MK

$$\mathscr{Q}(z,V,T) = \sum_{N=0}^{\infty} z^N Q_N(V,T) = \left[\exp\left(\frac{zV}{\lambda^3}\right)\right]$$

$$Q_N(V,T) = {\sum_{\{n_\epsilon\}}}' \left(e^{-\beta \sum\limits_{\epsilon} n_\epsilon \epsilon}\right)$$

$$\boxed{\begin{aligned} \mathscr{Q}(z,V,T) &= \sum_{N=0}^{\infty}\left[z^N {\sum_{\{n_\epsilon\}}}' e^{-\beta \sum\limits_{\epsilon} n_\epsilon \epsilon}\right], \\ &= \sum_{N=0}^{\infty}\left[{\sum_{\{n_\epsilon\}}}' \left(z e^{-\beta\epsilon}\right)^{n_\epsilon}\right] \end{aligned}}$$

$$\begin{aligned} \mathscr{Q}(z,V,T) &= \sum_{n_0,n_1,\cdots}\left[\left(z e^{-\beta\epsilon_0}\right)^{n_0}\left(z e^{-\beta\epsilon_0}\right)^{n_0}\cdots\right] \\ &= \left[\sum_{n_0}\left(z e^{-\beta\epsilon_0}\right)^{n_0}\right]\left[\sum_{n_0}\left(z e^{-\beta\epsilon_0}\right)^{n_0}\right]\cdots \end{aligned}$$

$n_\epsilon \begin{cases} \text{B.E.} & 0,1,2,\dots \\ \text{F.D.} & 0,1 \end{cases}$

$$\mathscr{Q}(z,V,T) = \prod_{\epsilon} \frac{1}{1 \mp z e^{-\beta\epsilon}}$$

$\begin{cases} - & \text{B.E.} \quad z e^{-\beta\epsilon} < 1 \\ + & \text{F.D.} \end{cases}$

$$\begin{aligned} q(z,V,T) &\equiv \equiv \ln \mathscr{Q}(z,V,T) \\ &= \mp \sum_{\epsilon} \ln\left(1 \mp z e^{-\beta\epsilon}\right) \end{aligned}$$

B.E. $-$
F.E $+$