$$q = \frac{S}{k} - \alpha\overline{N} - \beta\overline{E} = \frac{TS + \mu\overline{N} - \overline{E}}{k_{\mathrm{B}}T}$$

$$q \equiv \ln\left\{\exp\left(-\alpha N_r - \beta E_s\right)\right\} = \frac{PV}{k_{\mathrm{B}}T}$$

$$z \equiv e^{-\alpha} = e^{\frac{\mu}{k_{\mathrm{B}}T}}$$

$$\begin{aligned} q &\equiv \ln\left\{\sum_{r,s} z^{N_r} e^{-\beta E_s}\right\} \\ &= \ln\left\{\sum_{N_r=0}^{\infty} z^{N_r} Q_{N_r}(V,T)\right\} \qquad (Q_0 \equiv 1) \end{aligned}$$

$$q(z,V,T) \equiv \ln \mathcal{Q}(z,V,T)$$

$$\mathcal{Q}(z,V,T) \equiv \sum_{N_r=0}^{\infty} z^{N_r} Q_{N_r}(V,T) \qquad (Q_0 \equiv 1)$$