RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FOURTH SEMESTER EXAMINATION, MAY 2017

SECOND YEAR [BATCH 2015-18]

Date : 25/05/2017 **CHEMISTRY (General)**

Time : 11 am – 2 pm **Paper :** IV Full Marks : 75

[Use a separate Answer Book for each group]

(*Attempt <u>one</u> question from <u>each Unit</u>*)

Group - A

Unit I [13 marks]

1. a) Discuss the preparation of $K_2Cr_2O_7$ from chromite. Explain with equation that $K_2Cr_2O_7$ is a good oxidising agent. [2+2]
   b) What happens when $FeCl_3$ reacts with $K_4[Fe(CN)_6]$? Give equation. [2]
   c) What is anodising? [2]
   d) Write short note on — [2·5×2]
      i) Electroplating ii) Galvanising

2. a) Discuss the preparation of $KMnO_4$ from pyrolusite. What happens when $KMnO_4$ reacts with oxalic acid in acid medium? Give equation. [2+2]
   b) Write the name and formula of one import ore of nickel and give the extraction procedure of 'Ni' from the ore. Give balance chemical equation and mention one important use of Ni. [1+3+1+1]
   c) Comment on the most stable oxidation state of Cu, Ag and Au. [3]

Unit II [12 marks]

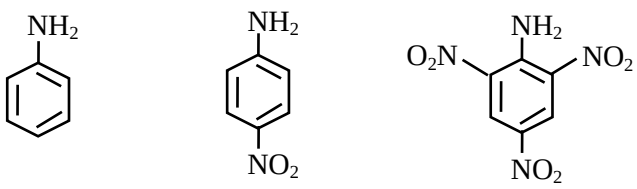
3. a) Why EDTA is not primary standard? Complexometric titration involving EDTA, always performed at a fixed pH or buffer medium; comment. [2+2]
   b) Give the flow-chart for the gravimetric estimation of nickel. [2]
   c) Explain systemic error with suitable example. [2]
   d) Discuss the principle of estimation of copper iodometrically. [2]
   e) What is gravimetric factor? Give one example. [2]

4. a) Determine the acidimetric and oxidimetric equivalent weight of $KH(IO_3)_2$ [taking M.Wt of $KH(IO_3)_2$ = M] [2]
   b) Write the name and formula of one important indicator, used in complexometric titration. [2]
   c) What are the common error in iodometry / iodimetry? How can you minimise these error? [3]
   d) Solubility of CaF_2 is 0·0002 mole/lit. Calculate its solubility product. [2]
   e) Define accuracy and precision. How they differ? [3]

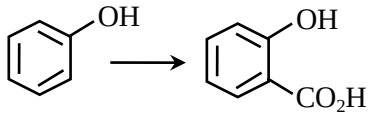
Group - B

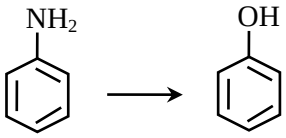
Unit III [15 marks]

5. a) Arrange the following compounds in increasing order of basicity with proper explanation. [3]



b) Carry out the following transformations. [2·5×2]

i) 

ii) 

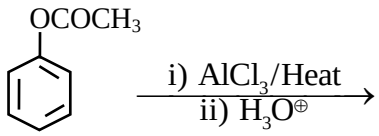
c) Convert : i) Benzene → Benzoic acid (Using Grignard Reagent)
ii) Acetone → 2-Methyl-2-propanol [2×2]

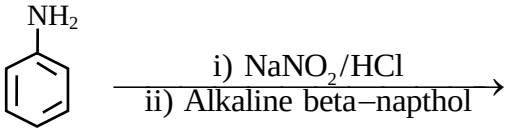
d) Write Reduction products of $C_6H_5NO_2$ under acidic, neutral and alkali medium. [3]

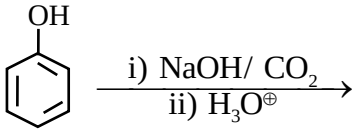
6. a) Write short notes on (**<u>any two</u>**) : [2×2·5]
i) Diazo-Coupling Reactions ii) Fries Rearrangement iii) Hofmann degradation

b) Separate out a mixture of $MeNH_2$, Me_2NH and Me_3N. [3]

