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Courses » Statistical Mechanics

Announcements

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Unit 12 - Week 10

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Course outline

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Prerequisite

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Week 10

- Quantum Statistical Mechanics
- Statistics of Fermions and Bosons
- Quantum to Classical Correspondance
- Quiz : Assignment 10
- Week 10 feedback : Statistical Mechanics
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Interaction Session

Assignment 10

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

Due on 2019-04-10, 23:59 IST

1) 1 point
 A system of two identical Bosons, each of mass m , is placed in a one dimensional box of length L . If the energy of the systems is $5\hbar^2\pi^2/(2mL^2)$, then the space part of the wave function is given by

- $\Psi(1, 2) = \sqrt{\frac{2}{L}} \left[\sin \frac{\pi x_1}{L} \sin \frac{2\pi x_2}{L} + \sin \frac{\pi x_2}{L} \sin \frac{2\pi x_1}{L} \right]$
- $\Psi(1, 2) = \sqrt{\frac{2}{L}} \left[\sin \frac{\pi x_1}{L} \sin \frac{2\pi x_2}{L} - \sin \frac{\pi x_2}{L} \sin \frac{2\pi x_1}{L} \right]$
- $\Psi(1, 2) = \frac{\sqrt{2}}{L} \left[\sin \frac{\pi x_1}{L} \sin \frac{2\pi x_2}{L} + \sin \frac{\pi x_2}{L} \sin \frac{2\pi x_1}{L} \right]$
- $\Psi(1, 2) = \frac{\sqrt{2}}{L} \left[\sin \frac{\pi x_1}{L} \sin \frac{2\pi x_2}{L} - \sin \frac{\pi x_2}{L} \sin \frac{2\pi x_1}{L} \right]$

No, the answer is incorrect. Score: 0

Accepted Answers:

$$\Psi(1, 2) = \frac{\sqrt{2}}{L} \left[\sin \frac{\pi x_1}{L} \sin \frac{2\pi x_2}{L} + \sin \frac{\pi x_2}{L} \sin \frac{2\pi x_1}{L} \right]$$

2) 1 point
 The Hamiltonian for the ultra-relativistic particle or photon is given by $H(p) = cp$, where c is the velocity of light and p is the photon momentum. The thermal wavelength for the particle is given by

- $k_B T / (hc)$
- $hc / (k_B T)$
- p / h
- $h / (\sqrt{2m\pi k_B T})$

No, the answer is incorrect. Score: 0

Accepted Answers:

$$hc / (k_B T)$$

3) 1 point
 If Q is the partition function of grand canonical ensemble, then the equation of state for a quantum ideal gas can be written as

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- $\frac{PV}{k_B T} = 0$
 $\frac{PV}{k_B T} = 2^N \ln Q(\mu, V, T)$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$\frac{PV}{k_B T} = \ln Q(\mu, V, T)$$

4)

A gas of N identical Boson particles, each of mass m , is kept in a volume V . If the energy of the state is ϵ , then the occupation probability is written as $f(\epsilon) = \frac{1}{e^{(\epsilon-\mu)/k_B T} - 1}$. In the limit $\mu \rightarrow 0$, the relation between the temperature and the total number of particles is given as

- $\lim_{\mu \rightarrow 0} T \sim N^{3/2}$
 $\lim_{\mu \rightarrow 0} T \sim N^{2/3}$
 $\lim_{\mu \rightarrow 0} T \sim N^1$
 $\lim_{\mu \rightarrow 0} T \sim N^0$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$\lim_{\mu \rightarrow 0} T \sim N^{2/3}$$

5)

For a system of free particles, the relation between density of states the energy E in one two dimensions scale respectively as

- $E^{1/2}$ and E^0
 $E^{-1/2}$ and $E^{1/2}$
 $E^{-1/2}$ and E^1
 $E^{-1/2}$ and E^0

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$E^{-1/2} \text{ and } E^0$$

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