Maxwell Relations

- useful partial derivatives of p, V, T, S.
- obtain from potentials

eg. $\frac{\partial H}{\partial S}\Big|_p = T$. $\frac{\partial H}{\partial p}\Big|_S = V$. $(dH = TdS + Vdp)$

$$\frac{\partial^2 H}{\partial p \partial S} = \frac{\partial^2 H}{\partial S \partial p} \Rightarrow \frac{\partial T}{\partial p}\Big|_S = \frac{\partial V}{\partial S}\Big|_p$$

if given a partial derivative: $\frac{\partial T}{\partial p}\Big|_S$

- p and S are variables
- $H(p, S)$.

Maxwell - Like Relation

$$dU = T\,dS + f\,dL.$$

- Given $\frac{\partial S}{\partial L}\Big|_T$.
- $F = U - TS$

  $dF = f\,dL - S\,dT$

- $\frac{\partial F}{\partial T}\Big|_L = -S$. $\frac{\partial S}{\partial L}\Big|_T = -\frac{\partial^2 F}{\partial L \partial T}$

  $-\frac{\partial^2 F}{\partial T \partial L} = -\frac{\partial f}{\partial T}\Big|_L$.

- $-\left(\frac{\partial S}{\partial L}\right)_T = \frac{\partial f}{\partial T}\Big|_L$