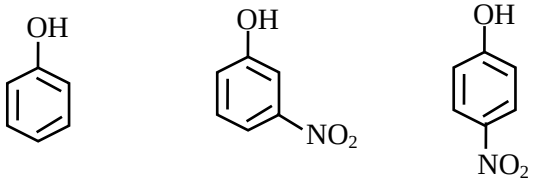
c) Write down the products of the following reactions. [2×3]

i) 

ii) 

iii) 

d) Arrange the following phenolic compounds in increasing order of acidity. [1]



<u>Unit IV</u> [10 marks]

7. a) Discuss the Strecker synthesis of alanine. [2]
b) convert (D)-arabinose to (D)-Glucose using Kiliani-Fischer method. [2]
c) Synthesise Glycine (By Gabriel's Method] [3]
d) Explain why glucose and fructose from the same osazone. [3]

8. a) Write short notes on (**<u>any two</u>**) : [2×2]
(i) Osazone ii) Zwitterion iii) Epimerization
b) What do you mean by mutarotation of glucose? [2]
c) Between α–(D)-glucopyranose and β–(D)-glucopyranose which one is more stable and why? [2]
d) Why do you mean by isoelectric point of an amino acid. [2]

<u>Group - C</u>

<u>Unit V</u> [12 marks]

9. a) Give the expression for the efficiency of a Carnot cycle in terms of the two working temperatures of the engine. From there calculate the efficiency of a Carnot engine working between temperatures of 300K and 100K. [3]

b) Calculate the entropy change when 100Kg of liquid water at 27°C transforms to steam at 100°C (at 1 atm pressure). Given : specific heat (at constant pressure) for water C_P = 4180 J kg^{-1}, latent heat of vaporisation for water = 23×10^5 Jkg^{-1}. [3]

c) Starting with Clausius inequality show that at constant temperature and pressure for any spontaneous process $\Delta G < 0$. [3]

d) PCl_5 is 41·7% dissociated at 180°C under atmospheric pressure. Calculate the equilibrium constant using partial pressure. Also calculate degree of dissociation at 1 atm. [3]

10. a) Of the three equilibrium constants K_P, K_C and K_X : which one/ones is /are dependent on the pressure. Justify your answer. [3]

b) Starting from the definition of Gibbs free energy (G) prove that $\left(\frac{\partial G}{\partial T}\right)_P = -S$. [2]

c) Write down the statistical mechanical definition of entropy. [2]

d) Define La Chatelier's principle and explain the effect of pressure and temperature on equilibrium. [3]

e) Show that K_P of the decomposition of $CaCO_3$(s) to CaO(s) is only dependent on the pressure. [2]

Unit VI [13 marks]

11. a) Positively charged $Fe(OH)_3$ sols are coagulated by divalent sulphide ions more effectively than monovalent ions. Explain. [2]

b) Name the disperse phase (solid, liquid or gas) and dispersion medium (solid, liquid or gas) from the following colloids — Smoke, Smog, Butter, Soup foam. [2]

c) State the Raoult's law for a binary solution. Is it valid for real solutions at all concentration ranges of the solute? [3]

d) Draw the schematic phase diagram for CO_2, representing all the regions and curves. [4]

e) State the Gibbs phase rule. [2]

12. a) What do you mean by azeotropic mixture? [2]

b) Write short notes on [2×2]

i) Tyndall Phenomenon ii) Schultze-Hardy rule

c) Lyophillic Colloids are stabilized through charge of particles— true or false, explain. [2]

d) What is the phenomenon called which makes a sol, like that of AgI, scatter light? How does the intensity of scattering depend on the wavelength of the incident radiation. [2]

e) It is found that for Fe_2O_3, that forms a positive lyophobic sol, the minimum concentration in millimoles of various electrolytes required are KCl – 101, K_2SO_4 - 0·219 and $K_3Fe(CN)_6$ – 0·096. Justify these experimental results using some theoretical principle. [3]

———— × ————