T.Y. BSC
Sem VI

Subject: Chemistry P II
Inorganic Chemistry.

Inorganic chemistry.

QP Code : 77173

(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) Define crystal field stabilization energy. Calculate C.F.S.E. for weak field octahedral complexes with d^4 and d^6 configurations. 5
(B) Considering only sigma bonding, draw a neat labelled molecular orbital diagram of hexa aqua titanium (III) ion. Explain its magnetic property. 5
(C) Write a short note on $M \rightarrow L\ \pi$ interactions. 5
(D) Explain crystal field splitting in tetrahedral complexes. 5
(E) (a) Define (i) term (ii) microstate 2
(b) Calculate the number of microstates for d^2 configuration. 3
(F) Write a short note on 'electron spin resonance spectrum' as an evidence for covalent bonding in coordination compounds. 5

2. Answer **any three** of the following :-
(A) Explain the terms 'stepwise stability constants' and 'overall formation constants.' How are they related to each other? 5
(B) Give the reasons for the following :-
(a) Co^{2+} ion when treated with excess of SCN^- ions gives blue solution but on dilution with water it changes to pink. 3
(b) phthalocyanine complex of Cu^{2+} is very stable. 2
(C) What are labile complexes ? Explain the relationship between electronic configuration of the metal and the lability of the complex. 5
(D) Discuss the possible mechanism for the 'acid hydrolysis' of cobalt ammine complexes, with the help of any two evidences. 5
(E) Write notes on --
(a) laporte orbital selection rule
(b) spin selection rule. 5
(F) Explain the Orgel diagram for d^1 octahedral complex. 5

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3. Answer **any three** of the following:-

(A) Discuss the metal-metal exchange reactions and carbanion halide exchange reactions for the synthesis of organometallic compounds of main group elements. 5

(B) Explain the following reactions of organometallic compounds of main group elements :-

(i) redistribution reactions. 5

(ii) reactions with oxygen and halogens.

(C) Explain quadruple bonding in $[Re_2Cl_8]^{2-}$ 2

(D) With reference to ferrocene, discuss the following :-

(i) reactions between iron and cyclopentadiene 3

(ii) sulphonation and oxidation reactions.

(E) Discuss in detail the structure and bonding in ferrocene on the basis of valence bond theory. 5

(F) Give an account of the following :-

(a) reactions of organometallic compounds of main group elements with protic reagents. 3

(b) acylation reactions of ferrocene. 2

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

(A) Explain the reactions of (a) Borazine (b) Benzene with the following reagents. 5

(i) HCl (ii) Br_2 (iii) H_2O

(B) What is 'Biological Oxygen Demand'? Explain five day BOD test. 5

(C) Explain the process of anaerobic degradation. 5

(D) Explain 'colloidal route method' for the preparation of nanomaterials. 5

(E) Give an account of preparation and applications of nano films. 5

(F) Give an account of the following inorganic pharmaceuticals 5

(i) $MgSO_4 . 7H_2O$ (ii) tincture iodine

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5. Answer the following :-

(A) Select and write the most appropriate answer. 4

(a) The number of electrons in non-bonding T_2g orbitals of complex $[Fe(CN)_6]^{4-}$ is_____

(i) 4 (ii) 5 (iii) 6

(b) The value of 10Dq in the case of tetrahedral complex is _____ that of octahedral complex.

(i) always greater than (ii) always equal to (iii) less than

(c) The total number of microstates for p^2 configuration is _____.

(i) 15 (ii) 20 (iii) 45

(d) The ground state term for d^1 configuration is _____.

(i) ^2D (ii) ^3F (iii) ^3D

OR

(A) State whether the following statements are **true or false.** 4

(p) The d-d electron repulsions are less in complexed metal ion than that in a free metal ion.

(q) The value of 10 Dq decreases on descending a group of transition elements.

(r) For a given value of 'S the state with highest 'L' value is the most stable.

(s) For the resultant orbital angular momentum quantum number L = 4, the state symbol is G .

(B) Select and write the most appropriate answer :- 4

(a) Among the following _____ is the most stable complex.

(i) LiOH (ii) $[Mg\ OH]^+$ (iii) $[YOH]^{2+}$

(b) Zn^{2+} forms the most stable complex with _____ ligand.

(i) NH_3 (ii) Cl^- (iii) en

(c) Geometry of the intermediate formed in S_N2 mechanism is_____.

(i) pentagonal bipyramid (ii) trigonal bipyramid

(iii) hexagon

(d) $M \rightarrow L$ charge transfer transitions involve _____

(i) reduction of the metal (ii) reduction of ligand

(iii) oxidation of ligand.

OR

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(B) State whether the following statements are **true or false.** 4

(p) In thermodynamic sense complexes are termed as labile or inert.

(q) Greater the number of chelate rings lesser is the stability of the complex.

(r) S_N1 mechanism in complexes is also called as dissociative mechanism.

(s) Base hydrolysis of octahedral cobaltammine complexes is much faster than their acid hydrolysis.

(C) Select and Write the most appropriate answer:- 4

(a) Face to face overlap of two dx^2-y^2 orbitals results in -------- bonding.

i) σ ii) δ iii) π

(b) Ferrocene is soluble in --------

i) water ii) benzene iii) liq. NH_3

(c) Condensation of ferrocene rings with formaldehyde and amine is called -------- reaction.

i) polymerization ii) Mannich iii) alkylation

(d) Metal or non-metal halide when treated with diazomethane under certain conditions -------- insertion takes place in M — Cl bond.

i) halide ii) metal iii) methylene

OR

(C) State whether the following statments are **true or false:-** 4

(p) The metal hydrogen exchange reaction is called transmetallation reaction.

(q) When methyl lithium reacts with silicon tetrachloride it forms organo silicon compound.

(r) Ferrocene molecule is paramagnetic in nature.

(s) Organometallic compounds of the first few main group elements are pyrophobic.

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(D) Select and write the most appropriate answer:- 3

(a) One of the end products of aerobic degradation is _____

(i) H_2S (ii) CO_2 (iii) CH_4

(b) The catalyst used in determination of C.O.D. value of sample of effluent is _____ .

(i) $K_2Cr_2O_7$ (ii) Ag_2SO_4 (iii) Hg_2SO_4

(c) The B-N bond length in borazine is _____ nm.

(i) 0.139 (ii) 0.144 (iii) 0.154

OR

(D) State whether the following statements are **true or false**: 3

(p) Sedimentation is the process in which waste water flow is slowed down to settle the suspended particles.

(q) In borazine the electron cloud is more concentrated on boron.

(r) Antacids help to neutralize excess acid secreted in the stomach.