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NPTEL

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Courses » Statistical Mechanics

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Unit 11 - Week 9

Register for Certification exam

Course outline

Assignment 9

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-04-03, 23:59 IST.

1) *1 point*

If a system of ideal gas exists in the grand canonical ensemble (μ, V, T), then we can say

- only E fluctuates in the system.
- only N fluctuates in the system.
- both E and N are fluctuating quantities.
- there are no fluctuating quantities.

No, the answer is incorrect.
Score: 0

Accepted Answers:
both E and N are fluctuating quantities.

2) *1 point*

The chemical potential μ of an ideal gas in the grand canonical ensemble depends on number density ρ and temperature T. The exact relationship between them stands as

- $\mu = k_B T \ \ln(\rho\lambda^3)$
- $\mu = k_B T \rho\lambda^3$
- $\mu = k_B T$
- $\mu = k_B T \ e^{\rho\lambda^3}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\mu = k_B T \ \ln(\rho\lambda^3)$

3) *1 point*

For an ideal gas in the grand canonical ensemble, the chemical enthalpy of a microstate ν is

$$H(\nu) = \sum_{i=1}^{N_\nu} \frac{p_i^2}{2m} - \mu N_\nu \quad \text{with } \mu \equiv \text{ chemical potential}$$

The average thermodynamic enthalpy is thus given as

- $\frac{3}{2} k_B T$
- $\frac{V e^{\beta\mu}}{\ldots} \left[\frac{3}{\ldots} - \mu \right]$

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No, the answer is incorrect.
Score: 0

Accepted Answers:

$$\frac{Ve^{\beta\mu}}{\lambda^3}\left[\frac{3}{2\beta}-\mu\right]$$

4) **1 point**

An ideal gas of particles is in contact with a catalyst of surface area A. There are $\mathcal{N}$ distinct adsorption sites on the surface, and each adsorbed particle gains an energy ϵ upon adsorption. Thus we now have a two-dimensional gas in the grand canonical ensemble (μ, A, T) with the expression for partition function and mean number of adsorbed particles, respectively

- $[1+e^{-\beta(\epsilon-\mu)}]^{\mathcal{N}}$ and $\mathcal{N}/[e^{\beta(\epsilon-\mu)}+1]$.
- $e^{-\beta(\epsilon-\mu)\mathcal{N}}$ and $\mathcal{N}$.
- $e^{-\beta(\epsilon-\mu)\mathcal{N}}$ and $\mathcal{N}/[e^{\beta(\epsilon-\mu)}+1]$.
- $e^{-\beta(\epsilon-\mu)\mathcal{N}}$ and $\mathcal{N}/[e^{\beta(\epsilon-\mu)}-1]$.

No, the answer is incorrect.
Score: 0

Accepted Answers:

$[1+e^{-\beta(\epsilon-\mu)}]^{\mathcal{N}}$ and $\mathcal{N}/[e^{\beta(\epsilon-\mu)}+1]$.

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