TB256809C

Reg. No :.....

Name :.....

BACHELOR'S DEGREE (C.B.C.S) EXAMINATION, MARCH 2025

2018, 2019, 2020, 2021 ADMISSIONS SUPPLEMENTARY

SEMESTER VI - CORE COURSE (PHYSICS)

PH6B09B18 - Thermal and Statistical Physics

Time : 3 Hours **Maximum Marks : 60**

Part A

I. Answer any Ten questions. Each question carries 1 mark **(10x1=10)**

1. State the condition for two gases to be in corresponding states.
2. State and explain Carnot's theorem.
3. What is the change in internal energy, when an ideal gas is expanded isothermally to double its volume?
4. Why does the temperature of a gas drop when it is subjected to adiabatic expansion? Explain.
5. Describe the Helmholtz and Gibb's functions associated with a system.
6. Explain the term intrinsic energy of a system.
7. What is Helmholtz function? It is also called the work function. Why?
8. Write a short note on negative temperature.
9. What is meant by indistinguishability of identical particles?
10. What is the total number of microstates possible for a system containing N particles distributed in two compartments?
11. Find the number of macrostates for a system of i) N particles distributed among two compartments ii) 5 particles distributed in two phase cells.
12. Write down the relation between entropy and thermodynamic probability and explain the symbols.

Part B

II. Answer any Six questions. Each question carries 5 marks **(6x5=30)**

13. Calculate the Van der Waals constants for dry air, given that $T_c = 132\ K$, $P_c = 37.2\ atmos$, $R = 82.7\ cm^3\ atmos\ K^{-1}$.
14. A quantity of dry air at 27^0C 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.
15. A motor car tyre has a pressure of 3atmospheres at the room temperature of 27^0C .If the tyre suddenly bursts, what is the resulting temperature (γ=1.4).
16. Discuss the Kirchoff's law of heat radiation.
17. Derive the experimental verification of Stefan's law.
18. Two large closely spaced concentric spheres (both are black body radiators) are maintained at temperatures 200K and 300K respectively. The space in between the two spheres is evacuated. Calculate the net rate of energy transfer between the two spheres, given $\sigma = 5.6 \times 10^{-8} MKS\ units$.
19. Derive an expression for Maxwell- Boltzmann distribution law of energies.

20. What is the relation connecting thermodynamic probability and probability of occurrence? Obtain expressions for maximum and minimum probability.
21. Calculate the probability that in tossing a coin 10 times, one gets a) 5 heads and 5 tails b) 7 heads and 3 tails.

Part C

III. Answer any Two questions. Each question carries 10 marks **(2x10=20)**

22. Derive the Van der Waals equation of state and use it to obtain the expressions for the critical constants.
23. Obtain the works done during isothermal and adiabatic processes.
24. What are thermodynamic potentials? Discuss Maxwell's thermodynamic relations using thermodynamic potentials.
25. What is Bose – Einstein statistics? Derive an expression for the most probable distribution of a system obeying this statistics.