Phy 410
Quiz #7, March 20, 2009

Starting from the thermodynamic identity

$$\tau\, d\sigma = dU + p\, dV - \mu\, dN$$

Calculate the chemical potential μ **at constant entropy and constant** <u>volume</u>**.**

For constant entropy and constant volume the above thermodynamic relation is correct because entropy σ **and volume V are natural variables along with N. So**

$$0 = dU + 0 - \mu\, dN$$

$$\mu = \left(\frac{\partial U}{\partial N}\right)_{\sigma, V}$$

Now for constant entropy and constant <u>pressure</u> **show that the chemical potential** μ **is given by an appropriate derivative of the enthalpy**

$$H = U + pV$$

For constant pressure we have change the free energy such that pressure instead of volume is the natural variable.

$$dH = dU + p\, dV + V dp = \tau d\sigma + \mu dN + V dp$$

For constant σ **and constant p**

$$dH = \mu\, dN$$

$$\mu = \left(\frac{\partial H}{\partial N}\right)_{\sigma, p}$$