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6 SEM TDC PHY M 1

2018

(May)

PHYSICS

(Major)

Course : 601

(Statistical Mechanics)

Full Marks : 60

Pass Marks : 24/18

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the corect option : 1×5=5

(a) Quantum statistics approaches to classical statistics, if

(i) $\frac{g_i}{n_i} = 1$

(ii) $\frac{g_i}{n_i} \gg 1$

(iii) $\frac{g_i}{n_i} \ll 1$

(iv) Never

(Turn Over)

(b) Which of the following is a boson?

(i) α-Particle

(ii) Neutron

(iii) Positron

(iv) Proton

(c) Bose-Einstein grand partition function is, $Z =$

(i) $\sum_i [1 + e^{\beta(\mu - \varepsilon_i)}]^{-1}$

(ii) $\sum_i [1 - e^{\beta(\mu - \varepsilon_i)}]^{-1}$

(iii) $\prod_i [1 + e^{-\beta(\mu - \varepsilon_i)}]^{-1}$

(iv) $\prod_i [1 - e^{\beta(\mu - \varepsilon_i)}]^{-1}$

(d) The Fermi function

$$f(\varepsilon) = \frac{n(\varepsilon)}{g(\varepsilon)}$$

has value $\frac{1}{2}$, when

(i) $\varepsilon < \varepsilon_f$

(ii) $\varepsilon > \varepsilon_f$

(iii) $\varepsilon = \varepsilon_F$ at absolute zero only

(iv) $\varepsilon = \varepsilon_F$ at any temperature

(Continued)

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(e) Bose-Einstein distribution function is, $n_i =$

(i) $g_i e^{-\beta\varepsilon_i}$

(ii) $g_i e^{\beta\varepsilon_i}$

(iii) $\frac{g_i}{e^{\beta\varepsilon_i} + 1}$

(iv) $\frac{g_i}{e^{\beta\varepsilon_i} - 1}$

2. (a) Derive the distribution function for identical and distinguishable particle. 7

(b) What do you understand by phase space? Define microcanonical, grand canonical and canonical ensembles. 1+2+2+2=7

3. (a) Write the statistical definition of entropy. 3

Or

Find a relation between entropy and partition function.

(b) Calculate the partition function for an ideal monochromatic gas. 6

Or

Express Gibbs' function in terms of partition function.

(Turn Over)

4. *(a)* What are the limitations of Maxwel Boltzmann distribution law?

   (b) What do you mean by classical limit?

   (c) Discuss the symmetry of wave functio of two particles.

5. *(a)* N numbers of spinless identica particles are distributed among number of energy levels having g energ states. Derive an expression to show th distribution of the particles.

   (b) Starting from B-E distribution law derive Stefan's law.

6. Write short notes on any *two* of the following : 5×2

   (a) White dwarf star

   (b) Chandrasekhar limit

   (c) Bose-Einstein condensation

★ ★ ★