TB206525W **Reg. No :.....**

Name :.....

B. Sc. DEGREE (C.B.C.S.) EXAMINATION, MARCH 2023

(2020 Admission Regular, 2019, 2018 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. Differentiate between a perfect gas and a real gas.
2. State zeroth law of thermodynamics.
3. What is meant by thermodynamic equilibrium?
4. What is the change in internal energy, when an ideal gas is expanded isothermally to double its volume?
5. What is meant by enthalpy?
6. What is T-S diagram? Explain its importance.
7. Discuss the change in entropy when water vapour condenses into water.
8. State and prove the principle of increase of entropy.
9. What are the assumptions made in deriving Plank's radiation law?
10. What is meant by black body radiations?
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 any two properties of bosons and fermions.

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. The temperature of 5kg of air is increased by 1^0C at constant volume. Calculate the increase in its internal energy. Given Cp =999J/kg/k, γ=5/3.
15. The efficiency of a reversible heat engine is 25% .If the temperature of the source is increased by 300K, its efficiency will be doubled. Calculate the temperature of the source and sink.
16. Derive Prevost's theory of heat exchange.
17. Discuss the change in entropy when ice is converted in to steam.
18. 50 grams of water at 0^0C is mixed with an equal mass of water at 83^0C. Calculate the resultant increse in entropy.
19. Derive the Boltzmann's thermodynamic relation in statistical mechanics.
20. Show that $g(p)dp = \frac{4\pi p^2 dpV}{{h_0}^3}$
21. What is meant by thermodynamic probability? Four distinguishable particles are distributed in two compartments. Find the most probable macrostate.

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. Explain the working of a Carnot's engine with the help of an indicator diagram. Arrive at an expression for the work done in a cycle.
24. Describe Maxwell's thermodynamic relations using thermodynamic variables.
25. What is Bose – Einstein statistics? Derive an expression for the most probable distribution of a system obeying this statistics.