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(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2023-25 ONLY)

SUBJECT CODE 23PPS103

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS : NOVEMBER – 2023

M.Sc. – PHYSICS **MAXIMUM MARKS: 75**

SEMESTER: I **TIME : 3 HOURS**

STATISTICAL MECHANICS

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS. (K1)

(MULTIPLE CHOICE QUESTIONS)

1. A collection of ver large number of assemblies which are essentially independent are referred

   a) μ -space b) micro gas c) entities d) ensembles

2. Arrangement of molecules with their representative points in particular cell is called as

   a) phase point b) ensemble c) microstate d) maccrostate

3. If a pair of particle leaves the wave function is unchanged , then the wave function referred as

   a) eigen function b) Hermition c) symmetric d) antisymmetric

4. Liquid helium becomes superfluid at temperature (K1)

   a) 4.12K b) 3.14K c) below 2.19K d) above 2.19K

5. Transition of non-ferromagnetic state to ferromagnetic state is (K1)

   a) a phase transition b) not a phase transition

   c) phase transition of first kind d) phase transition of second kind

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. (K2)

6. What is known as phase point?
7. State the law of equipartition of energy.
8. . Write the expression for time development of the density matrix
9. What are known as white dwarfs?
10. Give a statement to distinguish between first-order and second-order transition.

SECTION – B (5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)

11. a) What is statistical equilibrium? What are the conditions to be obeyed?

(OR)

b) Differentiate canonical and grand canonical ensembles with the relevant explanation

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12. a) What is known as Gibbs paradox? Describe it by arriving appropriate expression.

(OR)

b) Write a note on the partition function with an expression.

13. a) Discuss the general idea of matrices in quantum mechanics.

(OR)

b) Discuss the conditions for Quantum statistical equilibrium.

14. a) Explain the nature of liquid He through phase diagram.

(OR)

b) Give a brief idea of Debye's theory of quantum statistics.

15. a) Deduce the expression for fluctuation in energy.

(OR)

b) Write a brief note on Onsager reciprocal relations.

SECTION – C (5 X 8 = 40 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K4 (Or) K5)

16. a) State Liouville's theorem and deduce the proof.

(OR)

b) What is meant by an ensemble? Discuss microcanonical, canonical, and grand canonical ensembles. Compare these three types of ensembles.

17. a) Arrive various expressions which are connecting statistical and thermo dynamical quantities.

(OR)

b) educe Maxwell-Boltzmann law for the distribution of molecules in a gas.

18. a) Explain the basic idea of density matrix theory with postulates.

(OR)

b) Deduce Maxwell-Boltzmann law for Quantum statistics and differentiate it from classical derivations.

19. a) With the help of the partition function describe Debye's theory of specific heat of solids. Discuss its agreement with the experimental results

(OR)

b) Elaborate the Pauli's theory of Para magnetism and arrive the appropriate relations.

20. a) Write a note on Bragg-William approximation. Use this approximation to arrive the conditions of spontaneous magnetization and spontaneous magnetic moment.

(OR)

b) Explain the thermodynamics of irreversible process based on Onsager relations.

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