

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FOURTH SEMESTER EXAMINATION, MAY 2018

SECOND YEAR (BATCH 2016-19)

CHEMISTRY (General)

Date : 23/05/2018

Time : 11.00 am – 2.00 pm

Paper : IV

Full Marks : 75

[Use one Answer Book for each Group]

Group-A

Unit I

Answer **any one** question:

[1×15]

1. a) Outline the cyanide process for extraction of silver. Give relevant equations. 4
b) Explain the followings:
(i) The first ionisation energy of gold is higher than silver.
(ii) $K_3[Cu(CN)_4]$ is colourless but $[Cu(NH_3)_4]SO_4$ is deep blue. 2+2
c) Depict the principle for the preparation of $KMnO_4$ from pyrolusite. Explain with equation what happens when $KMnO_4$ reacts with oxalic acid in acid medium. 3+1
d) 3.0 gm of an Iron ore is dissolved in acid at reducing condition and the volume is made upto 250 ml. 25 cc of the solution is pipetted out and titrated with $\left(\frac{N}{20}\right) K_2Cr_2O_7$ using BDS as indicator and the titre value is 12.6 cc. Calculate the % of Fe in the ore. (At. Wt. of Fe = 55.58 gm). 3
2. a) Write the appropriate reactions for the preparation of $K_2Cr_2O_7$ from chromite. 3
b) 100 ml of hard water is titrated with $\frac{N}{50}$ EDTA using pH 10 buffer and EBT as indicator and the titre value is 35.5 ml. Calculate the hardness of water in terms of $CaCO_3$. 3
c) What is metal ion indicator? Explain its role in complexometric titration. 1+3
d) Explain the following giving balanced equations – A blue solution of copper sulphate turns brown on addition of potassium iodide at pH ~3 to 4. This brown colour is discharged by sodium thiosulphate and on adding excess of reagent a white solid settles down. 3
e) How is potassium ferrocyanide prepared? 2

Unit II

Answer **any one** question:

[1×10]

3. a) State and explain 'Schulze-Hardy rule' for the coagulation of colloids? 3
b) An excess amount of a sparingly soluble salt $KHTa$ is added to water.
(i) Write down the form of the equilibrium that is formed.
(ii) Define the terms activity and concentration solubility product in this context. 2+2
c) The solubility of calcium fluoride in water at $18^\circ C$ is 2.05×10^{-4} mole per liter. Calculate its solubility product with unit if any. 2+1
4. a) Write short notes on
(i) Brownian motion (ii) dialysis 2+2
b) You have a colloidal solution where the colloid particles are negatively charged w.r.t the dispersion medium. If 0.2 mole $NaCl$ completely sediments the colloid how much $Al_2(SO_4)_3$ will be required to do the same. 2
c) Explain the term "Electrophoresis". 2

- d) When H_2S is passed through a solution of Cu^{+2} and Zn^{+2} in presence of HCl only CuS is precipitated — Explain. 2

Group-B

Unit I

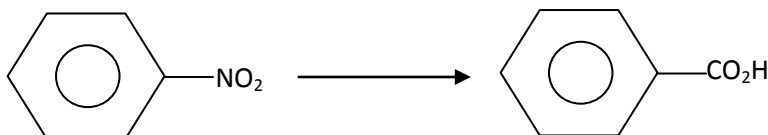
Answer **any one** question:

[1×15]

