Statistical Physics

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13-4 Show that for a system of N particles obeying Maxwell-Boltzmann statistics, the occupation number for the j-th energy level is given by

$$N_j = -Nk_BT\left(\frac{\partial \ln Z}{\partial \varepsilon_j}\right)_T.$$

13-5 Show that it is possible to write thermodynamic probability in the general form

$$\omega = \prod_{j=1}^{n} \frac{g_j(g_j - a)(g_j - 2a)\cdots[g_j - (N_j - 1)a]}{N_j!},$$

where

$$a = \begin{cases} 1 & \text{for FD statistics} \\ -1 & \text{for BE statistics} \\ 0 & \text{for MB statistics} \end{cases}.$$

13-7 For the Fermi-Dirac distribution, sketch N_j/g_j versus ε_j for $T = 0$ and for T slightly greater than zero.