

Τύποι για τέλειο ημι-κλασικό αέριο

$$S = k_B N \ln \left[\frac{V}{Na^3} \left(\frac{U}{N\varepsilon} \right)^{3/2} c_1 \right], \quad \varepsilon a^2 = \hbar^2 / m, \quad c_1 = \frac{e^{5/2}}{(3\pi)^{3/2}} = 0,42,$$

$$\left. \frac{\partial S}{\partial U} \right)_{V,N} = \frac{1}{T} \rightarrow U = \frac{3}{2} N k_B T$$

$$dU = TdS - PdV + \mu dN \rightarrow \left. \frac{\partial S}{\partial V} \right)_{U,N} = \frac{P}{T} \rightarrow PV = N k_B T$$

$$H \equiv U + PV = \frac{5}{2} N k_B T$$

$$F \equiv U - TS = \frac{3}{2} N k_B T - TS = N k_B T \left\{ \frac{3}{2} - \ln \left[\frac{V}{N} (k_B T)^{3/2} \left(\frac{3}{2\varepsilon a^2} \right)^{3/2} c_1 \right] \right\}, \quad \varepsilon a^2 = \hbar^2 / m, \quad c_1 = \frac{e^{5/2}}{(3\pi)^{3/2}} = 0,42$$

$$G \equiv H - TS = \frac{5}{2} N k_B T - TS = N k_B T \left\{ \frac{5}{2} - \ln \left[\frac{(k_B T)^{5/2}}{P} \left(\frac{3}{2\varepsilon a^2} \right)^{3/2} c_1 \right] \right\}, \quad \varepsilon a^2 = \hbar^2 / m, \quad c_1 = \frac{e^{5/2}}{(3\pi)^{3/2}} = 0,42$$

$$\mu = \frac{G}{N} \quad \text{επειδή} \quad G = N k_B T \varphi(P, T), \quad dG = -SdT + VdP + \mu dN \rightarrow \left. \frac{\partial G}{\partial N} \right)_{T,P} = \mu = \frac{G}{N}$$

Ισχύουν οι παραπάνω τύποι τελείων αερίων για T κοντά στο απόλυτο μηδέν ;