

Tutorial-7, StatMech, Electrochemistry & Others (Paper-203), January 20,2016

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Maximum Marks: 50

Q-1. What is residual entropy? Calculate residual entropies of $FCIO_3$, CO , NO and H_2O .

Q-2. Given equilibrium constant K_{Na} of $2Na \rightleftharpoons Na_2$, what will be $K_{Na^{24}}$ of the reaction $2Na^{24} \rightleftharpoons Na_2^{24}$?

Q-3. Given equilibrium constant $K_{Br^{79}}$ of isotope exchange reaction $CH_4 + DBr \rightleftharpoons CH_3D + HBr$, what will be $K_{Br^{81}}$ of $CH_4 + DBr^{81} \rightleftharpoons CH_3D + HBr^{81}$?

Q-4. Given equilibrium constant $K_{I^{129}}$ of $H_2 + I_2 \rightleftharpoons 2HI$, what will be $K_{I^{131}}$ of the reaction $H_2 + I_2^{131} \rightleftharpoons 2HI^{131}$?

Q-5. Obtain $Z(N, V, T)$ of Maxwell-Boltzmann distribution at classical limit of Fermi- and Bose-gases.

Q-6. Compare the residual entropy at Θ_E with third law of thermodynamics. Compare the residual entropy at Θ_D with third law of thermodynamics.

Q-7. What are the basic postulates of Debye's theory of specific heat of monoatomic crystal? Obtain C_v of Debye's theory on monoatomic crystal. How it limits at very high and at very low temperature (T^3 -law).

Q-8. Linearize Poisson's equation of dilute electrolytic solution. Obtain and discuss the solution of linearized $P - B$ equation for a point-charge ionic solution.

Q-9. How does ionic cloud affect the potential? What is Debye length/thickness of ionic cloud (r_D)?

Q-10. What is free energy of electrical charging of solution? How does electrical charging of the ionic cloud affect to activity coefficient of specific ions of a electrolytic dilute solution?

Q-11. Find mean ionic activity coefficient (f_{\pm}) of an electrolytic solution $A_{\alpha}B_{\beta} \rightleftharpoons \alpha A^{z_A} + \beta B^{z_B}$. (Debye-Hückel Limiting Law- $\log(f_{\pm}) = -A|z_A||z_B|I^{\frac{1}{2}}$)

Q-12. Obtain the solution of linearized $P - B$ equation for electrolytic solution of finite size ions. How size of the ion modifies thickness of ionic cloud/Debye length?

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) & Problems (DL Piron).