Unique Paper Code : 42174304_OC

Name of the Paper : Solutions, Phase Equilibrium, Conductance, Electrochemistry& Functional Group Organic Chemistry-II

Name of the Course : B.Sc (Prog) Life Sciences /Physical Sciences

Semester : III

Duration : 3 hours

Maximum Marks : 75

Instructions for Candidates:

i. Following details must be written on first page:
• University Roll No.:
• Unique Paper Code:
• Class:
• Course:
• Semester:
• Paper Name:
ii. Put page numbers on every page of the answer script.
iii. **Attempt and upload Section A and B separately.**
iv. Attempt **two** questions from **each** section and **four** questions in all.
iv. Marks are mentioned at the end of each question.
v. Attempt all parts of a question together.

Section A: Physical Chemistry

*Attempt any **two** questions.*

1. (a) A pair of partially miscible liquids shows upper CST if, an impurity which is soluble in both is added, the upper CST is .....while an impurity which is soluble in one of the liquids, upper CST ..... . **(0.75)**

(b) Explain, what do you understand by an ideal solution. Show that for an ideal solution $\Delta_{mix}H = 0$ and $\Delta_{mix}V = 0$, where $\Delta_{mix}H$ and $\Delta_{mix}V$ are the changes in enthalpy and volume on mixing various constituents of the liquid solution. Suggest a possible reason for $\Delta_{mix}H$ and $\Delta_{mix}V$ being equal to zero. **(6)**

(c) (i) Explain the Lever Rule.

(ii) What are azeotropic mixtures? Is it possible to separate the components of an azeotropic system using distillation? Explain. **(6)**

(d) A solute X is distributed between two immiscible liquids B and C with the value of the distribution coefficient, $[X]_C/[X]_B$, equal to 10. The concentration units are expressed in terms of grams of solute per dm^3 of solvent. It is desired to remove 99% of the amount of X from a solution containing 1 g of X in 100 cm^3 of B by extraction with successive 10 cm^3 portions of solvent C. Calculate the approximate volume of solvent C **(6)**

required for this purpose.

2. (a) What does '2' represent in the Gibbs phase rule, F=C-P+2? **(0.75)**

(b) (i) $KCl\text{-}NaCl\text{-}H_2O$ is a three component system whereas $KCl\text{-}NaBr\text{-}H_2O$ is a four component system. Explain.

(ii) In the phase diagram of water, the slope of the fusion curve is negative. Explain. **(6)**

(c) Draw the phase diagram of $FeCl_3\text{-}H_2O$ system and discuss its salient features. **(6)**

(d) (i) Draw the conductometric titration curve of a weak acid against a strong base and explain the nature of the plot.

(ii) The molar conductances at infinite dilution for sodium acetate and hydrogen chloride at 30°C are 91.0×10^{-4} and 426.16×10^{-4} S m^2 mol^{-1}, respectively. Also for H^+ ion in HCl, t_+ is 0.821 and for CH_3COO^- ion in CH_3COONa, t_- is 0.556. Assuming that, $t_\pm = t_\pm^0$, calculate Λ_M^0 for CH_3COOH. **(6)**

3. (a) Which one is preferred to make a salt bridge: KCl or KNO_3? **(0.75)**

(b) (i) Why does conductivity of an electrolyte solution decrease with dilution while molar conductivity increases?

(ii) How is ionic velocity different from ionic mobility? **(6)**

(c) (i) Write down the principles underlying potentiometric titration. What are the advantages of potentiometric titration?

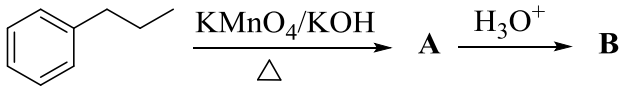
(ii) What is the role of salt bridge in an electrochemical cell? **(4,2)**

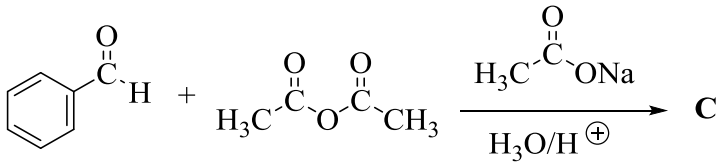
(d) The EMF of the Standard Weston cell written as
$Cd(Hg), CdSO_4.8/3H_2O(s)| \,| \, CdSO_4(sat.), Hg_2SO_4\,(s), Hg$
in which the cell reaction is
$Cd(Hg) + Hg_2SO_4(s) + 8/3H_2O(l) \leftrightarrow CdSO_4.8/3H_2O(s) + 2Hg(l)$
is 1.0185 V at 25°C. Calculate the free energy change $\Delta G°$, enthalpy change $\Delta H°$, entropy change $\Delta S°$ for the cell reaction at 25°C if the temperature coefficient of EMF of the cell is 5.00×10^{-5} V K^{-1}. Given that F= 96485 C mol^{-1}. **(6)**

