Enthalpy →

$$w = -P(V_B - V_A).$$

$$\Delta U = q - P(V_B - V_A) \text{ or } U_B - U_A = q - P(V_B - V_A)$$

$$(U_B + PV_B) - (U_A + PV_A) = q.$$

$U + PV$ is known as enthalpy of the system & is denoted by H.

$$H = U + PV$$

$$H_B - H_A = \Delta H = q$$

$$(U_B - U_A) + P(V_B - V_A) = q.$$

$$\Delta H = (U_B - V_A) + P(V_B - V_A) \text{ or } \Delta H = \Delta U + P\Delta V$$

Heat Capacity →

Heat Capacity of a system b/w two temperatures is defined as the quantity of heat required to raise the temperature of the system from lower to the higher temperature divided by the temperature difference

$$C = q/(T_2 - T_1)$$

$$C = \frac{dq}{dT}.$$

At const. volume, $\Delta V = 0 \Rightarrow w = 0.$

$$q = \Delta U$$

$$C_{V(T_2, T_1)} = \left(q / T_2 - T_1\right)_V = \Delta U / (T_2 - T_1)_V$$

$$C_v = \left(\frac{\partial U}{\partial T}\right)_V$$

At Const. pressure, if volume increases by ΔV

$$q = \Delta U - w \quad \& \quad C_p = \left(\frac{q}{T_2 - T_1}\right)_P$$

$$q = \Delta U - (-P\Delta V) = \Delta U + P\Delta V$$

$$C_p = \left(\frac{\Delta U + P\Delta V}{T_2 - T_1}\right)_P = \left(\frac{\Delta H}{T_2 - T_1}\right)_P$$

$$C_p = \left(\frac{\partial H}{\partial T}\right)_P$$

Relation b/w C_p & C_v →

At Const. volume $w = 0$.

$C_p > C_v$.

$w = P\Delta V$

$PV = RT$.

When temp. is raised by $1°C$ from T to $T+1$ → $V + \Delta V$

$$P(V + \Delta V) = R(T+1)$$

$$P\Delta V = R.$$

$$C_p - C_v = R$$

$$\boxed{C_p > C_v}$$