Reg. No..... Name.....

M. Sc. DEGREE END SEMESTER EXAMINATION - NOVEMBER 2016

SEMESTER **– 1: CHEMISTRY**

COURSE: **P1CHET04, P1CPHT04–: CLASSICAL AND STATISTICAL THERMODYNAMICS** *(Supplementary/Improvement for 2015 Admission)*

Time: Three Hours Max. Marks: 75

SECTION A

*Answer **any** **ten** questions. Each question carries **2** marks*

1. Explain Clausius inequality.
2. Prove that $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$
3. Explain the significance of Gibbs Duhem Margules equation.
4. State and explain Henry's law. How is it related to Raoult's law in the case of an ideal solution?
5. Account for the differences between first order and second order phase transitions.
6. Represent a three component system (ABC), where the composition is 40% A, 20% B and 40% C.
7. Explain the principle of microscopic reversibility.
8. Explain the exergonic nature of ATP hydrolysis.
9. Explain dilution factor and its significance.
10. What is meant by thermodynamic probability? How is it related to mathematical probability?
11. What is characteristic Einstein temperature of an atomic crystal? Explain its significance.
12. Arrange translational, rotational, vibrational partition functions based on their magnitude.

    Justify your answer.
13. What is meant by Cluster integral?

(2 × 10 = 20)

Section B

*Answer **any** **five** questions by attempting not more than **3** questions from each bunch.*

*Each question carries **5** marks*

Bunch 1 (Short essay type)

14. What is meant by fugacity? Provide the method of determination.
15. Comment on rate of entropy production. Show that $\Sigma JiXi>0$, in the case of an irreversible system where a temperature exists.
16. Derive Sackur-Tetrode equation.
17. Write a note on Bose Einstein condensation.

Bunch 2 (Problem type)

18. Find the molar change in internal energy, enthalpy, entropy, Gibbs free energy and Helmholtz free energy, in expanding 1 liter of an ideal gas at 25°C to 100 liters at the same temperature.

19. When a 1.86 g of a solute (Molar mass 154 g/mol) is added to 100 g of a solvent (Molar mass 78 g/mol, boiling point 353.15 K), the elevation in boiling point was 2.3 K. Calculate K_b and heat of vapourisation of the solvent.

20. The heat capacity (C_v)of silver at low temperature 20K is 0.390 cal/K/mol. Calculate the characteristic Debye temperature of the crystal and the heat capacity value at 10K.

21. Calculate the characteristic rotational temperature and rotational partition function of H_2 gas at 3000K. Moment of inertia of hydrogen is 4.603×10^{-48} kg m^2

(5 × 5 = 25)

Section C

*Answer **any** **two** questions. Each question carries **15** marks*

22. What is meant by absolute entropy of a system? Give the method of determination of absolute entropy of a gas.

23. What is meant by partial molar property? Explain its significance. Provide the method of intercepts for determining the parameter.

24. What is an ideal Fermi gas? Derive Fermi Dirac Distribution equation and apply the law to electrons in metals.

25. Explain Einstein’s theory of heat capacity. Comment on Debye’s modification on it.

(15 × 2 = 30)

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