RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. FOURTH SEMESTER EXAMINATION, MAY 2015

SECOND YEAR

Date : 28/05/2015 **CHEMISTRY (General)**

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

[Use a separate Answer book for each group]

Group – A

Unit - I

[*Answer **any one** question*]

1. a) Explain inert pair effect with examples. [2]
   b) Give the preparation and two uses of the following compounds (**any two**) : [3+3]
      i) $KMnO_4$ ii) $K_4[Fe(CN)_6]$ iii) $K_2Cr_2O_7$
   c) Give the name and formula of the principal ore of chromium. How is it extracted from this ore? [2+3]

2. a) What is electroplating? Explain the phenomenon with gold salt. [3]
   b) Give a comparative account of Zn-Cd-Hg with particular reference to their electronic configuration, oxidation state and any one of the chemical properties. [3]
   c) Comment on the oxidation states of copper, silver and gold. [2]
   d) Write the balanced equation of the reaction of potassium dichromate with Mohr's salt in presence of dilute H_2SO_4 and hence find the equivalent weight of potassium dichromate. (K – 39, Cr – 52). [2+3]

Unit - II

[*Answer **any one** question*]

3. a) What is dichrometry? Write down the principle for the estimation of Fe^{2+} by $K_2Cr_2O_7$. Write down the role of H_3PO_4 in the above reaction. [1+2+2]
   b) Describe the method of estimation of chloride gravimetrically, indicating principle, reaction and calculation.
      What do you mean by "accuracy" and "precision" of an analytical method of determination? [3+2]
   c) Discuss the principles of complexometric titration. [2]

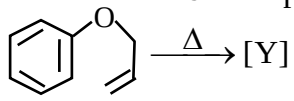
4. a) Write the principle for the estimation of Na_2CO_3 and $NaHCO_3$ from a mixture. [2]
   b) Write down the structure of EDTA and state the method for estimation of Ca^{2+} complexometrically. [1+3]
   c) Draw a comparative study between $K_2Cr_2O_7$ and $KMnO_4$ as on oxidant in the redox titration. [2]
   d) Explain the term and importance of solubility product and common ion effect properly with examples. [4]

Group – B

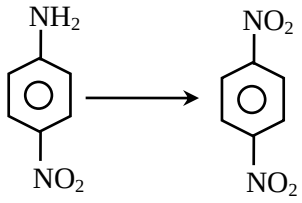
Unit - I

[*Answer **any three** questions*]

5. a) Write short note on $B_{AC}2$ mechanism of ester hydrolysis. [3]
   b) Between acetic acid and benzoic acid which one is stronger and why? [2]

6. Give mechanism of the product [X] and [Y] formed in the following reactions [2×2·5]
   a) $PhCOOH + CH_3\overset{18}{O}H \xrightarrow[\text{reaction}]{B_{AC}2} [X]$
   b)  $\xrightarrow{\Delta}$ [Y]

7. a) Write short notes on reduction of nitrobenzene in acidic, alkaline and neutral medium. [3]

b) Convert :  [2]

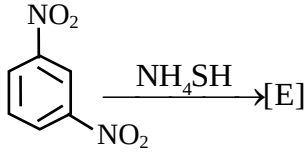
8. a) Predict the products of the following conversion

$$CH_3Br \xrightarrow[\text{ether}]{\text{Mg in}} [A] \xrightarrow[\text{dil.HCl}]{CO_2} [B] \xrightarrow{\text{liq.}NH_3} [C] \xrightarrow[Br_2]{\text{alc.KOH}} [D]$$

Or,

Explain the Heinsberg's method of 1°, 2°, 3° amine separation. [3]

b) Predict the product [E] in the following reaction. [2]



9. a) Write short notes on (**<u>any one</u>**) : [3]

i) Kolbe reaction ii) Reimer-Tiemann reaction

b) Between p-nitrophenol and phenol, which one is more acidic and why? [2]

<u>Unit - II</u>

[*Answer **<u>any two</u>** questions*]

10. a) Glucose and fructose form fame osazone – explain with reason. [3]

b) How will you prove by chemical reaction that a glucose molecule contains—

i) CHO group and ii) five –OH groups? [2]

11. a) What is Mutarotation? [2]

b) How will you convert an aldopentose to an aldohexose? [3]

12. a) Write short note on epimerization. [3]

b) How will you distinguish between glucose and fructose by a chemical test? [2]

<u>Group – C</u>

<u>Unit - I</u>

[*Answer **<u>any one</u>** question*]

13. a) Draw a Carnot cycle on P-V diagram. Deduce the expression for the efficiency of a Carnot cycle working between two temperatures T_1 and T_2 ($T_1 > T_2$). [2+4]

b) For the reaction $2H_2S(g) \rightleftharpoons 2H_2(g) + S_2(g)$, find out a relation among K_P, α and P. Explain what will be the effect of inserting an inert gas on the equilibrium of a reaction at constant pressure and constant volume respectively. [3+3]

14. a) Write down the thermodynamic definition of entropy. [2]

b) Starting with Clausius Inequality show that the entropy of the universe is increasing with time. [3]

c) S, ω are the entropy and the thermodynamic probability, respectively of a system at a given state. Prove that $S = k \ln \omega$. [3]

d) A general chemical / transformation (at constant T, P) can be represented as : $aA + bB + ... \rightleftharpoons rR + sS + ...$ show that for the above process $\Delta G^\circ = -RT \ln K_P$ (A, B, R, S are all ideal gases) [4]

Unit - II

[*Answer **any one** question*]

15. a) State Roult's law of elevation of boiling point. [2]

b) Arrange with explanation the following solution in the increasing order of their osmotic pressure : 0·1 (M) sugar solution, 0·1 (M) NaCl solution and 0·1 (M) H_2SO_4 solution. [3]

c) Write down the phase rule explaining phase, component and degrees of freedom. [3]

d) Why anhydrous ethanol cannot be prepared by fractional distillation of ethanol water mixture? [2]

e) What is Schultz-Hardy rule? Why $MgCl_2$ is better coagulant than KCl for As_2S_3 sol? [1+2]

16. a) Plot the following quantities for an ideal solution (explain the equations that you use for plotting) — [3×2]

i) ΔT_f (freezing point depression) against molality of solution.

ii) Vapor pressure of solvent against mole fraction of solute.

iii) Osmotic pressure of a solution against concentration.

b) i) Draw phase diagram of CO_2. [2]

ii) Calculate the no. of phases, no. of components and degrees of freedom for CO_2 at triple point. [3]

iii) 'Micellization property helps soap to remove stain from clothes' —explain. [2]

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