6-45)

(a) $S \equiv -\left(\frac{\partial F}{\partial T}\right)_{N,V} = -\partial_T \left\{ -NkT\left[\ln\left(\frac{V}{NV_Q}\right) + 1\right] + F_{int} \right\}$

$= Nk\left[\ln\left(\frac{V}{NV_Q}\right)+1\right] + NkT\,\partial_T \ln\left(\frac{2\pi mkT}{h}\right)^{3/2} - \partial_T F_{int}$

$= Nk\left[\ln\left(\frac{V}{NV_Q}\right) + \frac{5}{2}\right] - \partial_T F_{int}$.

(b) $\mu \equiv \left(\frac{\partial F}{\partial N}\right)_{T,V} = \partial_N \left\{ -NkT\left(\ln\left(\frac{V}{NV_Q}\right) + 1\right) + F_{int.} \right\}$

$= -kT\left(\ln\left(\frac{V}{NV_Q}\right)+1\right) + kT + \partial_N F_{int}$

But $F_{int} = -NkT \ln Z_{int}$.

Thus, $\mu = -kT \ln\left(\frac{V}{NV_Q}\right) - kT \ln Z_{int}$

$= -kT \ln\left(\frac{V Z_{int.}}{NV_Q}\right)$.