

Thermodynamic Formula Sheet

1.

$$\begin{aligned} \left(\frac{\partial U}{\partial V} \right)_T &= \left(\frac{\partial P}{\partial T} \right)_V \\ \left(\frac{\partial U}{\partial P} \right)_T &= \left(\frac{\partial V}{\partial T} \right)_P \end{aligned}$$

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2.

$$\begin{aligned} f(x_1, x_2, \dots, x_n; T) &= 0 \\ PV &= nRT \\ p + \frac{an^2}{V^2} (V - nb) &= nRT \\ M &= \frac{C}{T} H \end{aligned}$$

M, C

3.

$$\begin{aligned} C_V &= \lim_{T \rightarrow 0} \left(\frac{\partial U}{\partial T} \right)_V = \left(\frac{\partial U}{\partial T} \right)_V \\ C_P &= \lim_{T \rightarrow 0} \left(\frac{\partial U}{\partial T} \right)_P = \left(\frac{\partial U}{\partial T} \right)_P + p \left(\frac{\partial V}{\partial T} \right)_P \\ H &= U + pV \\ C_P &= \left(\frac{\partial H}{\partial T} \right)_P \end{aligned}$$

4.

$$\begin{aligned} C_V &= \frac{dU}{dT} \quad C_P = \frac{dH}{dT} \\ H &= U + PV = U + nRT \\ C_P &= C_V + nR \\ C_P &= C_V / C_V \end{aligned}$$

$C_V \quad C_P$

$$\begin{aligned} C_V &= \frac{nR}{1} \quad C_P = \frac{nR}{1} \\ pV &= \text{Const} \\ &= 1 \quad \frac{T_1}{T_2} \\ &= \frac{Q_2}{Q_1} \quad \frac{Q_2}{Q_1} \end{aligned}$$

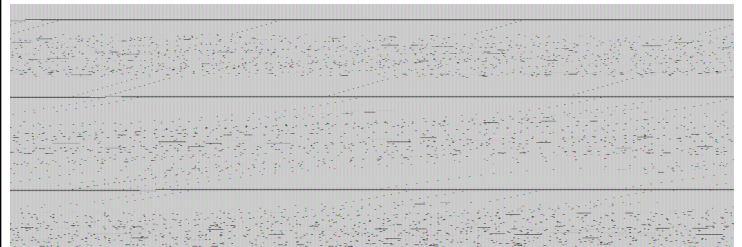
5.

$$\begin{aligned} S &= \frac{dQ}{T} \\ S &= C_V \ln \frac{T_2}{T_1} + nR \ln \frac{V_2}{V_1} \\ S &= C_P \ln \frac{T_2}{T_1} - nR \ln \frac{p_2}{p_1} \end{aligned}$$

6. p - V - T



External : U Have a Good Friend
Internal : S - Port T - V !



p S
p, S