

M.Sc. Examination 2019
Semester - II
Chemistry
Course: CH-810
(Physical Chemistry)

Time: Three Hours

Full Marks: 40

Questions are of value as indicated in the margin.
Notations and symbols have their usual meanings.
Attempt *any four* questions.

1. a) Show that ion-quadrupole theory of solvation predict quantitatively that the differences of heat of hydration of ions vary with radius. 4
b) How does the solvation number determined by compressibility method. 3
c) Why the plot of heat of hydration of transition metal ion vs their atomic number shows double-humped curve? 3
2. a) How does protein is denatured by concentrated urea solution? 3
b) Write down the demerits of Gouy-Chapman model. 2
c) Derive the Born expression for the free-energy of the ion-solvent interaction per mole of ions. 2
d) How probability of finding an ion of one type of charge near an ion of the opposite charge varies with distance. 3
3. a) In the case of an electrode-electrolyte interface M_1/S what are the various possible types of work present?
Why absolute potential difference $\Delta\phi$ remains experimentally indeterminable even at PZC? 1+2
b) What is the physical significance of the outer potential in double layer studies? 2
c) Show that the slopes of the surface tension vs $\log a_{\pm}$ curve at constant potential yields the surface excess. 3
d) State how the surface tension changes with applied cell potential along interface region with the help of Helmholtz-Perin model. 2
4. a) Show that the mobility of an ion is directly proportional to its equivalent conductance. 3
b) Derive the relation between the streaming potential and the zeta potential. 4
c) According to DLVO theory how the value of Hamaker constant and surface potential influence the net potential energy curve of two planar surface. 3
5. a) Write down the expressions of mean ionic-activity coefficient considering point charge model and finite ion size model. How does the value of mean-ionic activity coefficient of finite ion size model reduce to point charge model. 2+2
b) Show that Debye-Hückel expression for the activity coefficient is valid for functions. 2

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- c) How the ion association constant of Bjerrum reduces to $K_A = \frac{4\pi N_A a^3}{1000} \frac{e^b}{b}$. 2
- d) How does triple ions are formed from ion-pairs? 2
6. a) What is critical micelle concentration? How turbidity, osmotic pressure and conductivity changes at the critical micelle concentration (CMC)? 1+1
- b) Classify the lipid protein interaction in membrane. 2
- c) Describe the hydrophobic bond factor to stabilize the protein. 2
- d) What are ion-selective channels? Show that the structure of a K^+ channel reveals the basis for its specificity. 1+3
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