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Total No. of Printed Pages: 1

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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 $0.019 \text{ dm}^3 \text{ mol}^{-1}$ and the molar volume of steam is $30.199 \text{ dm}^3 \text{ mol}^{-1}$ all at 100°C and 1 atm. What would be the change in the boiling point of water at 100°C 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.