Law of Thermodynamics :-

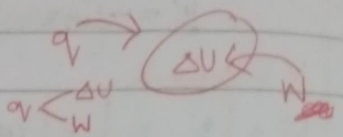
1) **Zeroth law :-** If two systems A and B are thermally equilibrium with system C, then A is thermally equilibrium with B

2) **First law :-** (Conservation of energy)

Energy can neither be created nor destroyed but can be converted from one form to another

In thermodynamics, heat (q) given to a system is partly converted into internal energy (ΔU) and work done on the environment (W)

$$\therefore q = W + \Delta U$$



2) **Second law :-**

Heat always flow from high to low temperature.

In thermodynamics, the change in entropy of an isolated system always increases

Entropy (S) $\rightarrow \frac{Q}{T}$

1) **When Heat is Added / Heat is Removed**

System absorbs heat ($Q > 0$), entropy of that system increases

If a hot object transfer heat to cold object, the entropy of hot object decreases and entropy of cold object increases

For hot object :- $S_h = -\frac{Q_h}{T_h}$

For cold object :- $S_c = \frac{Q_c}{T_h}$

Net change in entropy :-

$$\Delta S = -\frac{Q_h}{T_h} + \frac{Q_c}{T_c}$$

if $Q_h = Q_c$ & $T_h > T_c$

Overall change in entropy is always +ve

Relation bet^{n} Enthalpy & Internal energy

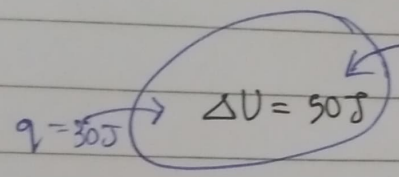
$$\Delta U = q + W$$

(q: heat, W: work done)

In Isobaric condition :- $\Delta U = q_p + W$ (constant pressure)

$$\Rightarrow \boxed{\Delta U = H + W}$$, where $H \rightarrow$ enthalpy

When heat is added to cold body :-



$\therefore H = 50 - 20$
$= 30\,J$

* Enthalpy → heat supplied to system at constant pressure

We know, $W = -P_{ext} \cdot \Delta V = -P\Delta V$

$\therefore \Delta U = H + (-P\Delta V)$ (for each ~~system~~ object)

$$\Rightarrow \boxed{H = \Delta U + P\Delta V}$$

∴ For system, ΔH (Change in enthalpy) :-

$$\boxed{\Delta H = \Delta U + P\Delta V}$$

↓ (or) $P\Delta V = \Delta nRT$

$$\boxed{\Delta H = \Delta U + \Delta nRT}$$

Here, $W = -P\Delta V$

$\Rightarrow W = -\Delta nRT$