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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 Boltzmann distribution law.
- Q10. Elaborate Fermi Dirac statistics.
- Q11. Derive thermodynamic equation of state in terms of energy as well as enthalpy.