5. a) Write how phenol may be prepared from Cumene? 2

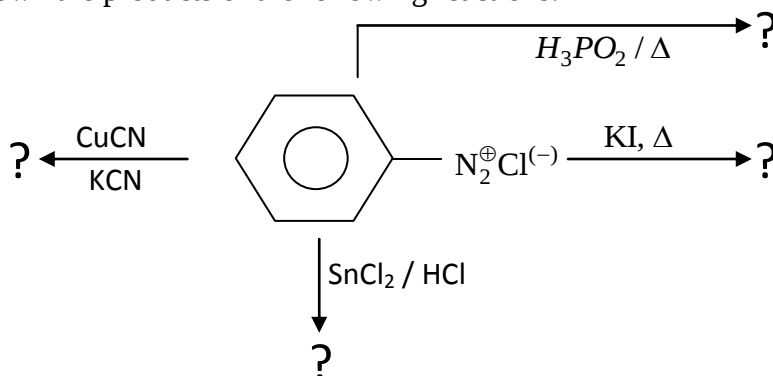
- b) Convert the following: 2 × 1

(i)



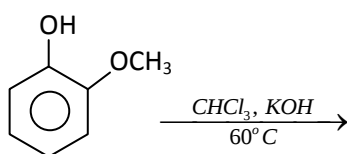
(ii) $\text{CH}_3\text{MgI} \longrightarrow \text{CH}_3\text{CO}_2\text{H}$

- c) Write down the products of the following reactions: 2

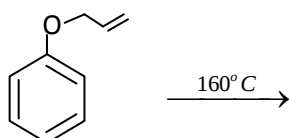


- d) Ar-NH_2 (Ar = aromatic group) forms diazonium salts but $\text{R-CH}_2\text{NH}_2$ (R = aliphatic group) does not. Explain. 2
- e) Complete the following reaction (no mechanism required): 2×2

(i)



(ii)

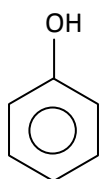


- f) Compare the acid strength for the following pair of molecules: 1½ × 2

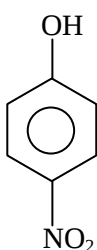
(i) $\text{CH}_3\text{CO}_2\text{H}$ and $\text{Cl}_3\text{CCO}_2\text{H}$

(ii) CH_3OH and PhOH

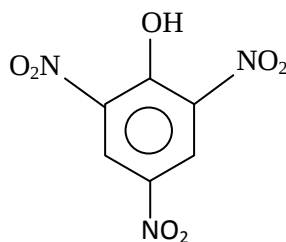
6. a) Arrange the following molecules in increasing order of acidity with proper explanation: 3



I



II

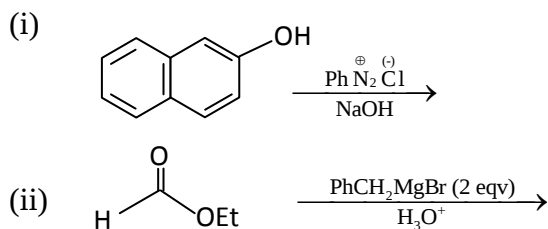


III

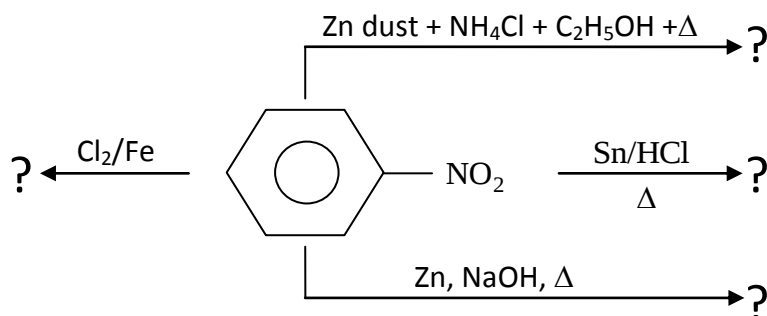
- b) Write short note (**any two**): 2×2

(i) Kolbe-Schmitt Reaction

- (ii) Ester hydrolysis (B_{AC} 2 mechanism) 2
 (iii) Fries-Rearrangement
 c) What will be the action of sodium nitrite and dilute hydrochloric acid in cold condition (0° ~ 5° C) on the following compounds: (i) Methylamine (ii) Dimethyl amine (iii) Tri methyl amine (iv) Aniline. 2
 d) Convert the following: 2×2



