Roll No……..….. **Total No. of Printed Pages: [1]**
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M.Sc. (Chemistry) (Semester – 1st)
THERMODYNAMICS & SOLID STATE
Subject Code: MCHMS1103
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. Calculate free energy of mixing and enthalpy of mixing when 10 moles of He are mixed with 20 moles of Ne.

Q2. Calculate the q, w, ΔE and final temperature when 2 moles of an ideal gas expand reversibly and isothermally from a volume of 500 ml to a volume of 2 L at 25°C and normal pressure.

Q3. What are excess functions for non-ideal systems? Explain.

Q4. Describe (a) macrostate, (b) microstate, (c) canonical and (d) grand canonical ensemble.

Section – B **(8 marks each)**

Q5. Describe how absolute entropy can be determined. Calculate the molar residual entropy of a crystal in which the molecules can adopt 6 orientations of equal energy at 0K.

Q6. Compare stoichiometric defects with non-stoichiometric defects.

Q7. Calculate mole fraction of Schottky and Frenkel defects in NaCl crystal at 1000K if energy of formation of these defects is 2eV and 3eV respectively.

Q8. One mole of benzene is converted reversibly into vapour at its boiling point 80.2 °C by supplying heat. The vapour expands against the pressure of 1 atm. The heat of vaporization of benzene is 395 J/gm. Calculate q, w, ΔE and ΔH for the process.

Section – C **(10 marks each)**

Q9. (a) The enthalpy of reaction for the formation of ammonia was found to be -91.94kJ at 27°C. What will be the enthalpy of reaction at 50°C? Molar heat capacities at 27°C for nitrogen, hydrogen and ammonia are 28.45, 28.32 and 37.07 joules, respectively.
(b) Derive Maxwell Boltzmmann distribution law.

Q10. Elaborate Fermi Dirac statistics.

Q11. Derive thermodynamic equation of state in terms of energy as well as enthalpy.