TYBSC Sem-VI 20/4/17
Cold Course) 2016-17
Inorganic Chemistry.

QP Code : 03325

(2½ Hours) [Total Marks : 75

N.B. (1) **All** questions are **compulsory**.
(2) **Figures** to the **right** indicate **full** marks.
(3) Use of **log table / non-programmable calculator** is **allowed**.

1. Answer any **three** of the following :—
   (A) What is meant by Crystal Field Stablization Energy (CFSE) ? Calculate CFSE for strong field octahedral complexes with d^5 and d^8 configurations. 5
   (B) Draw a neat labelled molecular orbital energy level diagram for $[Fe(CN)_6]^{3-}$ showing proper distribution of electrons in various energy levels. Explain its magnetic properly. 5
   (C) Explain crystal field splitting in tetrahedral complexes. 5
   (D) What do you mean by Russell–Saunder's coupling ? Explain with suitable example. 5
   (E) (a) Explain in brief M → L π interactions. 3
   (b) Calcualte the number of microstates for p^3 configuration. 2
   (F) Explain the effect of (i) charge on metal ion and (ii) geometry of the complex on the value of 10 Dq. 5

2. Answer any **three** of the following :—
   (A) Discuss the effect of size and charge of central metal ion on stability of complexes. 5
   (B) Explain the terms "Stepwise stability constants" and "Overall formation constants". How are they related ? 5
   (C) Discuss the possible mechanism involved in base hydrolysis reactions for octahedral complexes. 5
   (D) Discuss S_N1 mechanism in ligand substitution reactions of octahedral complexes. 5
   (E) Explain the Laporte orbital selection rule which governs electronic transitions. 5
   (F) Discuss the charge transfer transitions occuring in complexes. 5

3. Answer any **three** of the following :—
   (A) What are organometallic compounds ? Discuss the method of preparation involving — 5
   (i) metathesis
   (ii) metallation reactions.
   (B) Discuss the following chemical reactions of organometallic compounds of main group elements — 5
   (i) alkylation and arylation
   (ii) complex formation.
   (C) Write note on structure and bonding of ferrocene. 5
   (D) Explain sigma bond, pi bond and δ bond in $[Re_2Cl_8]^{2-}$ 5
   (E) What are metallocenes ? Discuss the method of preparation of ferrocene involving iron and cyclopentadiene. 5
   (F) With reference to ferrocene, disuss the following :— 5
   (i) Sulphonation reaction
   (ii) Alkylation reaction
   (iii) Applications.

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4. Answer any **three** of the following :—

(A) (a) Explain the method of preparation of borazine.

(b) With balanced equation explain the action of Br_2 on borazine.

(B) Write a note on biological oxygen demand.

(C) What do you understand by secondary treatment of liquid effluent ?

(D) What are nanomaterials ? Explain its mechanical properties.

(E) What are antacids ? Mention any two examples and explain any one of these in detail.

(F) (a) With reference to liquid effluent, discuss the flocculation step.

(b) With reference to nanomaterials, discuss its applications.

5. Answer the following :—

(A) Select and write the most appropriate answer.

(a) The ground state term for d^2 configuration is _____ .

(i) $^2S_{\frac{1}{2}}$

(ii) $^2P_0$

(iii) $^3F_2$

(b) Generally weak field ligand forms _____ complexes.

(i) low spin

(ii) high spin

(iii) zero spin

(c) The term g (gerade) corresponds to _____ .

(i) symmetrical

(ii) unsymmetrical

(iii) none of the above

(d) The strong field ligand from the following is _____ .

(i) CO

(ii) H_2O

(iii) F^-

OR

(A) State whether the following statements are **True** or **False.**

(p) The value of Δ_0 is higher for $[CrCl_6]^{3-}$ and lower for $[Cr(CN)_6]^{3-}$.

(q) The six ligands are directed along x, y and z axis in octahedral complexes.

(r) A term is an 'energy level of a system resulting from the electron-electron repulsion in an electronic arrangement.

(s) Spin multiplicity is the number of orientations of the spin vector 'S' along the direction of magnetic field.

(B) Select and write the most appropriate answer.

(a) A metal chelate involves _____ ligands.

(i) monodentate

(ii) polydentate

(iii) ambidentate

(b) With increase in number of chelate rings in a complex, its stability _____ .

(i) incrases

(ii) decreases

(iii) remains the same

(c) If the resulting product is an aquo complex, the reactions is called _____ .

(i) acid hydrolysis

(ii) base hydrolysis

(iii) hydration reaction

(d) The orgel diagram for d1 configuration of octahedral complexes shows _____ absorption band.

(i) $Eg \rightarrow T_{2g}$

(ii) $A_{1g} \rightarrow T_{2g}$

(iii) $T_{2g} \rightarrow Eg$

OR 4

(B) State whether the following statements are **True** or **False**.

(p) Class 'a' metals form most stable complexes with ligands having more electronegative donor atoms.

(q) Labile complexes undergo substitution reaction in less than a minute.

(r) With respect to octahedral complexes, displacement mechanism involves two step mechanism.

(s) Spin allowed transitions involve change in spin multiplicity.

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(C) Select and write the most appropriate answer.

(a) In transmetallation reactions, displacing metal is higher in the _____ than the displaced metal.

(i) electrochemical series

(ii) oxidation state

(iii) periodic table

(b) Metal or non-metal halides when treated with _____ under suitable conditions, methylene insertion takes place in M – Cl bond.

(i) diazo

(ii) diazomethane

(iii) methane

(c) During nitration ferrocene itself undergoes _____ .

(i) reduction

(ii) nitration

(iii) oxidation

(d) Ferrocene obeys _____ rule.

(i) 18 electron

(ii) 16 electron

(iii) 20 electron

OR

(C) State whether the following statements are **True** or **False**. 4

(p) Electron deficient organometallics behave as Lewis acids.

(q) In oxidative addition reaction of organometallics, oxidation state of metal increases.

(r) Most of the organomentallic compounds are covalent compounds with some ionic character.

(s) Ferrocene is less reactive than benzene towards electrophilic reagents.

(D) Select and write the most appropriate answer. 3

(a) Borazine is _____ with benzene.

(i) Isoelectronic

(ii) isomeric

(iii) isotopic

(b) Primary treatment of liquid effluent removes _____ material.

(i) dissolved

(ii) floating

(iii) None of the above

(c) Nanomaterials can be constructed by _____ technique.

(i) "top down" or "bottom up"

(ii) only "top down"

(iii) only "bottom up"

OR

(D) State whether the following statements are **True** or **False**. 3

(p) In borazine B – C bond is polar.

(q) Domestic sewage and industrial wastes are responsible for water pollution.

(r) In nanomaterials, surface to bulk atom ratio increase with decrease in particle size.