Reg. No ..... Name **22U605**

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2022

SEMESTER 6 : PHYSICS

COURSE : **19U6CRPHY09: THERMAL AND STATISTICAL PHYSICS**

(For Regular - 2019 Admission)

Time : Three Hours Max. Marks: 60

PART A

Answer any 8 (2 marks each)

1. What is a Grand-Canocial Ensemble in Statistical Mechanics?
2. State the 2 conditions when the Quantum Statistics will converge towards Classical Statistics.
3. How many microstates can be associated in the case of 4 identical and distinguishable balls to be distributed in 3 identical boxes.
4. Distinguish between heat and temperature. Briefly describe the units used for measurment.
5. What do you mean by quasi-static process? Can it be achieved in practice? State its importance.
6. Explain the concept of reversible and irreversible processes.
7. Why gas has two specific heats? Define the two.
8. Distinguish between isoentropic and isoenthalpic processes. Give examples.
9. Give a brief account of prevost's theory of heat exchanges.
10. Explain the meaning of emissive power and absorptive power.

(2 x 8 = 16)

PART B

Answer any 6 (4 marks each)

11. Differentiate between the Maxwell Boltzmann Distribution function and Bose Einstein Distribution Function.
12. What is meant by thermodynamic Probability? In an experiment where 4 identical distinguishable balls are distributed in 3 identical boxes (X, Y and Z) evaluate the thermodynamic probability for the macrostate (2,1,1) ie, the case were we will have 2 balls in box X, 1 ball in box Y and 1 ball in box Z.
13. 1 gram molecule of monoatomic perfect gas ($\gamma = 5/3$) at 27 ^{o}C is adiabatically compressed in a reversible precess from an initial pressure of 1 atmosphere to a final pressure of 50 atmosphere. Calculate the difference in temperature.
14. Find the efficiency of a Carnot's engine working between 127 ^{o}C and 27 ^{o}C. It absorbs 80 cal of heat. How much heat is rejected?
15. A gas occupying 1 litre at 80 cm of Hg pressure is expanded adiabatically to 1190 c.c. If the pressure falls to 60 cm of Hg in the process, deduce the value of γ.
16. 10 gram of helium occupies a volume of 100 cm^3 at a pressure of 10^8 N/m^2. Find the temperature of the gas assuming it as (i) ideal gas (ii) real gas. For He, a = 3.43 x 10^{-3} Nm^4mol^{-2} and b = 2.34 x 10^{-5} m^3mol^{-1}.
17. Calculate the depression of melting point of ice produced by one atmosphere increase of pressure. Given that latent heat of ice = 80 cal/gm and specific volume of ice and water at 0 ^{o}C are 1.091 cm^3 and 1.0 cm^3 respectively.
18. An ice box is built of wood 1.75 cm thick, lined inside with cork 3 cm thick. If the temperature of the inner surface of the cork is 0 ^{o}C and that of the outer surface of wood is 12 ^{o}C, what is the temperature of the interface? The thermal conductivity of wood and cork are 0.0006 and 0.00012 CGS units respectively.

(4 x 6 = 24)

PART C
Answer any 2 (10 marks each)

19. What is meant by the term ensemble? What is the use of using ensemble concepts in statistical ensembles? Discuss the major 3 classes of ensembles.
20. i) State and explain four laws in thermodynamics? ii) Explain indicator diagram and its uses.
21. Describe adiabatic process in detail and obtain expressions for the following: i) equation of adiabatic process in term of P and V, P and T; and V and T, ii) work done in adiabatic process, and iii) cooling caused in adiabatic expansion.
22. What are thermodynamic potentials (functions)? Why are they known as potentials? Derive Maxwell's thermodynamic relations from thermodynamic potentials with state variables.

(10 x 2 = 20)