统计力学第八次作业

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9.18

$$
\begin{aligned}
P_n =& \sum \rho_{n,s} \\
=& \frac{1}{\Xi} e^{-\alpha n} \sum e^{-\beta E_s} \\
=& \frac{1}{\Xi} e^{-\alpha n} Z_n(T,v)
\end{aligned}
$$

又

$$
Z_n(T,v) = \frac{1}{n!}[Z_1(T,v)]^n
$$

$$
\ln \Xi = e^{-\alpha} Z_1(T,v)
$$

$$
\overline{n} = \ln \Xi
$$

可得

$$
P_n = \frac{1}{Xi}\frac{1}{n!} e^{-\alpha n}[Z_1(T,v)]^n = \frac{1}{n!} e^{-\overline{n}} (\overline{n})^n
$$

2

$$
\Xi = \sum e^{-\alpha N} Z_N(T,A) = \sum e^{-\alpha N} \frac{1}{N!} Z_1^N
$$

$$
Z_1 = A\left(\frac{2\pi m}{\beta h^2} e^{\beta \varepsilon_0}\right)
$$

$$
\implies \Xi = e^{e^{-\alpha} A\left(\frac{2\pi m}{\beta h^2} e^{\beta \varepsilon_0}\right)}
$$

$$\overline{N} = -\frac{\partial}{\partial \alpha} \ln \Xi = A \left(\frac{2\pi mkT}{h^2} \right) e^{\frac{\varepsilon_0 + \mu}{kT}}$$

$$\frac{\overline{N}}{A} = \frac{p}{kT} \left(\frac{h^2}{2\pi mkT} \right)^{1/2} e^{\frac{\varepsilon_0}{kT}}$$