

CO-ORDINATION COMPOUNDS

- Potassium ferrocyanide is an example for
1) Complex salts 2) Normal salts 3) Double salts 4) Basic salts
- Example for a coordination compound is
1) $KCl Mg Cl_2 \cdot 6H_2O$ 2) $K_2 SO_4 \cdot Al_2 (SO_3) \cdot 24 H_2O$
3) $CoCl_3 \cdot 6N H_3$ 4) $Fe SO_4 (NH_4)_2 SO_4 \cdot 6 H_2O$
- Which is a double salt?
1) Carnallite 2) Potassium ferrocyanide
3) Potassium ferricyanide 4) Nessler's reagent
- Which forms equal number of moles of ions, when one mole it is dissolved in excess of water
1) Ferrous ammonium sulphate, Carnallite
2) Carnallite, Alum
3) Alum, Potassium ferrocyanide
4) Potassium ferrocyanide, Potassium ferricyanide
- Which answers all the tests of the constituent ions?
1) Mohr's salt
2) Nessler's reagent
3) Lithium aluminium hydride
4) Prussian blue coloured complex

CHARACTERISTICS OF COMPLEX COMPOUNDS

- In which of the following transition metal complexes does the metal exhibit zero oxidation state
1) $[Co (NH_3)_6] Cl_3$ 2) $[Fe (H_2O)_6] SO_4$
3) $[Ni (CO)_4]$ 4) $[Fe (H_2O)_6] Cl_3$
- The number of moles of ions produced when one mole of Potassium Ferricyanide is dissolved in water is
1) 2 2) 4 3) 5 4) 6
- Total number of moles of ions that can be obtained from each mole of $[Co (NH_3)_3 Cl_3]$ is
1) 1 2) 0 3) 3 4) 4
- The number of ions formed in aqueous solution by the compound $[Co (NH_3)_4 Cl_2] Cl$ is
1) 2 2) 3 3) 4 4) 5
- The following does not give a precipitate either with $AgNO_3$ or $BaCl_2$
1) $[Co (NH_3)_5 Cl] SO_4$ 2) $[Co (NH_3)_3 Cl_3]$
3) $[Co (NH_3)_4 Cl_2] Cl$ 4) $[Co(NH_3)_2 Cl_4] Cl$
- Which of the following has highest molar conductivity?
1) $[Co (NH_3)_6] Cl_3$ 2) $[Co (NH_3)_5 Cl] Cl_2$
3) $[Co (NH_3)_4 Cl_2] Cl$ 4) $[Co (NH_3)_3 Cl_3]$

12. Transition elements form complexes readily because
- 1) Small size of cation
 - 2) Large ionic Charge
 - 3) Vacant d orbitals
 - 4) All the above
13. Which of the following is cationic complex?
- 1) $K_4[Fe(CN)_6]$
 - 2) $[Ni(CO)_4]$
 - 3) $[Co(NH_3)_3Cl_3]$
 - 4) $[Cu(NH_3)_4]SO_4$
14. The no. of moles of AgCl obtained when excess AgNO₃ is added to one mole of $[Cr(NH_3)_4Cl_2]Cl$
- 1) 1
 - 2) 2
 - 3) 3
 - 4) 4
15. Aqueous solution of $[Co(H_2O)_5SO_4]Cl$ gives precipitate with
- 1) BaCl₂ (aq)
 - 2) AgNO₃ (aq)
 - 3) both 1 and 2
 - 4) neither 1 nor 2
16. The following solutions requires three moles of AgNO₃ for the complete precipitation of all the chloride ions present in it
- 1) One litre of 1M $[Co(NH_3)_6]Cl_3$
 - 2) Three litres of 1M $[Co(NH_3)_4Cl_2]Cl$
 - 3) One litre of 1.5M $[Co(NH_3)_5Cl]Cl_2$
 - 4) all the above
17. Bonds present in $K_4[Fe(CN)_6]$ are
- 1) Only ionic
 - 2) Only covalent
 - 3) Ionic and Covalent
 - 4) Ionic, covalent and coordinate covalent

LIGANDS AND CO-ORDINATION NUMBER

18. Ligand in a metal carbonyl complex is
- 1) NH₃
 - 2) CO
 - 3) CN⁻
 - 4) SCN⁻
19. The ionizable valency of Ni in $Ni(CO)_4$ is
- 1) 2
 - 2) 4
 - 3) 0
 - 4) 1
20. According to Werner's theory of valency transition metals possesses
- 1) Only one type of valency
 - 2) two types of valencies
 - 3) Three types of valencies
 - 4) four types of valencies
21. The no. of moles of AgCl ppted when excess of AgNO₃ is mixed with one mole of $[Cr(NH_3)_4Cl_2]Cl$ is
- 1) 0
 - 2) 1
 - 3) 2
 - 4) 3
22. A bidentate ligand is
- 1) Oxalate ion
 - 2) Carbon monoxide
 - 3) Nitronium ion
 - 4) Water
23. Which is a polydentate ligand
- 1) EDTA
 - 2) Ethylene diamine
 - 3) Oxalate ion
 - 4) CO

