

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

This paper contains 3 pages

Your Roll. No. : .....

S.No. of Q. Paper :

Unique Paper Code :42174304

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.(Do all parts of a question together).
3. Attempt any two question 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.
- 7.

### Questions SECTION-A

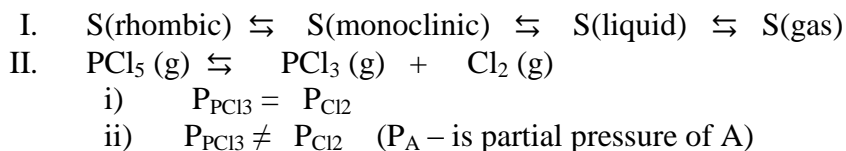
Q1.

- a) The following temperature composition data were obtained for a mixture of two liquids A and B at one atmosphere, where  $x$  is the mole fraction of A in the liquid and  $y$  is the mole fraction of A in the vapour, at equilibrium.

$t/^\circ\text{C}$	125	130	135	140	145	150
$x_A$	0.91	0.65	0.45	0.30	0.18	0.098
$y_A$	0.99	0.91	0.77	0.61	0.45	0.25

the boiling points are  $124^\circ\text{C}$  for A and  $155^\circ\text{C}$  for B. Plot the temperature-composition diagram for the mixture on a graph sheet. What is the composition of the vapour in the equilibrium with the liquid of composition i)  $x_A = 0.50$  and ii)  $x_B = 0.33$

- b) In the systems given below determine the number of phases, number of components with names and degrees of freedom using the Gibbs Phase rule.



12, 6.75

Q2.

- a) Write the electrode half-reactions, cell reaction and write Nernst equation for each of the following cells:
- i)  $\text{Zn}|\text{ZnSO}_4(\text{aq})||\text{AgNO}_3(\text{aq})|\text{Ag}$
  - ii)  $\text{Cd}|\text{CdCl}_2(\text{aq})||\text{HNO}_3(\text{aq})|\text{H}_2(\text{g})|\text{Pt}$
  - iii)  $\text{Pt}|\text{K}_3[\text{Fe}(\text{CN})_6](\text{aq}), \text{K}_4[\text{Fe}(\text{CN})_6](\text{aq})||\text{CrCl}_3(\text{aq})|\text{Cr}$

b) The conductivity of saturated solution of  $\text{BaSO}_4$  is  $3.48 \times 10^{-4} \text{ S/m}$  and the conductivity of pure water is  $0.50 \times 10^{-4} \text{ S/m}$  at 298 K. Calculate the solubility product of  $\text{BaSO}_4$ . (limiting molar conductance of  $\text{BaSO}_4$  is  $287.3 \times 10^{-4} \text{ S m}^2 \text{ mol}^{-1}$ .)

c) Why is it necessary to measure the cell potential under zero-current?

12, 4, 2.75

Q3.

a) A Hittorf cell fitted with silver-silver chloride electrodes is filled with HCl solution that contains  $0.3856 \times 10^{-3} \text{ g HCl}$  per g of water a current of 2 mA is passed for exactly three hours. The solutions are withdrawn, weighed and analysed. Total weight of the anode solution weighs 52.0461 g and contains 0.0133 g of HCl. Calculate the transference number of the  $\text{H}^+$ .

b) Distribution of  $\text{I}_2$  between  $\text{H}_2\text{O}$  and  $\text{CCl}_4$  at 298 K, at equilibrium the following results were obtained

$[\text{I}_2]$ (in water layer /mol dm <sup>-3</sup> ) $\times 10^4$ :	2.35	4.69	7.03	9.30
$[\text{I}_2]$ (in $\text{CCl}_4$ layer/mol dm <sup>-3</sup> ) $\times 10^2$ :	2.00	4.00	6.00	8.00

Show that these results obey the distribution law. Evaluate the distribution coefficient of  $\text{I}_2$  between carbon tetrachloride and water.

c) What is the cause of liquid-junction potential?. How it can be eliminated?

d) Explain why  $\text{H}^+$  and  $\text{OH}^-$  have exceptionally high ionic mobility in Aqueous media. Show schematically.

6, 6, 4, 2.75

### SECTION B

Q4.

a) How can you carry out the following transformations using diazonium salt formation as one of the steps?

i) Benzene  $\xrightarrow{\hspace{2cm}}$  1,2,4,6-tetrabromobenzene

ii) Toluene  $\xrightarrow{\hspace{2cm}}$  1,3-benzenedicarboxylic acid (Isophthalic acid)

b) Glucose and fructose give identical osazone with phenylhydrazine. Explain this fact.

c) Glycine is a low-molecular weight organic compound, yet it is a high-melting crystalline solid and more soluble in water than in benzene. Justify.

d) Write down the three isomeric amines represented by the molecular formula  $\text{C}_3\text{H}_9\text{N}$ . Give a chemical method to distinguish them.

e) What happens when aqueous solution of glucose is kept for some time? Name the phenomenon and discuss the mechanism involved.

6, 3, 2, 4, 3.75

Q5.

a) Outline the solid phase synthesis of Val-Gly.

b) Answer the following:

i) Convert fructose to glucose

ii) Convert Glucose to mannose

- c) N-ethyl-N-methylamine is chiral but non resolvable. However,  $C_6H_5N^+(CH_3)(C_2H_5)(C_3H_7)Cl^-$  is resolvable. Explain with the help of suitable structures.
- e) Between acrylic acid and propionic acid, which one is more acidic and why?
- f) How can you use the method of Gabriel phthalimide synthesis to synthesize alanine? Give the reactions with the mechanism. Define isoelectric point.

4, 3, 3, 3, 2, 3.75

Q6.

- a) How can a mixture of arginine and aspartic acid be separated by electrophoresis using a buffer solution having a pH=6.0?
- b) Coupling reactions of diazonium salts occur in mildly alkaline or mildly acidic conditions only. Explain giving all the involved structures.
- c) How ethylacetoacetate is synthesized using Claisen condensation? Give the mechanism.
- d) Write short note on the following:
- Secondary structures of proteins
  - Hell-Volhard-Zelinsky reaction.
- e) Explain why D-fructose reduces Fehling's solution although it is a ketohexose.

3,3,3,5,4.75