

Ex 4211

$$(1) \quad Z^{AB} = \left(\frac{L}{\lambda_M}\right)^3 e^{\beta \epsilon_0} \frac{1}{2 \sinh(\frac{1}{2} \beta \omega_0)} \cdot 2 m a^2 T$$

where $M = 2m_0$, $m = m_0/2$

and $\omega_0 = \sqrt{\alpha/m}$

$$(2) \quad \frac{n_{AB}}{n_A n_B} = K(T) = \frac{Z^{AB}}{Z^A Z^B} = \left(\sqrt{2} \frac{\lambda_T}{L}\right)^3 e^{\epsilon_0/T} \frac{T}{\omega_0} m_0 a^2 T$$

where $\lambda_T \equiv \left(\frac{m_0 T}{2\pi}\right)^{-1/2}$

$$(3) \quad \frac{n_{HD}^2}{n_H n_D} = K(T) = \frac{(Z^{HD})^2}{(Z^{HH})(Z^{DD})}$$

(4) For high T $Z^{AB} \propto (M \cdot m)^{3/2} = (m_A m_B)^{3/2}$

$$\frac{Z^{HH}}{Z_{AB}^{HH}} = (2 \cdot 2)_{\text{spin}} \cdot \left(\frac{1}{2}\right)_{\text{parity}} \cdot \frac{\cancel{(1 \cdot 1)^{3/2}}}{\text{masses}}$$

$$\frac{Z^{DD}}{Z_{AB}^{DD}} = (3 \cdot 3)_{\text{spin}} \cdot \left(\frac{1}{2}\right)_{\text{parity}} \cdot \frac{\cancel{(2 \cdot 2)^{3/2}}}{\text{masses}}$$

$$\frac{Z^{HD}}{Z_{AB}^{HD}} = (2 \cdot 3)_{\text{spin}} \cdot (1) \cdot \frac{\cancel{(1 \cdot 2)^{3/2}}}{\text{masses}}$$

(5) $K(T) \approx 4$ for high T

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