LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **CHEMISTRY**

SECONDSEMESTER – APRIL 2018

CH 2816- THERMODYNAMICS AND STATISTICAL MECHANICS

Date: 28-04-2018 Dept. No. Max. : 100 Marks
Time: 01:00-04:00

Part-A

Answer ALL questions. **(10 x 2= 20)**

1. Define activity coefficient.
2. Mention the need for reduced phase rule.
3. Calculate the ionic strength of 0.2M NaBr.
4. What are azeotropic mixtures? Give an example.
5. State Onsager's microscopic reversibility.
6. Define most probable velocity.
7. Calculate the symmetry number of CO molecule.
8. What is electronic partition function?
9. What is factorization of partition function?
10. Predict the ground state electronic degeneracy for the term $^2P_{3/2}$.

Part-B

Answer any EIGHT questions. **(8 x 5= 40)**

11. What is Ellingham's plot? How does it help to understand extraction of metals?
12. Explain the temperature dependence of equilibrium constant.
13. How is the fugacity of a gas determined?
14. Calculate the translational partition function of a nitrogen molecule confined in a 1 litre vessel.
15. What is internal entropy production? Predict its condition to i) be positive ii) maintain thermal equilibrium.
16. Calculate the value of ln 9! with and without Stirling's theorem. Find the difference between the values.
17. Explain the following i) Canonical ensemble ii) microstate.
18. How will you establish the relationship between equilibrium constant and partition function?
19. Derive the relation between partition function and entropy
20. Calculate the translational energy and translational enthalpy for oxygen gas at 298 K and at 1 atm.
21. How is the flux-force relationship explained through phenomenological coefficients?
22. Discuss the equilibrium theory of reaction rates briefly.

Part-C

Answer any FOUR questions. **(4 x 10= 40)**

23. Derive Gibbs-Duhem equation and mention its significance.

24 Discuss the phase diagram of a ternary system involving the formation of double salt. Calculate the number of phases and the degree of freedom in each region of the diagram.

25a. Write a note on Electro kinetic phenomenon.

b. What is the effect of temperature on the mutual solubility of water and phenol? (5+5)

26a. Calculate the molar residual entropy of a crystal in which the molecules can adopt seven orientations of equal energy at 0 K.

b. Explain the effect of molecular symmetry on rotational partition function with suitable examples.

(4+6)

27. Discuss the Einstein and Debye models of heat capacity of solids.

28a. Obtain an expression to compute the translational entropy of monoatomic ideal gas.

b. Explain the application of Bose-Einstein statistics for a photon gas. (5+5)

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