Roll No……..….. **Total No. of Printed Pages: 1**
Total No. of Questions: [11]

M.Sc. (Chemistry) (Semester –1st)
THERMODYNAMICS AND SOLID STATE
Subject Code: MCHMS1-103
Paper ID: [20220203]

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is compulsory. It carries 16 marks. It consists of 4 questions of 4 marks each.
2. Section B consist of 4 questions of 8 marks each. The student has to attempt any 3 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A (4 marks each)

Q1. Define activity, activity coefficient, fugacity and fugacity coefficient.
Q2. Explain molecular basis of residual entropy.
Q3. State second law of thermodynamics.
Q4. Explain Schottky defect in detail.

Section – B (8 marks each)

Q5. The heat of vaporization of water is 40820 J mol^{-1}, the molar volume of liquid water is 0.019 dm^3 mol^{-1} and the molar volume of steam is 30.199 dm^3 mol^{-1} all at 100℃ and 1 atm. What would be the change in the boiling point of water at 100℃ if the atmospheric pressure is changed by 1mm?
Q6. Differentiate between Fermi-Dirac and Maxwell-Boltzmann statistics.
Q7. The enthalpies of combustion of carbon, hydrogen and sucrose are -393.5, -286.2 and -5644.2 kJ/mol, respectively. Calculate the enthalpy of formation of sucrose.
Q8. Derive (a) Gibb's Duhem equation assuming free energy as a function of temperature, pressure and amount of various species (b) Gibb's Helmholtz equation

Section – C (10 marks each)

Q9. What do you understand by partition function? Explain canonical ensemble partition function. Also correlate energy and partition function.
Q10. What are reciprocal lattices? Explain stoichiometric and non-stoichiometric defects in detail.
Q11. Calculate q, w, ΔE and ΔH if 1.6 mol of an ideal gas ($C_{v,m} = 2.5R$) at 300K were allowed to expand adiabatically from 5 atm to a final pressure of 2 atm against a constant external pressure of 1 atm.