
(iii)Radiation : method of heat transfer requiring no material medium.

Wien displacement

$\lambda_m \propto \frac{1}{T}$ or $\lambda_m = \frac{b}{T}$

b(wine's constant) = 2.9×10^{-3} mK

Newton's law of cooling

For small temperature difference between a body and its surroundings, the loss of heat is given by $-\frac{dQ}{dt} = k\,(T_2 - T_1)$

Thermal Laws

Stefan's Boltzmann law

$E \propto T^4$; $E = \sigma T^4$

$\sigma = 5.672$ Js^{-1}m^{-2}K^4

For a perfectly black body

$E = \sigma\left(T^4 - T_0^4\right)$

Kirchhoff's Law

At any given temperature $\frac{e_\lambda}{a_\lambda} = E_\lambda = \text{constant}$

Relation among different temperature scales

$\frac{T_C - 0}{100 - 0} = \frac{T_F - 32}{212 - 32} = \frac{T_K - 273.15}{373.15 - 273.15} = \frac{R - 0}{80 - 0}$

A form of energy, transferred between two systems by virtue of temperature difference.

Heat

Thermal Properties of Matter

Temperature
Degree of hotness or coldness of a body measuring device = Thermometer

Specific Heat

Specific heat capacity $C = \frac{s}{m} = \frac{Q}{m\Delta T}$

Heat capacity $s = \frac{\Delta Q}{\Delta T}$

Molar specific heat capacity, $c = \frac{s}{n} = \frac{\Delta Q}{n\Delta T}$

Thermal Expansion
Increase in dimensions due to increase in temperature

Thermal Conductivity

$(K) = \frac{Q\,x}{A(T_2 - T_1)\,t}$

Latent Heat

Heat required to change the state of unit mass substance without changing its temperature , $L = \frac{Q}{m}$

For water, latent heat of fusion, $L_f = 3.33\times10^5$ J/ kg

Latent heat of vapourisation, $L_v = 22.6\times10^5$ J/ kg

Thermal Stress

$\frac{\Delta F}{A} = Y\left(\frac{\Delta l}{l}\right)$, Y = Young's modulus

Principle of calorimetry
Heat lost = Heat Gain

Types (In solids)

Linear expansion
Increase of length of a solid on heating. Coefficient of linear expansion

$\alpha = \frac{\Delta l}{l_0 \Delta T} = \frac{L - l_0}{l_0(T - T_0)}$

Superficial or area Expansion
Increase in area of a solid on heating. Coefficient of superficial expansion

$\beta = \frac{\Delta A}{A\Delta T} = \frac{dA}{A\,dT} = \frac{A - A_0}{A_0(T - T_0)}$

Relation

$\gamma = 2\beta = 3a$

or

a:b:γ=1:2:3

Cubical or volume expansion
Increase in volume of a solid on heating. Coefficient of cubical expansion.

$\gamma = \frac{\Delta V}{V_0 \Delta T} = \frac{dV}{V_0 dT} = \frac{V - V_0}{V_0(T - T_0)}$