(i) Printed Pages : 4 Roll No. .....

(ii) Questions : 9 Sub. Code : 0 3 5 0

Exam. Code : 0 0 0 4

B.A./B.Sc. (General) 4th Semester

1046

CHEMISTRY (Same for B.Sc. Microbial & Food Technology)

Paper–XV : Physical Chemistry-B

Time Allowed : Three Hours] **[Maximum Marks : 22**

Note : (1) Attempt **five** questions in all, selecting at least **one** question from each Section. Section **E** is compulsory.

(2) Use of log tables and simple calculators is allowed.

SECTION–A

1. (a) State and explain 'Nernst Distributions Law'. Prove that the law does not undergo modification if the solute undergoes chemical combination with one of the solvents except that the numerical value of partition coeffiecient changes. 2

(b) What do you understand by 'Critical Solution Temperature' (CST) ? Explain a system which has both upper CST as well as lower CST. 2

2. (a) Define 'Gibb's Phase Rule'. Derive it thermodynamically. 2

(b) What do you understand by congruent and incongruent melting points ? What is the number of components and the degree of freedom at congruent melting point of a system, consisting of two components ? 2

SECTION–B

3. (a) Define 'Transport Number'. Describe briefly the principle underlying the determination of transport number by 'Hittorf's Method'. 2

(b) Calculate the concentration of hydronium ions in an aqueous solution of acetic acid in which 0.05 moles of acetic acid are dissolved in 250 ml of solution. Given that ka value for acetic acid is 1.8×10^{-5}. 2

4. (a) Explain two interionic effects :

(i) Relaxation Effect

(ii) Electrophoretic Effect. 2

(b) The transport numbers of Ag^+ ion and NO_3 ion in an aqueous solution of $AgNO_3$ are 0.466 and 0.534 respectively. The molar conductance at infinite dilution for this solution is 116.5 $Scm^2 gm\ eq^{-1}$ Calulate :

(i) ionic conductances of Ag^+ and NO_3^- ions

(ii) Absolute velocity of the two ions. 2

SECTION–C

5. (a) Derive 'Nernst equation' for the following general reversible cell reaction.

$aA + bB \leftrightharpoons cC + dD$ 2

(b) Standard Electrode Potential of Copper Electrode at 298 K is + 0.34 V, calculate the concentration limit beyond which the electrode will have a negative potential. 2

6. (a) What is a reference electrode ? Describe the construction and working of calomel electrode ? Is it a primary reference electrode or secondary reference electrode ? 2

(b) Why does an electrochemical cell stop working after some time ? Relate emf of a galvanic cell with equilibrium constant of the corresponding cell reaction. 2

SECTION–D

7. (a) What are 'Concentration cells' ? Derive an expression for the determination of emf of an electrolyte concentration cell with transference, of the type

$Pt, H_2 (1 atm) | HCl (a_1) || HCl (a_2) | H_2 (1 atm), Pt$ 2

(b) Discuss the principle underlying potentiometric titrations. How would you titrate an aqueous solution of NaOH against standard HCl solution ? 2

8. (a) Express the 'Free Energy Change' (ΔG) for a cell reaction in terms of emf of the cell and hence deduce the relation :

$$\Delta S = nF\left(\frac{\partial E}{\partial T}\right)_P$$ 2

(b) Calculate 'Liquid Junction Potential' at 298 K between two solutions of HCl of mean activities 0.1 and 0.01 respectively. Given that the transport number of cation is 0.85. 2

SECTION–E

9. (a) Two ice cubes are floating on the surface of water in the presence of water vapours. Determine the number of components present in the system.

(b) Write down 'Debye Huckel Onsagar' equation for strong electrolytes.

(c) Will the molar conductance at infinite dilution of a decinormal aqueous solution of a dibasic acid be the same as its equivalent conductance at infinite dilution or different ?

(d) What do you understand by temperature coefficient of emf of a galvanic cell.

(e) How can the feasibility of a cell reaction be predicted from its cell potential.

(f) Give two conditions which are necessary for validity of 'Distribution Law'. $6 \times 1 = 6$