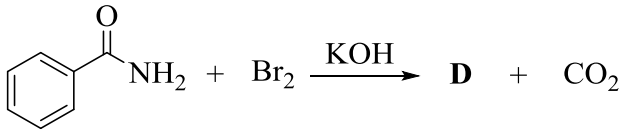
Section B: Organic Chemistry

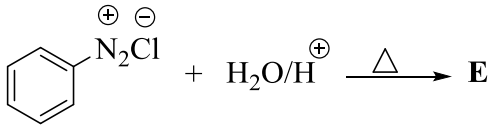
*Attempt any **two** questions.*

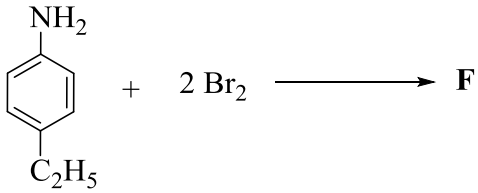
4. (a) Predict the structure of products (A-F) in the following reactions:











(b) Explain the following name reactions with suitable examples.

(i) Hell-Volhard-Zelinsky reaction.

(ii) Schotten-Baumann reaction.

(c) How will you synthesize the followings?

(i) Acetic acid using acidic hydrolysis of ethyl acetate.

(ii) Glycine using Streker's synthesis.

(d) Write the reaction involve for the conversion of an acid chloride to an amide.

(6, 6, 5, 1.75)

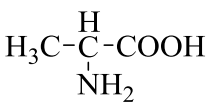
5. (a) Write short notes on:

i. Carbylamine test

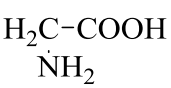
ii. Zwitter ion

iii. Claisen condensation reaction.

(b) Deabbreviate: *t-BOC* and *DCC*. Using these, write all the steps involve for the synthesis of ala-gly dipeptide.



Alanine



Glycine

(c) How will you separate Arginine, Alanine and Aspartate by electrophoresis technique?

(Isoelectric points for Arginine, Alanine and Aspartate are 10.76, 6.02, and 2.98, respectively).

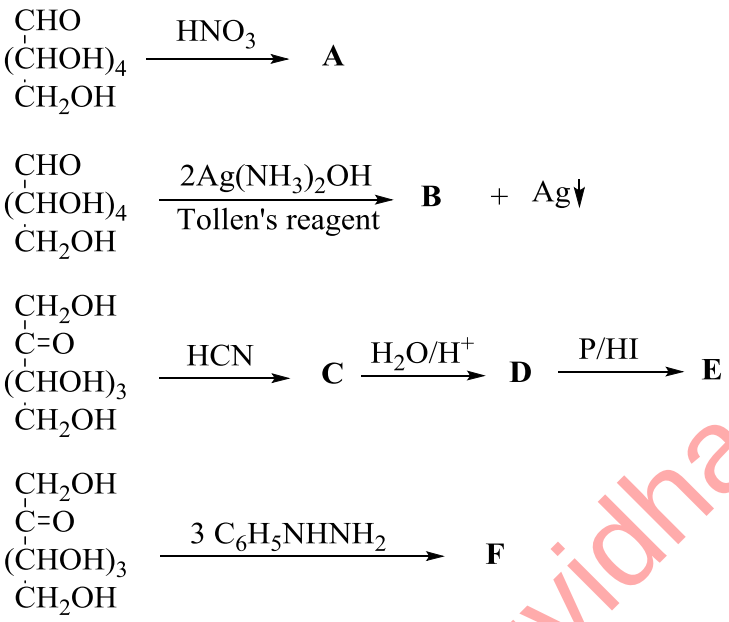
(d) Draw the structure of Edman's reagent. Write the PTH-amino acid structure formed, when it applies on the following structure.

ala-gly-his-val-asp

(e) Draw the structure of violet/purple coloured complex which is obtained by glycine with ninhydrin.

(6, 6, 4, 1.75, 1)

6. (a) Write the structure of the products (A-F) of the following reactions:



(b) How will you convert D-arabinose to D-glucose and D-mannose by Killiani-fisher synthesis?

(c) What does it mean by mutarotation. Explain by taking D-glucose as an example.

(d) Draw the following structures:

(i) α-D-Glucose and β-D-Glucose (Haworth projection)

(ii) α-D-Fructopyranose and β-D- Fructopyranose (Haworth projection)

(e) Maltose is reducing sugar while sucrose is not. Why?

(6, 4, 2, 4, 2.75)