Thermal properties of matter

- Temperature of a body is a measure of its hotness or coldness.
- **Zeroth Law of thermodynamics –** If two bodies A and B are separately in thermal equilibrium with a third body C, then A and B are in thermal equilibrium with each other.
- Temperature of a body can be measured using a **thermometer**.
- If T_C is temperature on Celsius scale and T_F is temperature on Fahrenheit scale then relation between them is $T_F = 32^0 + \frac{9}{5}T_C$.
- If T_C is temperature on Celsius scale and T (K) is temperature on Kelvin's absolute scale then relation between them is $T = T_C + 273.15$.
- If R_0 & R_{100} are resistance of metallic wire at ice and steam point respectively then temp T can be defined corresponding to resistance R_T as follows

  $$T = \frac{(R_T - R_0) \times 100}{(R_{100} - R_0)}$$
- **Coefficient of linear expansion**

  $$\alpha = \frac{l_t - l_0}{l_0 t}$$

  Where α=coefficient of linear expansion, l_t= length at t^0C and l_0 is length at 0^0C.
- **Length at temperature t^0C** is given as $l_t = l_0(1+\alpha t)$
- **Coefficient of superficial expansion**

  $$\beta = \frac{A_t - A_0}{A_0 t}$$
- **Area at temperature t^0C** is given ad $A_t = A_0(1+\beta t)$
- **Coefficient of volume expansion**

  $$\gamma = \frac{V_t - V_0}{V_0 t}$$
- **Volume at temperature t^0C** is given by $V_t = V_0(1+\gamma t)$
- **Coefficient of apparent expansion of a liquid**

  $$\gamma_\alpha = \frac{V_a - V_0}{V_0 t}$$

  Where γ_a is the coefficient of apparent expansion, V_0=volume at 0^0C and V_α= apparent volume at t^0C

- **Density variation with temperature**

  $$d_t = \frac{d_0}{1+\gamma t}$$

  Where d_t=density at temperature t^0C , d_0= density at 0^0C.

- **Ideal Gas equation**
  PV=nRT where n is number of moles of gas and R is universal constant.
- When a material is cooled or heated and held so it cannot contract or expand, it is under a tensile stress F/A.
- **Specific Heat Capacity** is given as

  $$C = \frac{Q}{\Delta T}$$
- **Heat of Transformation**
  Q=Lm
  where L is the latent heat
  - Its unit is JKg-1.
  -Latent Heat for a solid liquid change is called Latent Heat of Fusion L_f
  -Latent Heat for a liquid gas change is called Latent Heat of Vaporization L_f