24. An ambident ligand is
 1) CO 2) CN^- 3) CO_2 4) H_2O

**IUPAC NOMENCLATURE OF
CO-ORDINATION COMPOUNDS**

25. IUPAC name for the complex
 $[Cu(NH_3)_4]SO_4$
 Is
 1) cupramonium sulphate
 2) copper sulphate tetra ammonia
 3) tetramine copper sulphate
 4) copper amonium sulphate
26. HexaaquoTitanium Chloride is represented as
 1) $[Ti(H_2O)_6]Cl_3$ 2) $[TiCl_3] \cdot 6H_2O$
 3) $[Ti(H_2O)_5Cl]Cl_2$ 4) $[Ti(H_2O)_3Cl_3]$
27. Which of the following is not a neutral molecular complex?
 1) $[Co(NH_3)_3Cl_3]$ 2) $[Ni(CO)_4]$ 3) $[Cu(NH_3)_4]SO_4$ 4) All

BONDING AND EFFECTIVE ATOMIC NUMBER

28. Which does not obey EAN rule?
 1. $K_4[Fe(CN)_6]$ 2. $K_3[Fe(CN)_6]$
 3. $[Co(NH_3)_6]Cl_3$ 4. $[Ni(CO)_4]$
29. Which follows EAN rule?
 1. $Fe(CO)_5$ 2. $Ni(CO)_4$
 3. $K_4[Fe(CN)_6]$ 4. All are correct
30. The complex follows the EAN rule. Then the value of x is
 1. 3 2. 4 3. 5 4. 6
31. Assertion (A): Racemic mixture has a net rotation of zero.
 Reason (R): Racemic mixture contains optically inactive isomers.
 1. both A and R are true, R properly explains A
 2. both A and R are true, R does not explain A
 3. A is true, but R is false
 4. A is false, but R is true

32. Ammonium ions are detected with
 1) Nessler's reagent 2) Borsch reagent
 3) Tollen's reagent 4) Fehling's solution
33. The complex $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]^{2+}$ is formed in the brown ring test for nitrates when freshly prepared FeSO_4 solution is added to aqueous solution of NO_3^- followed by addition of $\text{con.H}_2\text{SO}_4$. Select correct statement about this complex.
 1) Color change is due to charge transfer
 2) it has iron in +1 oxidation state and nitrosyl as NO^+
 3) it has magnetic of 3.87 BM confirming three unpaired electrons in
 4) all are correct statements
34. The yellow colored solution of chromate salt changes to orange color on acidification due to the formation of:
 1) Cr^{3+} 2) $\text{Cr}_2\text{O}_7^{2-}$ 3) CrO_4^- 4) Cr_2O_3
35. Blue solution of CuSO_4 on treatment with excess KCN gives colourless solution due to the
 1) Formation of CuCN
 2) Formation of $\text{Cu}(\text{OH})_2$
 3) Formation of $[\text{Cu}(\text{CN})_4]^{2-}$
 4) Cu^{2+} is reduced by CN^- to Cu^+ which forms complex $[\text{Cu}(\text{CN})_4]^{3-}$.
36. $\text{Hypo} \xrightarrow{\text{AgNO}_3} \text{white ppt} \xrightarrow{\text{Hypo}} \text{soluble complex x. the x is}$
 1) $\text{Na}_2\text{S}_2\text{O}_3$ 2) $\text{Na}_2[\text{Fe}(\text{CN})_6]$
 3) $\text{Na}_3[\text{Ag}(\text{S}_2\text{O}_3)_2]$ 4) $\text{Na}_2\text{S}_4\text{O}_8$
37. Which of the following cannot be detected by AgNO_3 in qualitative analysis?
 1) NaCl 2) NaBr 3) NaF 4) KCl

KEY

- 1) 12) 3 3) 1 4) 1 5) 1 6) 3 7) 2 8) 2 9) 1 10) 2
 11) 1 12) 2 13) 4 14) 1 15) 21 16) 4 17) 4 18) 2 19) 3 20) 2
 21) 2 22) 1 23) 1 24) 2 25) 3 26) 1 27) 3 28) 2 29) 4 30) 3
 31) 3 32) 1 33) 4 34) 1 35) 4 36) 3 37) 3

