

Examen Stat mech

January 18, 2018

1 Oral part

1.1 Classical part

The equipartition theorem states that

$$\left\langle x_r \frac{\partial H}{\partial x_s} \right\rangle = k_B T \delta_{rs} \quad (1)$$

Explain the meaning of this formula. Show the meaning of "Every quadratic degree of freedom contributes $\frac{k_B T}{2}$ to the system". Show some applications to a few examples.

1.2 Quantum part

For bosons and fermions

$$\log(\Xi) = \mp \sum_{\gamma} \log(1 \mp e^{\beta(\mu - \epsilon_{\gamma})}) \quad (2)$$

Derive this equation and explain the plus and minus sign. Why would you want to use the grand canonical ensemble? Then derive from the result the average occupation number $\langle n_{\gamma} \rangle$. Why is the quantum mechanics important in your derivation and in your end result?