TYB.Sc (VI) (T5:25)
Inorg. chem

10/04/15

Q.P. Code : 14589

(2½ Hours) **[Total Marks : 75**

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

1. Answer any **three** of the following :
   (a) Draw a labelled molecular orbital energy level diagram for $[Ti(H_2O)_6]^{3+}$. Comment on its magnetic property. 5
   (b) Explain crystal field spliting in octahedral complexes. 5
   (c) Derive the term symbol for ground state of carbon atom 5
   (d) Explain L $\longrightarrow$ Mπ interactions. 5
   (e) Write a short note on 'Electron spin resonance spectrum' as an evidence for covalent bonding in coordination compounds. 5
   (f) Explain the effect of the following on the value of 10dq. 5
      (i) geometry of the complex
      (ii) nature of ligands

2. Answer any **three** of the following :
   (a) (i) What are hydrolysis reactions ? 2
      (ii) Explain in brief the mechanism involved in anation reactions. 3
   (b) What is lability of a complex ? Give the relationship between the lability of a complex and the electronic configuration of the metal ion. 5
   (c) Justify the following : 5
      (i) $[Zn(NH_3)_4]^{2+}$ is less stable than $[Zn(en)_2]^{2+}$
      (ii) Ca^{2+} readily forms stable complexes with 'EDTA'
   (d) Explain the potentiometric method of determination of stability constant of a complex. 5
   (e) Give an account of : 5
      (i) Laporte orbital selection rule
      (ii) Spin selection rule
   (f) Name the different types of electronic transitions. Explain any one of them in brief. 5

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

(a) What are organometallic compounds ? With reference to organometallics of main group elements, discuss the following reactions. 5

(i) Methylenation

(ii) Oxidative addition

(b) Discuss the following chemical reactions of organometallic compounds of main group elements. 5

(i) Alkylation and arylation

(ii) Complex formation

(c) Explain the metallation reactions with reference to - 5

(i) Organometallics of main group elements

(ii) ferrocene

(d) With reference to ferrocene discuss the following : 5

(i) Any one method of preparation

(ii) Acylation reactions.

(e) Discuss the structure and bonding involved in ferrocene 5

(f) What are metal clusters ? Discuss the structure of $[Re_2Cl_8]^{2-}$ 5

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

(a) Discuss the structure and bonding involved in borazine 5

(b) Explain in brief the principles involved in the aerobic and anaerobic processes. 5

(c) Explain briefly the terms - BOD and COD 5

(d) What are nanomaterials ? Discuss the two dimensional nanoparticles 5

(e) Explain the synthesis of nanomaterials by sol-gel method. 5

(f) Write brief notes on the following with respect to pharmacy. 5

(i) Antacid

(ii) Tincture iodine

5. Write the most appropriate answer from those given for the following (Answer any **fifteen**) : 15

(1) The number of microstates in p^2 configuration is _____
(a) 10 (b) 15 (c) 20

(2) CFSE for d^6 configuration in the case of high spin octahedral complex is _____
(a) -4Dq + P (b) -6Dq + 2P (c) -24Dq + 3P

(3) The ground state term for d^1 configuration is _____
(a) ^3F (b) ^2D (c) ^3P

(4) _____ is known as spin multiplicity.
(a) S - 1 (b) 2S + 1 (c) S + 1

(5) The terms are same for d^n and _____ configuration
(a) d^{n+3} (b) d^{n-3} (c) d^{10-n}

(6) Splitting of d-orbitals is maximum in _____ complexes.
(a) tetrahedral (b) octahedral (c) square planar

(7) SN1CB mechanism is seen in complexes with ligands having ionisable _____ atoms.
(a) H (b) O (c) Cl

(8) The reactions in which exchange of ligands takes place in complexes are called as _____.
(a) Redox reactions (b) Nucleophilic substitution reactions
(c) Electrophilic substitution reactions.

(9) _____ among the following metal ion hydroxo complexes is the most stable one.
(a) $[BaOH]^+$ (b) $[CaOH]^+$ (c) $[MgOH]^+$

(10) Higher the value of the stability constant _____ will be the stability of the complex
(a) greater (b) lesser (c) no change

(11) Broadening of the electronic absorption bands occurs due to the changes in _____ of electrons.
(a) Rotational energy
(b) Vibrational energy
(c) both

(12) Spectrum of a coloured solution is recorded using _____
(a) spectrophotometer
(b) flame photometer
(c) Conductometer

(13) In the formation of $[Re_2Cl_8]^{2-}$, the dxy and dyz orbitals of two Re atoms overlap to form _____ bonds.
(a) σ (b) π (c) δ

(14) The organometallic compounds in which a metal atom is between two planar _____ ligands are called metallocenes.
(a) ambidentate (b) monodentate (c) polyhapto

(15) The Cp rings in ferrocene are _____ and therefore undergo most of the reactions of benzene.
(a) aliphatic (b) aromatic (c) saturated

(16) The regular nitrocompounds of ferrocene are not formed, because during nitration ferrocene itself undergoes _____
(a) substitution (b) reduction (c) oxidation

(17) The alkyls of first three main group elements readily react with _____ reagents and undergo hydrolysis.
(a) aprotic (b) common (c) protic

(18) Carbanion-halide exchange reactions of synthesis of organometallics of main group elements are also refered to as _____ .
(a) geothesis (b) transmetathesis (c) metathesis

(19) Removal of suspended solids from the waste water stream is called _____
(a) sedimentation (b) filtration (c) elimination

(20) The agglomeration of small particles into larger units to speed up the settling process is called _____
(a) coagulation (b) flocculation (c) screening

(21) Oxygen demanding waste in water leads to _____ in dissolved oxygen.
(a) increase (b) no change (c) depletion

(22) Chlorination of water is done for the removal _____
(a) suspended solids (b) sediments (c) bacteria

(23) The macromolecules which do not have _____ in their backbone are considered as inorganic polymers.
(a) carbon (b) hydrogen (c) oxygen

(24) The polymers that have atoms of only one element in their backbone are called _____ morganite polymer.
(a) hetero atomic (b) homo atomic (c) subatomic
