Theo 5 Blatt 3 Julian Bergauer

Aufg 8

$$\mu = -T\frac{\partial S}{\partial N}, \qquad S = kN\left(\ln\left(\frac{V}{N}\left(\frac{4\pi mE}{3k^2N}\right)^{3/2}\right)+\frac{5}{2}\right)$$

$$\frac{\partial S}{\partial N} = k\left(\ln\left(\frac{V}{N}\left(\frac{4\pi mE}{3k^2N}\right)^{3/2}\right)+\frac{3}{2}\right) + kN\left(\frac{1}{\frac{V}{N}\left(\frac{4\pi mE}{3k^2N}\right)^{3/2}}\right)$$

$$\cdot\left(-\frac{V}{N^2}\left(\frac{4\pi mE}{3k^2N}\right)^{3/2} + \frac{V}{N}\cdot\frac{3}{2}\left(\frac{4\pi mE}{3k^2N}\right)^{3/2}\cdot\left(-\frac{4\pi mE}{3k^2N^2}\right)\right)$$

$$= k\left(\ln\left(\quad\right)+\frac{3}{2}\right) + k\frac{N^2}{V}\left(\frac{4\pi m}{3k^2}\frac{3}{2}kT\right)^{-3/2}$$

$$\frac{V}{N}\left(\frac{4\pi m}{3k^2}\frac{3}{2}kT\right)^{3/2}$$

$$\cdot\left(-\frac{V}{N^2}\left(\frac{4\pi m}{3k^2}\frac{3}{2}kT\right)^{3/2} - \frac{V}{N^2}\cdot\frac{3}{2}\cdot\left(\frac{4\pi m}{3k^2}\frac{3}{2}kT\right)^{3/2}\right)$$

$$= k\ln\left(\frac{V}{N}\left(\frac{4\pi m}{3k^2}\frac{3}{2}kT\right)^{3/2}\right) + \frac{3}{2}k - k\cdot\frac{N^2}{V}\cdot\frac{V}{N^2}\cdot\frac{(\cdots)^{3/2}}{(\cdots)^{3/2}}\cdot\left(1+\frac{3}{2}\right)$$

$$= k\ln\left(n\left(\frac{4\pi m}{3k^2}\frac{3}{2}kT\right)^{3/2}\right) - k$$

Oder: $S = Nk\ln\left(\frac{V}{N}u^{3/2}\right) + NkS_0$

$$\Rightarrow \frac{\partial S}{\partial N} = k\ln\left(\frac{V}{N}u^{3/2}\right) + Nk\,\frac{1}{\frac{V}{N}u^{3/2}}\left(-\frac{V}{N^2}u^{3/2}\right) + kS_0$$

$$= k\ln\left(n\left(\frac{3}{2}kT\right)^{3/2}\right) - k + k\left(\frac{5}{2}+\frac{3}{2}\ln\left(\frac{4\pi m}{3k^2}\right)\right)$$

$$= k\ln\left(n\left(\frac{4\pi m}{3k^2}\frac{3}{2}kT\right)^{3/2}\right) + \frac{3}{2}k$$

unterschiedlich $\Rightarrow$ Faktor $N!$