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Total Pages : 3

238302

December, 2019

M.Sc. - III SEMESTER

Statistical Mechanics (PHL302)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (3 marks each) of Part -A.*
2. *Answer any four questions from Part -B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART - A

1. (i) Explain the entropy of mixing of two samples of the same gas. (3)

(ii) Discuss the conditions when a system obeying quantum statistics starts following the approximately the laws of classical statistics. (3)

(iii) Present brief analysis of anharmonic oscillators. (3)

(iv) Describe the connection between a microcanonical and a canonical ensemble, if any. (3)

(v) Discuss the anomalous behavior of liquid He4. (3)

PART - B

2. (i) Define statistical equilibrium and derive necessary condition. Establish the contact between statistics and thermodynamics by deriving various relations. (6)

(ii) Differentiate between macroscopic and microscopic states and obtain expression of entropy S for a perfect monatomic gas in a microcanonical ensemble. (9)

3. Define occupation number and compare it in different statistical distributions. As an application of BE statistics, explain the phenomenon of condensation in momentum space. How it is related to the properties of liquid Helium? (15)

4. (i) Derive the grand canonical distribution function and discuss its applications. (5)

(ii) Derive expression for partition function for a perfect gas in Gibb's canonical ensemble and discuss the effect of shifting of zero level of energy. (10)

5. Differentiate between a real and an ideal gas. In case of real gas, deduce the virial equation of state and find out the expressions of first three virial coefficients. Derive Vander-waals equation and discuss the results. (15)

6. (i) Define occupation number and compare it in different statistical distributions. (5)

(ii) As an application of BE statistics, explain the phenomenon of condensation in momentum space. How it is related to the properties of liquid Helium? (10)

7. (i) What are the phase transitions of first and second kind? (5)

(ii) How cooperative phenomenon accounts for phase transitions of second kind? Present the analysis of Ising Model in two dimensions. (10)
