

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

M.A./M.Sc. FIRST SEMESTER EXAMINATION, DECEMBER 2017

FIRST YEAR [BATCH 2017-19]

APPLIED CHEMISTRY

Date : 16/12/2017

Time : 11 am – 1 pm

Paper : I

Full Marks : 50

(Use a separate Answer Book for each Unit)

UNIT-I

Answer **any one** from question nos. 1 and 2:

[1 X 13]

1.
 - a) What is meant by 'Crystal Field Stabilization Energy' (CFSE) of a transition metal complex. 2
 - b) Predict the crystal field splitting pattern of five d -orbitals in (i) square planar, (ii) square based pyramid and (iii) trigonal bipyramidal geometries. 3
 - c) Both Ni(IV) and Co(III) are $3d^6$ systems but $K_2[NiF_6]$ is diamagnetic while $K_3[CoF_6]$ is paramagnetic — Explain. 2
 - d) Predict the spin structure of Fe_3O_4 . 2
 - e) Predict the possible electronic transitions of CrF_6^{3-} ion from Orgel diagram. 3
 - f) Which one of the given pair should have comparatively more intense $d-d$ transition:
 $trans-[Cr(H_2O)_4Cl_2]^+$ or $cis-[Cr(H_2O)_4Cl_2]^+$? 1
2.
 - a) For the $[Cr(H_2O)_6]^{2+}$ ion, the mean pairing energy (P) is found to be 23500 cm^{-1} . The magnitude of Δ_0 is 13900 cm^{-1} . Calculate the CFSE for the complex in configurations corresponding to high spin and low spin states. Which is more stable? 2+1
 - b) For an octahedral Ni(II) salt, $\mu_{eff} = 3.3\beta$ while for a tetrahedral Co(II) salt, $\mu_{eff} = 4.5\beta$. Find their individual ν_{spin} -value and hence explain their difference between μ_{eff} and μ_{spin} values of each case. 3
 - c) State the difference with example, between inner orbital and outer orbital complexes of a transition metal ion. 2
 - d) Tetrahedral and Octahedral Ni(II) complexes both have observed magnetic moment higher than spin only value. Explain. 2
 - e) Using molecular orbital theory (MOT), explain the π -bonding effect on the stability of oh-complexes in the presence of (i) π -donor and (ii) π -acceptor ligands. 3

UNIT-II

Answer **any one** from question nos. 3 and 4:

[1 X 12]

3.
 - a) Write down a brief note on Supramolecular 'Host-Guest' chemistry. What is hydrogen bonding? 3+1
 - b) What do you mean by 'nanochemistry'? Give two reasons why properties of nanomaterials differ from that of bulk material. How is gold hydro-sol synthesized? 1+2+1
 - c) Give a general definition of explosive and what are the essential properties to be an efficient explosive?
What is detonation and velocity of detonation (VoD)?
Name some chemicals used as detonators. 1+1+1+1

4. a) What is sensor and write down the different types of sensors? Write a short note on 'molecular switch'. 1+1+2
 b) What are the two possible routes for nanomaterial synthesis? Mention two processes of each route. Mention two characterisation techniques for nanomaterials. 1+1+2
 c) What is oxygen balance (OB) of an explosive compound? What essential information can be obtained from it? Name three commercial explosives mentioning their compositions. 1+1+2

UNIT-III

Answer **any one** from question nos. 5 and 6:

[1 X 13]

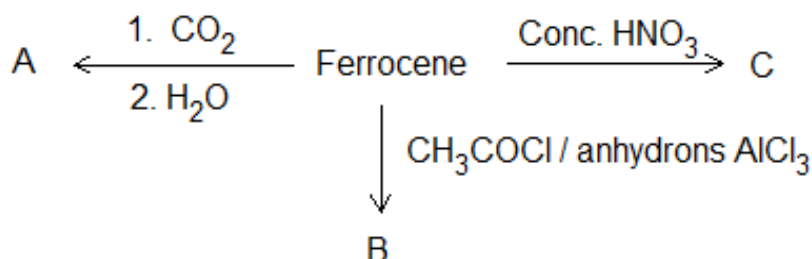
5. a) Define active and passive transport. Write down the mechanism through which the nerve cell maintains the concentration of Na^+ and K^+ inside and outside of the cell. 2+4
 b) Explain the biological function of haemoglobin and myoglobin; mention the role of the metal ion(s) present at their active sites. 4
 c) Write briefly on (i) itai-itai disease & (ii) Parkinson's disease. 3
6. a) Explain the function of (i) globin chain (ii) distal histidine and (iii) proximal histidine in haemoglobin / myoglobin. 2+2+2
 b) What is *cis*-platin and briefly explain its action as anti-cancer drug. 1+2
 c) Name two gold drugs and state its therapeutic applications and also mention its limitation of use. 2+2

UNIT-IV

Answer **any one** from question nos. 7 and 8:

[1 X 12]

7. a) How is ferrocene prepared? Discuss its structure. Identify A, B and C in the following reaction scheme. 2+2+3



- b) How is Zeise's salt prepared? Write down its structure and discuss the bonding. 2+1+2
8. a) Using 18 electron rule as a guide find out the value of 'x' in the following compounds. 2
 (i) $\text{Fe}_3(\text{CO})_x$ (ii) $\text{Co}_4(\text{CO})_x$
 b) Write down the differences between 'Fischer' and 'Schrock' carbene. 3
 c) Define the term 'oxidative addition reaction'. Give an example. 2
 d) What is meant by Ziegler-Natta type of catalytic systems? Discuss the various steps of the involvement of this type of catalyst in the polymerization of ethylene. What are the advantages of the process? 1+3+1

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