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Relation b/w, Cp and Cv

Specific heat at constant volume

C_V → It is defined as the amount of heat required to raise the temp of one mole of gas through 1°C when volume kept const

$$C_V = \left(\frac{dQ}{dT}\right)_V$$

Specific heat at const Pressure

C_P → It is defined as the amount of heat required to raise the temp of 1 mole of gas through 1°C when the pressure is kept const.

$$C_P = \left(\frac{dQ}{dT}\right)_P$$

Derivation of Mayer's formula.

$$\boxed{C_P - C_V = R}$$

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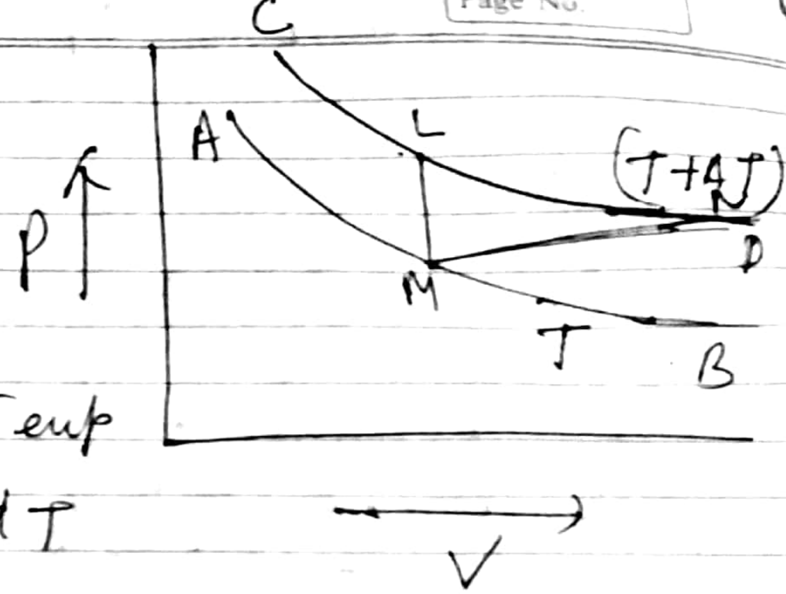
The two isothermal AB and CD lines have Temp T and T + dT



M → L const volume.

$$dQ = dU + dW$$

$$dQ = dU + dW$$

$$dW = PdV = 0$$

$$dQ = dU = U_L - U_M$$

$m = 1$ mole, $S = C_V$ "

$$dQ = 1 \times C_V \times dT$$

$$dQ = C_V dT$$

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Change in internal energy in process

$M \rightarrow N$

$$U_N - U_M = \Delta Q - \Delta W$$

$$\Delta W = P\Delta V$$

$$U_N - U_M = C_P \Delta T - P dV$$

Since gas is supposed to ideal gas so perfect gas equation follows.

$$PV = RT$$

initial point M, Pressure P ... up T and at point N ~~pressure~~

... e becomes $V + \Delta V$

Temp $T + \Delta T$

~~Heat Engine and~~

$$PV = RT \quad \text{--- (a)}$$

$$P(V+\Delta V) = R(T+\Delta T) \quad \text{--- (b)}$$

Subtracting (b) − (a)

$$P\Delta V = R\Delta T$$

Substituting $P\Delta V = R\Delta T$.

$$\underline{U_N - U_M} = C_P\Delta T - R\Delta T$$

So internal energy is only depend upon temp

$$U_N - U_M = U_N - U_M$$

$$C_V\Delta T = C_P\Delta T - R\Delta T$$

$$\boxed{C_P - C_V = R}$$