PG – 200

II Semester M.Sc. Examination, June 2016
(CBCS)
CHEMISTRY
C 203 : Physical Chemistry – II

Time : 3 Hours Max. Marks : 70

Instruction : *Answer question number* ***1*** *and* ***any five*** *of the* ***remaining.***

1. Answer **any ten** questions of the following : **(2×10=20)**

a) Calculate the thickness of ionic atmosphere for 0.01 M NaOH using the following data :

$D = 78.6$

$T = 298°K$

$k = 1.38 \times 10^{-6}$

$\varepsilon = 4.802 \times 10^{-10}$ esu.

b) Give the Debye Huckel equation for higher concentration and comment on the constants A and B.

c) Describe the Helmholtz double layer theory.

d) What is meant by surface excess and how it can be measured graphically ?

e) Justify the presence of trible ions in a medium of low dielectric constant.

f) What is meant by concentration overpotenital ?

g) State phase rule and define the term phase and degree of freedom.

h) What is the difference between a canonical and microcanonical ensemble ?

i) Mention the physical significance of partition function.

j) Define the terms 'apparent molar volume' and 'partial molar volume', write the expression for both.

k) Calculate the partition function of a system at 298 K which has energy levels at 0, 2×10^{-21} J and 8×10^{-21} J with a degeneracy of 1, 3 and 5 respectively.

l) What is de-Donder's inequality ?

P.T.O.

2. a) How do you estimate metal ions qualitatively and quantitatively by polarographic technique ?

   b) Derive the Butler-Volmer equation and show that small changes in 'q' produces large changes in 'i'. **(5+5=10)**

3. a) Describe the thermodynamic aspects of surface excess.

   b) Describe the theory of quantum aspects of charge transfer at electrode solution interface. **(5+5=10)**

4. a) Derive the Debye-Huckel equation for the problem of activity coefficient.

   b) Give the Lipmann's equation and calculate the charge density, if the value of the slope is 0.735. **(6+4=10)**

5. a) What are thermodynamic excess functions obtain the equation for G^E, S^E and H^E ?

   b) Calculate the rotational partition function and rotational entropy values for nitrogen at 300 K . Given, I moment of Inertia = 1.39×10^{-46} Kg m^2. **(5+5=10)**

6. a) How are the values of activity and activity coefficient determined by solubility method ?

   b) Explain the concept of uncompensated heat and relate it to various thermodynamic quantities. **(5+5=10)**

7. a) Derive the equation for Maxwell-Boltzmann distribution for a system containing N distinguishable non-interacting particles.

   b) Calculate the translational partition function for one mole of nitrogen at 2 atms and 300 K, assuming the gas to behave ideally. **(6+4=10)**

8. a) Derive Onsagar's reciprocity relation.

   b) Write a note on :

      i) Semiconductor-solution interface

      ii) Electrocatalysis. **(4+6=10)**