

42174304(OC)\_III\_set1\_ Sol., Phase Equilibria -functional group Org. chem. B.Sc(Program)

This paper contains 4 pages

Your Roll. No. : .....

S.No. of Q. Paper :

Unique Paper Code :42174304 (Old Course)

Name of the Course :B.Sc(Program) – Core Chemistry

Name of the Paper :Solutions, Phase Equilibria, conductance, electrochemistry and functional group organic chemistry-II

Semester :III

Time: 3 Hours

Maximum Marks: 75

1. Write your Roll number, User ID, UPC of paper on the top of first Answer sheet.
2. **Attempt four questions. Attempt all parts of a question together.**
3. **Attempt any two questions from each SECTION A and SECTION B.**
4. Use Graph Sheet wherever required.
5. Use of non-programmable scientific calculator is allowed.
6. Use the internet only for Downloading/Uploading of your Q-paper/Answer sheets.

### Questions SECTION-A

Q1.

- a) Write the SI unit of ionic mobility.
- b) A solution of  $\text{AgNO}_3$  containing 0.00739 g of  $\text{AgNO}_3$  per gram of water was electrolyzed between silver electrodes. During the experiment, 0.078 g of silver was deposited in a silver coulometer placed in series. At the end of the experiment, the anodic solution contained 23.14 g of water and 0.236 g of  $\text{AgNO}_3$ . What are the transport numbers of  $\text{Ag}^+$  and  $\text{NO}_3^-$  ions?
- c) Explain
  - i) Conductivity decreases on dilution whereas molar conductivity increases.
  - ii) Arrhenius theory is not applicable to strong electrolytes.
- d) A substance exists in two solid modifications  $\alpha$  and  $\beta$  and also as liquid and vapour. At a pressure of 1 atm,  $\alpha$  melts at a lower temperature than  $\beta$  which melts at a higher temperature to form the liquid. Also,  $\alpha$  is denser than the liquid but  $\beta$  is less dense than the liquid. Assuming that no metastable equilibria are observed, sketch the pressure-temperature phase diagram showing the significance of each point, line and region. Also, show in the diagram all the triple points that can be observed.

Q2.

- a) For a reaction,  $M^{n+} + ne^- \longrightarrow M(s)$ . Write the Nernst equation for the given reaction.
- b) Explain
- Why ammonium nitrate or potassium nitrate is preferred for salt bridge?
  - The compounds of active metals such as Zn, Na and Mg are not reducible by hydrogen gas under standard conditions while those of noble metals such as Cu and Ag are reducible by hydrogen gas.
- c) The EMF of the cell:  
 $Sn, SnCl_2(0.5 M) | AgCl, Ag$   
 is 0.430 V at 25°C and 0.448 at 0°C. Calculate the free energy change  $\Delta G^\circ$ , enthalpy change  $\Delta H^\circ$ , entropy change  $\Delta S^\circ$  of the cell reaction at 25°C.
- d) For the concentration cell  $Pb | PbSO_4(s), H_2SO_4(m=1.0) | H_2SO_4(m=0.1), PbSO_4 | Pb$   
 Calculate the EMF of the cell
- Without transference of ions.
  - With transference of ions; given  $t_+(H^+) = 0.831$ .

Q3.

- In the phase diagram of water, at one point there exists an equilibrium between three states of water. What is this point called?
- All feasible electrochemical cells should have positive EMF values. Explain.
  - Explain, why we cannot use a voltmeter for determining the electromotive force (EMF) of a galvanic cell.
- At a temperature lower than CST, if we sweep from one extreme composition to the other, we will have to pass through the miscibility gap. Suggest an alternative path where this miscibility gap could be avoided.
  - Calculate  $\Delta H_{mix}$ ,  $\Delta S_{mix}$  and  $\Delta G_{mix}$  of one mole of toluene and two moles of benzene at 25°C, assuming ideality.
- When an immiscible liquid A was steam-distilled with water it gave a distillate 200 ml of which contained 57.2 ml of A. The boiling point for distillation was found to be 98.2°C at

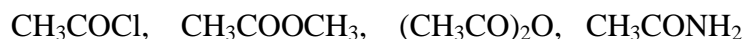
a pressure of 758 Torr. At this temperature the vapour pressure of water was 712 Torr. If the density of the liquid is  $1.68 \text{ g ml}^{-1}$ . what is the molar mass of liquid A?

0.75,6,6,6

### SECTION B

#### Q4

a) Arrange the following acid derivatives in decreasing order of reactivity with reasons.



b) How will you synthesize phenylalanine from potassium phthalimide? Give mechanism also.

c) Comment on the following facts:

i) All  $\alpha$ -amino acids are high-melting crystalline solids and soluble in water.

ii) Why is sucrose known as invert sugar? Write down the structure of sucrose molecule.

iii) Fructose is a pentahydroxy ketone, still it reduces Tollen's reagent or Fehling's solution.

d) How will you convert

i) Aniline to Benzoic acid

ii) Toluene to m-Bromotoluene

e) What are essential amino acids? Name any two and write their structures.

3, 3, 6, 6, 0.75

#### Q5

a) How do starch and cellulose differ in their structures? Why does starch give a blue colour with iodine?

b) What is the difference between epimers and anomers. Explain with examples.

c) Give test to differentiate the following:

Aniline and N-methylaniline

d) Write short note on the following:

i) Hoffmann bromamide degradation reaction

ii) Zwitterion structure of amino acids.

iii) Hell-Volhard-Zelinsky reaction

e) How will you separate a mixture of aspartic acid ( $pI=2.92$ ) and lysine ( $pI=9.7$ ) by electrophoresis using a buffer solution having a  $pH=6.0$ ?

f) What is ninhydrin reagent?

3, 3, 3, 6, 3, 0.75

## Q6

- a) Explain the following:
- Sucrose, a disaccharide is a non-reducing sugar while maltose (also a disaccharide) is a reducing sugar.
  - Coupling reactions of diazonium salts occur in mildly alkaline or mildly acidic conditions only. Explain giving all the involved structures.
- b)
- How ethylacetoacetate is synthesized using Claisen condensation? Give the mechanism.
  - Name two N-terminal protecting groups in the synthesis of a peptide
- c) Write the structure, using Haworth formula, for
- $\alpha$ -D-glucopyranose
  - $\beta$ -D-fructopyranose
  - $\beta$ -D-glucopyranose
- d) Give the mechanism for the formation of arenediazonium salt.
- e) Explain Edman degradation with mechanism.

6, 4, 3, 3, 2.75