

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

M.A./M.SC. SECOND SEMESTER EXAMINATION, MAY-JUNE 2013

FIRST YEAR

APPLIED CHEMISTRY

Date : 22/5/2013

Time : 11 am – 1 pm

Paper : VI

Full Marks : 50

[Use separate Answer Books for each group]

(Answer **any one** question from **each group**)

Group - A

1. a) Explain the intense colour of Prussian blue. [3]
b) Explain the relative position of iodide ion in respect of fluoride ion in the spectrochemical series. [3]
c) Common oxidation states of gold are +3 and +1 but common oxidation state of silver is +1. Justify. [3]
d) State how diamagnetism is developed in coordination compounds. [2]
e) Ions with T ground terms possess magnetic moment higher than spin-only value. Justify. [2]
2. a) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ absorbs at $8,500\text{ cm}^{-1}$, $13,800\text{ cm}^{-1}$ and $25,300\text{ cm}^{-1}$. Calculate $10Dq$ and B from this data. [3]
b) CuFe_2O_4 exhibits an inverse spinel structure but ZnFe_2O_4 exhibits normal spinel structure. Comment. [3]
c) Explain the difference of stereochemistry between $[\text{NiCl}_4]^{2-}$ and $[\text{PtCl}_4]^{2-}$. [2]
d) $\text{K}_3[\text{CoF}_6]$ is paramagnetic but $\text{K}_4[\text{NiF}_6]$ is diamagnetic though both are d^6 system. Explain. [2]
e) $\text{Cu}_2(\text{OAc})_4 \cdot 2\text{H}_2\text{O}$ exhibits subnormal magnetic moment. Explain. [3]

Group - B

3. a) How nanoparticles can be synthesised? [2]
b) What do you mean by 'molecular switch' and 'molecular recognition'? [$2 \times 1\frac{1}{2}$]
c) Write notes on (**any one**) : (i) detonation velocity, (ii) C-4 explosives [2]
d) Discuss Hume-Rothery Rules and mention the difference between substitutional alloys and intermetallic compounds. [3+2]
4. a) What do you mean by 'over oxidised' and 'under oxidised' explosives? [3]
b) What do you mean by 'Lock and Key principle' in supramolecular chemistry? [2]
c) Write notes on 'carbon nanotubes'. [2]
d) Explain Barden Cooper Schrieffer (BCS) of semiconductivity. [2]
e) Write short notes on Ferro electric material and piezo electric materials. [3]

Group - C

5. a) Explain the trans-effect, with its utility. [2+2]
b) Write down the detailed mechanism of the reaction between $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$ and $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ to form $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]^{2+}$. [3]
c) Write the rate law expression of substitution at a square-planer site. How can you prove that the reaction is (i) associative throughout the series. (ii) A solvento intermediate is formed? [2+2+2]
6. a) The substitution reactions of square-planer complexes proceed with retention of stereochemistry explain, mention one exception. What are the causes of exceptions? [2+1+2]
b) Define with example, the Macrocyclic ligand and macrocyclic effect. [2]

- c) The ion $[\text{Co}(\text{en})\text{Cl}_2\text{Br}_2]^-$ can have how many different isomers. Draw the structures of these isomers. [2]
- d) Suggest the mechanism of the reaction, give explanation. [4]
- $$[\text{Fe}(\text{CN})_6]^{4-} + [\text{Mo}(\text{CN})_8]^{3-} \rightarrow [\text{Fe}(\text{CN})_6]^{3-} + [\text{Mo}(\text{CN})_8]^{4-}$$

Group - D

7. a) Discuss the structure, bonding and orientation of ethylene in the anion of zeise's salt. [1+2+1]
- b) Comment on the CO stretching frequencies of $\mu_1\text{CO}$, $\mu_2\text{CO}$ and $\mu_3\text{CO}$. [2]
- c) Ferrocene is more susceptible to electrophilic reaction than benzene. Explain with reaction. [2+1]
- d) What do you mean by insertion reaction? Explain the insertion reaction with an example. [1+2]
8. a) Explain the magnetic property and stability of ferrocene with respect to other metallocenes. [2]
- b) Terminal carbonyls are more liable to attack by nucleophiles than bridging (μ_2 and μ_3) carbonyls. Explain. [2]
- c) Define hydroformylation and the reaction pathways in this reaction with an example. [1+2]
- d) How will you prepare nitroferrocene from ferrocene? [1]
- e) Write down the IUPAC name of zeise's salt. [1]
- f) Using polyhedral skeletal electron pair theory determine the structure of the following compounds or anions. [3]
- $$[\text{Re}_4(\text{CO})_{16}]^{2-}; \text{Os}_5(\text{CO})_{16}; \text{Rh}_4(\text{CO})_{12}$$

