

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.SC. THIRD SEMESTER EXAMINATION, DECEMBER 2012

SECOND YEAR

CHEMISTRY (Honours)

Date : 15/12/2012

Time : 10.30 am – 11.30 am

Paper : III (Gr. C)

Full Marks : 25

Group – C

UNIT-I

(Answer **any one** question)

1. a) What are superacids? Give two examples. How the acidity of such solutions is expressed? Mention their uses. 1+1+1+1
- b) Calculate the equilibrium constant value for the disproportionation reaction of copper (I) ion from the Latimer diagram of copper.
- $$\text{Cu}^{+2} \xrightarrow{0.15} \text{Cu}^{+1} \xrightarrow{0.52} \text{Cu}$$
- If the copper (I) ion is dissolved in dimethyl sulfoxide as a solvent, the equilibrium constant value is only about 2. Suggest an explanation. 2+2
- c) In the following solution equilibrium, will the products or reactants be favoured? Explain, 1+1
- $$2\text{Fe}(\text{OCN})_3(\text{aq}) + 3\text{Fe}(\text{SCN})_2(\text{aq}) \rightleftharpoons 2\text{Fe}(\text{SCN})_3(\text{aq}) + 3\text{Fe}(\text{OCN})_2(\text{aq})$$
- d) Establish the Nernst equation for $\text{O}_2(\text{g})/2\text{H}_2\text{O}(\text{l})$ couple at 25°C for which $E^\circ = 1.23$ volts. Find the reduction potential of the couple at pH=7 when the partial pressure of $\text{O}_2(\text{g})$ is 0.2 bar at 25°C. 1+2
2. a) What is formal potential? How does it differ from standard potential? 1+1
- b) Using Pauling's rules predict the structural formulae of the following acids: 3
- $$\text{H}_3\text{PO}_4 (\text{PK}_a = 2.12); \text{H}_3\text{PO}_3 (\text{PK}_a = 1.8) \text{ and } \text{H}_3\text{PO}_2 (\text{PK}_a = 2.0)$$
- c) Calculate the concentrations of Cu^{+2} and Cd^{+2} ions remaining in solution after precipitation by excess H_2S from a 0.1 M solution of the ions in 0.3 M HCl medium. 3
- [For H_2S $K_1 = 9.1 \times 10^{-8}$; $K_2 = 1.2 \times 10^{-15}$ solubility products of CuS and CdS are 1×10^{-44} and 5×10^{-25} respectively]
- d) Justify the role of Zeimermann-Reinhardt solution in permanganatometric titration of iron (II) in HCl medium. 3
- e) Predict the direction of the following reaction: $\text{BF}_4^- + \text{BH}_4^- \rightleftharpoons \text{BF}_3\text{H}^- + \text{BH}_3\text{F}^-$. 2

UNIT-II

(Answer **any one** question)

3. a) Molar conductance values of 0.001 M solutions of the compounds $\text{PtCl}_4.6\text{NH}_3$, $\text{PtCl}_4.5\text{NH}_3$, $\text{PtCl}_4.4\text{NH}_3$, $\text{PtCl}_4.3\text{NH}_3$, $\text{PtCl}_4.2\text{NH}_3$ and $\text{PtCl}_4.\text{NH}_3.\text{KCl}$ are 523, 404, 229, 97, 7 and 107 $\text{ohm}^{-1}\text{cm}^2$ respectively. Suggest Werner's formulation of the compounds. 3
- b) Distinguish between extrinsic semiconductors and intrinsic semiconductors. 3
- c) Suggest IUPAC names of the following coordination compounds: 2
- i) $\text{K}_2 [\text{OsCl}_5\text{N}]$
- ii) $[(\text{H}_3\text{N})_5\text{Co}-\text{O}_2-\text{Co}(\text{NH}_3)_5](\text{NO}_3)_4$
- d) Explain 'Walsh Rule' for linear and bent molecules. Illustrate the structure of BeH_2 with the help of Walsh diagram. 4

4. a) Construct a molecular orbital diagram for Carbon monoxide and predict its dipole moment value and mode of coordination with hard and soft acid centers. 4
- b) What do you mean by 'Labile complexes' and 'Inert complexes'? Explain with suitable example. 3
- c) A solution containing 0.319 g of a hydrate isomer, with molecular formula $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ was passed through a cation exchange resin in acidic form and the acid so liberated was neutralized with 19 ml of 0.125 M sodium hydroxide. Identify the isomer. 3
[Molecular weight of $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ = 266.35]
- d) Distinguish between chelated complex and non-chelated complex. 2