WERNER THEORY OF CO-ORDINATION COMPOUNDS

- The groups satisfying the secondary valencies of a cation in a complex are called
 - Radicals
 - Electron deficient Molecules
 - Primary valencies
 - Ligands
- The primary valence of the metal ion is satisfied by
 - Neutral molecules
 - positive ions
 - Negative ions
 - all
- IUPAC name of the complex is
 - Cobalt trichloride penta amonium
 - Penta amine carbonyl chloride
 - Trichloro penta amino cobalt
 - Pentamine chloro cobalt chloride
- No of ionizable & non-ionizable ions in reprehensively are
 - 3, 0
 - 2, 1
 - 1, 2
 - 0, 3
- Silver Chloride dissolves in excess ammonia due to the formation of a soluble complex whose formula is
 - $[\text{Ag}(\text{NH}_3)\text{Cl}]$
 - $[\text{Ag}(\text{NH}_3)_2]\text{Cl}$
 - $[\text{Ag}(\text{NH}_3)_3]\text{Cl}$
 - $[\text{Ag}(\text{NH}_3)_4]\text{Cl}$
- Copper sulphate solution forms blue coloured complex with excess of ammonia. Its formula is
 - $[\text{Cu}(\text{NH}_3)_4]^{+3}$
 - $[\text{Cu}(\text{NH}_3)_4]^{+2}$
 - $[\text{Cu}(\text{NH}_4)_3]^{+2}$
 - $[\text{Cu}(\text{NH}_4)_3]^{+3}$
- Zn^{+2} dissolves in excess of NaOH due to the formation of
 - Soluble $\text{Zn}(\text{OH})_2$
 - Soluble $\text{Na}_2[\text{Zn}(\text{OH})_4]$
 - Soluble $\text{Na}(\text{Zn}(\text{OH})_3)$
 - ZnO
- Which of the following cannot act as a ligand
 - BF_3
 - NH_3
 - NO^+
 - CN^-
- Which of the following is not a draw back of Werner's theory?
 - does not explain the valency of metal ions in the complex
 - does not give any explanation for the colour of complex compounds
 - does not explain the magnetic behaviour of complex compounds
 - does not correlate electronic configuration of the metal with the formation of complex
- The primary and secondary valency of Co in the complex respectively are
 - 6 & 3
 - 3 & 6
 - 4 & 3
 - 3 & 5
- Number of ions satisfying both primary and secondary valency are in
 - 1
 - 2
 - 3
 - 4
- Pick out the incorrect statement
 - Primary valency of a transition metal ion in complex represents its oxidation number
 - Zn^{2+} is colorless
 - MnCl_2 exhibit green color in aqueous solution
 - Fe, Co, Ni are examples of diamagnetic in nature
 - Only i, ii
 - Only ii
 - Only iii,iv
 - Only iv

13. When one mole of a complex is treated with excess of solution, 143.5 g of white precipitate is formed the complex is
- 1) $CoCl_3 \cdot 6NH_3$ 2) $CoCl_3 \cdot 5NH_3$
 3) $CoCl_3 \cdot 4NH_3$ 4) $CoCl_3 \cdot 3NH_3$

VALENCY BOND THEORY AND SHAPES OF COORDINATION COMPOUNDS

14. The shape of the complex species will be square planar if its coordination number is
 1) 2 2) 6 3) 5 4) 4
15. Which one of the following acts as a Lewis base in complexes?
 1) CO_2 2) BF_3 3) NH_3 4) BCl_3
16. Which of the following is inner orbital complex?
 1) $[CoF_6]^{-3}$
 2) $[Cu(H_2O)_6]^{+2}$
 3) $[Co(NH_3)_6]^{+2}$ 4) All
17. sp^3d^2 hybridisation is present in
 1) $[CoF_6]^{-3}$ 2) $[Ni(CO)_4]$
 3) $[Co(NH_3)_6]^{+2}$ 4) All
18. The shape of is
 1) Square Planar 2) Trigonal bipyramidal
 3) Octahedral 4) Tetrahedral
19. Match the following.