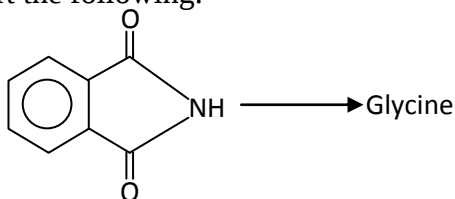
- e) Write down the products of the following reactions: 2



Unit II

Answer **any one** question:

7. a) How will you synthesise alanine by the Strecker's method? [1×10] 2
 b) Glucose reduces Tollen's reagent but sucrose does not. Explain. 2
 c) Define the following terms: 2×1
 (i) Zwitter ions (ii) isoelectric point.
 d) Complete the following conversion: 3
 aldohexose $\longrightarrow$ aldopentose
 e) Predict the product in the following reaction: 1
 D-glucose $\xrightarrow[\text{H}_2\text{O}]{\text{Br}_2}$
8. a) Write short note on (**any two**): 2×2
 (i) Osazone formation (ii) Kiliani Fischer synthesis (iii) Mutarotation of glucose
 b) Write the structure of the following compounds as mentioned: 2
 (i) L-alanine (Fischer projection)
 (ii) Methyl- α -D-glucopyranoside (Haworth projection)
 c) Convert the following: 2



- d) How will you prove by chemical reaction that a Glucose molecule contains: 2
 (i) -CHO group and (ii) five hydroxyl groups.

Group-C

Unit I

Answer **any one** question:

[1×12]

9. a) State Le Chatelier's principle and apply it to predict the effect of increase in T and P on the yield of SO_3 in the following reaction:
 $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) = 2\text{SO}_3(\text{g}) + Q$ 5
- b) "The efficiency of heat engine cannot be 1."— Justify. 2
- c) What are the conditions of spontaneous processes from the thermodynamic point of view? Comment on the point of view of Gibbs free energy and entropy. 3
- d) Why the entropy can be treated as state function? 2
10. a) Write down the second law of thermodynamics from the point of direction. 2
- b) Proof that $\Delta G = \Delta H - T\Delta S$ 3
- c) Show that $K_p = K_c (RT)^{\Delta n}$; where Δn is the change in the no. of moles in a chemical reaction. 2
- d) (i) The equilibrium constant for the reaction
 $2\text{CO}_2 + \text{O}_2 = 2\text{CO}$
is K_1 and that for the reaction
 $\text{H}_2 + \frac{1}{2}\text{O}_2 = \text{H}_2\text{O}$
is K_2 . Find K_p for the reaction
 $\text{H}_2 + \text{CO}_2 = \text{H}_2\text{O} + \text{CO}$
All in gaseous state. 3
- (ii) The free energy change also leads to the same result. Can you confirm it? How? 2

Unit II

Answer **any one** question:

[1×13]

11. a) State laws on osmotic pressure of dilute solution and derive Vant Hoff equation. 4
- b) Write short notes on Raoult's law. 2
- c) "Colligative properties are intensive." Comment. 3
- d) What do you mean by azotropic and eutectic mixture? Give some examples. 3
- e) What is triple point temp.? 1
12. a) Which of the following aqueous solutions has highest freezing point depression and why?
(i) 0.1 (M) glucose (ii) 0.1 (M) FeCl_3 (iii) 0.1 (M) KCl . 3
- b) What is van't Hoff factor 'i'? 2
- c) Find the degrees of freedom in the reaction mixture: $\text{CaCO}_3(\text{s}) = \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$ 2
- d) Draw the phase diagram of H_2O and explain the nature of curve. 3
- e) When 3.33 gm urea is dissolved in 250 gm water, the freezing point of water is depressed by 0.413°C . Calculate the molecular wt. of urea. Cryoscopic constant of water is given as 1.86° . 3

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