

In the name of God

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ADVANCED STATISTICAL MECHANICS I

Exercise Set 6

(Due Date: 1402/09/19)

1. *The mean number density absorbed on the surface:* Suppose that the ideal gas absorbed on a surface of container and that part in the volume of container are in equilibrium. Using following condition, compute the number density of particles absorbed on the surface denoted by $n \equiv N/A$ (where A is the total surface of container).
- 1) Both part in the volume (gas state) and part absorbed on the surface are considered as ideal Gas.
 - 2) The pressure of gas in container is supposed to be P and the temperature is T .
 - 3) The total number of particles absorbed on the surface and in surrounding inside the container is N_0 .
 - 4) The Hamiltonian of particle in gas phase is $\mathcal{H}_g = (p_x^2 + p_y^2 + p_z^2)/(2m)$, while the Hamiltonian of that particle absorbed on the surface is $\mathcal{H}_s = (p_x^2 + p_y^2)/(2m) - \epsilon_0$, where ϵ_0 is the surface binding energy.
- Hint: the chemical potential should be equal for gas state and that part absorbed on the surface.

Answer:

$$n_s \equiv \frac{N_s}{A} = \frac{P}{k_B T} \left(\frac{h^2}{2\pi m k_B T} \right)^{1/2} e^{\epsilon_0/k_B T}$$

2. Solve exercises of chapter 4 (R. K. Pathria-3th edition): Q1, Q3, Q5, Q12, Q13

Good luck, Movahed