Set -I

Set -II

- | | |
|---------------------------|---------------------------|
| A) Co-ordination number 3 | 1) Pentagonal bipyramidal |
| B) Co-ordination number 2 | 2) Trigonal bipyramidal |
| C) Co-ordination number 5 | 3) Linear |
| D) Co-ordination number 7 | 4) Trigonal planar |

The correct matching is

- | | A | B | C | D |
|----|---|---|---|---|
| 1) | 4 | 3 | 2 | 1 |
| 2) | 1 | 2 | 3 | 4 |
| 3) | 4 | 3 | 1 | 2 |
| 4) | 3 | 1 | 2 | 4 |

20. The hybridisation of the complex is $[NiCl_4]^{-2}$
 1) sp^3 2) dsp^2 3) sp^3d 4) sp^3d^2
21. The hybridisation of the complex is $[Cu(NH_3)_4]^{+2}$
 1) sp^3 2) sp^3d 3) dsp^2 4) sp^3d^2
22. The hybridisation of the complex is $Fe(CO)_5$
 1) sp^3d^2 2) dsp^3 3) sp^3 4) d^2sp^3

BONDING AND EFFECTIVE ATOMIC NUMBER

23. The effective atomic number of iron ion is $[Fe(CN)_6]^{3-}$
 1. 34 2. 36 3. 37 4. 35
24. Which does not obey EAN rule
 1) $Fe(CO)_5$ 2) $K_4[Fe(CN)_6]$
 3) $[Cu(NH_3)_4]SO_4$ 4) $[Co(NH_3)_6]Cl_3$
25. The effective atomic number of central metal ion is wrongly calculated in the following complex?
 1. In $[Ni(CO)_4]$ the EAN of Ni is 36
 2. In $K_2[Ni(CN)_4]$ the EAN of Ni is 36
 3. In $K_3[Fe(CN)_6]$ the EAN of Fe is 35
 4. In $[Cr(NH_3)_6]Cl_3$ the EAN of Cr is 33

CRYSTAL FIELD THEORY

26. The crystal field splitting energy for octahedral complex (Δ_o) and tetrahedral complex (Δ_t) are related as
 1) $\Delta_t = \frac{4}{9}\Delta_o$ 2) $\Delta_t = 0.5\Delta_o$
 3) $\Delta_t = 0.33\Delta_o$ 4) $\Delta_t = \frac{9}{4}\Delta_o$
27. Which of the following is a correct Irving-Williams order? (Tendency of complex formation)
 1) $Mn^{2+} < Fe^{2+} < Co^{2+} < Ni^{2+}$
 2) $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$
 3) $Fe^{2+} < Mn^{2+} < Ni^{2+} < Co^{2+}$
 4) $Co^{2+} < Mn^{2+} < Fe^{2+} < Ni^{2+}$
28. Which order is correct in spectrochemical series of ligands?
 1) $Cl^- < F^- < C_2O_4^{2-} < NO_2^- < CN^-$
 2) $CN^- < C_2O_4^{2-} < Cl^- < NO_2^- < F^-$
 3) $C_2O_4^{2-} < F^- < Cl^- < NO_2^- < CN^-$
 4) $F^- < Cl^- < NO_2^- < CN^- < C_2O_4^{2-}$

ISOMERISM IN COMPLEXES

29. The property of possessing at least one atom that is attached to four non-identical groups is called
 1. Polarization 2. Chirality
 3. Enantiomerism 4. Meridionity
30. A racemic mixture has a net rotation
 1. to right of original plane 2. to left of original plane
 3. to right or left of original plane 4. zero

31. Optical isomer has
A) Property of chirality
B) Almost identical chemical properties
C) Almost identical physical properties
D) Similar rotation of plane polarized light
1. A, B, C are correct
2. B, C, D are correct
3. A, C, D are correct
4. A, B, D are correct

APPLICATION OF COMPLEXES IN QUALITATIVE ANALYSIS

32. The central metal ion in haeme is
1) Fe^{+2} 2) Co^{+3} 3) Mn^{+2} 4) Mg^{+2}
33. The central metal present in chlorophyll is
1) Mg 2) Co 3) Fe 4) Ca
34. Nessler's reagent is
1) K_2HgI_4 2) K_2HgI_2
3) K_2HgCl_4 4) HgI_2
35. The metal ion present in Vitamin B₁₂ is.....
1) Co^{3+} 2) Co^{2+} 3) Fe^{2+} 4) Fe^{3+}
36. The coordination number of Fe (II) in Oxyhaemoglobin is.....
1)6 2)4 3)8 4)10

KEY

- 1) 4 2) 3 3) 4 4) 2 5) 2
6) 2 7) 2 8) 1 9) 1 10) 2
11) 1 12) 3 13) 3 14) 4 15) 3
16) 3 17) 1 18) 3 19) 1 20) 1
21) 3 22) 2 23) 4 24) 3 25) 2
26) 1 27) 1 28) 4 29) 2 30) 4
31) 1 32) 1 33) 1 34) 1 35) 1
36) 1