Reg. No ..... Name **24U605**

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2024

SEMESTER 6 - PHYSICS

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

(For Regular - 2021 Admission and Supplementary -2020/2019 Admissions)

Time : Three Hours Max. Marks: 60

PART A

Answer any 8 (2 marks each)

1. What is enthalpy? Give its unit and dimension. Give an example for isoenthalpic process.
2. What is meant by Erodic hypothesis?
3. From the relevant Maxwell's thermodynamic equation, obtain Clausius-Clapeyron equation. Explain the use of the equation.
4. State and explain Rayleigh-Jeans law. Explain its validity in terms of experimental results.
5. State first law of thermodynamics. Briefly describe it's physical significance and limitations.
6. Briefly explain adiabatic process and obtain expression $TV^{\gamma-1}$ = constant.
7. Obtain an expression for efficiency of a reversible Carnot's engine with a perfect gas as the working substance. Suggest a method to increase its efficiency.
8. Write down the expression of Fermi Dirac distribution function and explain the terms involved.
9. Write down the expression of Bose Einstein distribution function and explain the terms involved.
10. Why gas has two specific heats? Define the two.

(2 x 8 = 16)

PART B

Answer any 6 (4 marks each)

11. Differentiate between Bosons and Fermi - Give 2 examples each
12. Considering 6 identical and distinguishable balls to be distributed in 3 identical boxes, evaluate the probability for the macrostate (2,2,2) with 2 balls equally distributed in 3 boxes.
13. Calculate the change in the boiling point of water when the pressure of steam on its surface is increased from 1 atmosphere to 1.10 atmospheres. Latent heat of water at 100 ^{o}C = 537 calg. Volume of one gram of steam at 100 ^{o}C = 1676 cm^3.
14. Calculate the pressure required to lower the melting point of ice by 1 ^{o}C. The density of ice is 0.917 x 10^3 kg/m^3, latent heat of ice is 3.36 x 10^5 J/kg.
15. A Carnot engine has an efficiency of 30 % when the temperature of the sink is 27 ^{o}C. What must be the change in temperature of the source to make its efficiency 50 %?
16. A certain mass of gas at NTP is expanded to three times its volume under adiabatic conditions. Calculate the resulting temperature and pressure. γ for the gas is 1.40.
17. Calculate the work done when one litre of a mono atomic perfect gas at N.T.P. is compressed adiabatically to half its volume. γ = 1.67.
18. A quantiy of dry air at 27 ^{o}C is compressed (i) slowly and (ii) suddenly, to 1/3 of its volume. Find the change in temperature in each case, assuming γ to be 1.4 for dry air.

(4 x 6 = 24)

PART C
Answer any 2 (10 marks each)

19. Why does a gas possess two different specific heats and give reason for Cp>Cv? Hence, derive Mayer's relation starting from the first law of thermodynamics, assuming volume and temperature are independent variables.
20. With necessary diagram, discuss the experimental results of Andrew's experiment on Carbon Dioxide and hence explain critical parameters of a gas.
21. Derive Maxwell Boltzmann Distribution function.
22. What are black body radiation. Explain the salient features of black body radiation spectrum hence outline Wien's displacement law and Rayleigh – Jeans law with special reference to ultraviolet catastrophe.

(10 x 2 = 20)