Tutorial-8, StatMech, Electrochemistry & Others (Paper-203)

Dr. R K Hazra

Maximum Marks: 50

Q-1. Obtain activity-coefficient (f_i) of any ionic species of finite-size-ion?

Q-2. Find mean ionic activity coefficient ($f_\pm$) of an ionic solution $A_\alpha B_\beta \rightleftharpoons \alpha A^{z_A+} + \beta B^{z_B-}$ for finite-size-ion.

Q-3. What molality of $CuSO_4$ has the same ionic strength as 1.0 molal KCl?

Q-4. Obtain $\bar{G}_{excess}$, $\bar{S}_{excess}$ and $\bar{H}_{excess}$ in terms of $\sqrt{I}$ and A.

Q-5. Calculate the ionic strengths of 0.1 (M) KCl and 0.1 (M) $CaCl_2$ solutions.

Q-6. Calculate pH of $1L$ 0.1 (M) HCl solution before and after addition of 1.0 mole $NaCl$.

Q-7. Compute pH of 0.01 (M) $NaOH$ solution.

Q-8. Calculate pH of 0.1 (M) acetic acid solution ionized to 1.32% at room temperature.

Q-9. A 0.001 (M) tryptophan hydrochloride solution at pH=2.38 reaches equilibrium to give 50-50% ratio of cation to zwitter ion. What are the pH and ratio going to be with the addition of 0.05 moles of $Al_2(SO_4)_3$?

Q-10. 1.2 $mmol$s of HCl and 1.0 $mmol$ of $NaOH$ are mixed in 1 L of water. Calculate pH of the solution.

Q-11. Chemical potential of a Bose-gas lies below all bound states- justify.

Q-12. Using Euler's theorem, prove that $\bar{p}V = k_B T \ln(Z(v,T,\mu))$ where $\ln(Z(v,T,\mu))$ is the grand partition function.

Q-13. Solubility product of $AgCl$ is 10^{-10} at $25^o C$. Estimate solubility of $AgCl$ in (a) water, (b) 0.1 M $NaNO_3$ and (c) 0.1 M $CaCO_3$ solutions.

Books: McQuarrie (Statistical Mechanics), Callen (Thermodynamics and Thermostatistics), Nash (Elements of Statistical Thermodynamics), Atkins (Physical Chemistry), Landau & Lifshitz (Statistical Physics), Electrochemistry (Glasstone), Electrochemistry-Ionics (Bockris&Reddy), Problems (Predrag-Peter Ilich),Amalendu Ghoshal (Numerical Probs..) & Problems (DL Piron).