Thermal PROPERTIES

1.) $L = L_0(1 + \alpha \Delta T)$ → Linear

2.) $A = A_0(1 + \beta \Delta T)$ → areal

3.) $V = V_0(1 + \gamma \Delta T)$ → volume

4.) Also, $\boxed{\rho = \dfrac{\rho_0}{1 + \gamma \Delta T}}$

$$\boxed{\beta = 2\alpha \quad \gamma = 3\alpha}$$

$$\boxed{6\alpha = 3\beta = 2\gamma}$$

$$\boxed{\alpha : \beta : \gamma = 1 : 2 : 3}$$

$$\boxed{\alpha = \frac{dL}{L\,dT}}$$

Simple Pendulum

[On incre temp clock will lose time]

$$\boxed{\text{Time loss in 1 day} = \frac{\alpha}{2} \Delta T \times 86400 \text{ sec}}$$

Apparant γ

Time gain = Temp. dec.
Time loss = Temp. inc.

$$\boxed{\gamma_{app} = \gamma_l - \gamma_c}$$

CALORIMETRY

ESTIMATE

- Molar Heat Capacity

$$\boxed{C = \frac{\Delta Q}{n \Delta T}}$$ Unit :- J/mol-K

- Specific Heat Capacity (S)

$$\boxed{S = \frac{\Delta Q}{m \Delta T}}$$ Unit : J/Kg-K or J/Kg°C

- Heat Capacity (H)

$$\boxed{H = \frac{\Delta Q}{\Delta t}}$$ Unit :- J/K

$$\boxed{H = mS = nC}$$

$\boxed{1 \text{ calorie} = 4.18 \text{ J}}$

- S_{water} = 4200 J/Kg°C or 1 cal/g°C
- S_{ice} = 2100 J/Kg°C or 0.5 cal/g°C

Latent Heat of Fusion

$$\boxed{L_f = \frac{\Delta Q}{m}}$$

Latent Heat of Vaporisation

$$\boxed{L_V = \frac{\Delta Q}{m}}$$

$$L_{ice} = 80 \text{ cal/g}$$

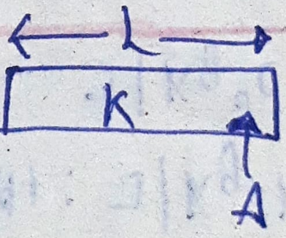
$$L_{steam} = 540 \text{ cal/g}$$

PRINCIPLE OF CALORIMETRY

$\boxed{\text{Heat Loss} = \text{Heat Gain}}$

Heat TRANSFER

$$\boxed{H = \frac{KAdT}{L}}$$



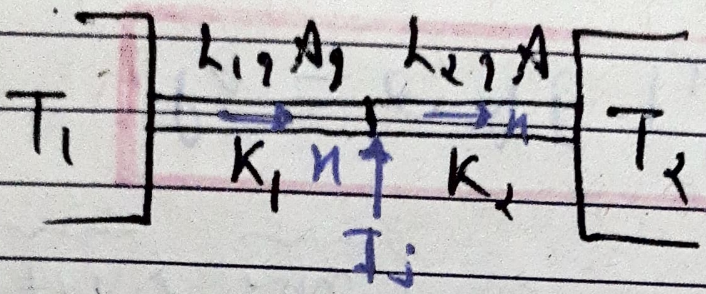
$$\Delta T = H \times \left(\frac{L}{KA}\right)$$

(Thermal Resistance)

A rod can be treated as a resistance of L/KA

Combination :-

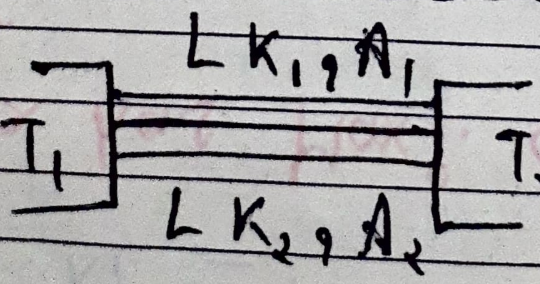
1) Series Combination -



$$\boxed{T_j = \frac{K_1 T_1 L_2 + K_2 T_2 L_1}{K_1 L_2 + K_2 L_1}}$$

$$\boxed{K_{eff.} = \frac{K_1 K_2 (L_1 + L_2)}{K_2 L_1 + K_1 L_2}}$$

2) Parallel Combination -



$$\boxed{K_{eff} = \frac{K_1 A_1 + K_2 A_2}{A_1 + A_2}}$$

By principle of Calorimetry,

$$\boxed{(m \times L) + (m \times s \times \Delta\theta_1) = m \times s \times \Delta\theta_2}$$

Growth of Ice on Surface of Lake :-

Water has Maxi. density at 4° C

Distance of water becoming freezes is,

$$\boxed{y = \sqrt{\frac{2KTt}{\rho L_f}}}$$

Radiation :-

- Stefen's Law –

$$\boxed{P_e = \sigma A E T_b^4}$$

σ (Stefan constant) $= 5.6 \times 10^{-8}\ W/m^2K^4$

ESTIMATE

for black body, $\boxed{\epsilon = 1}$

$$\boxed{\frac{dQ}{dt} = P_{net} = \sigma A \epsilon (T_b^4 - T_s^4)}$$

Temp. surrounding

$\boxed{\text{Rate of cooling} \propto \Delta T}$

Newton's Law of Cooling

$$\boxed{\frac{T_{bi} - T_{bf}}{t} = k\left(\frac{T_{bf} + T_{bi}}{2} - T_s\right)}$$

$$\boxed{T_b = T_s + (T_{bi} - T_s)e^{-kt}}$$

Emissive Power :-

$E_p = \frac{P_e}{A}$

$$\boxed{E_p = \sigma \epsilon T_b^4}$$

Wein's Displacement Law [for black body radiation]

$$\boxed{\lambda_{max} \times T = \text{constant}}$$

$$\boxed{\lambda_1 T_1 = \lambda_2 T_2}$$

Ratio of Emissive Power to Absorptive Power is same for all bodies equal to emissive power of perfectly black body

$$\boxed{\left(\frac{e}{a}\right)_{body} = E_{black\ body} = (E_\lambda)_{black\ body}}$$

—x—x—x—x—