REVISION

CBSE 12th BOARD 2021

MOST EXPECTED QUESTIONS

INORGANIC CHEMISTRY

P-BLOCK
(GROUP 15 - 18)

D & F BLOCK

COORDINATION COMPOUNDS

MAHENDRA KALRA

CHEMISTRY TEACHER

UNIT: 7: P –BLOCK ELEMENTS

GROUP 15 ACCOUNT FOR THE FOLLOWING (1 TO 39)

1. The ionization enthalpy of the group 15 elements is greater than that of group 16 elements in the corresponding periods.
2. The first ionization energy of nitrogen is greater than oxygen.
3. Nitrogen exists as diatomic molecule and phosphorus as P_4.
4. NH_3 is basic while BiH_3 is only feebly basic.
5. The HNH angle value is higher than HPH, HAsH, and HSbH angles.
6. $R_3P{=}O$ exist but $R_3N{=}O$ does not.
7. Nitrogen shows catenation properties less than phosphorus.
8. Ammonia has higher boiling point than Phosphine.
9. Nitrogen does not form the compound NCl_5.
10. Nitrogen does not form pentahalides.
11. Nitrogen is fairly inert gas.
12. Reactivity of nitrogen differ from phosphorus?
13. All the bonds in the molecules of PCl_5 are not equal.
14. In solid state PCl_5 exists as Ionic compound.
15. NH_3 is a good complexing agent.
16. Nitrogen shows anomalous behaviour.
17. Bi(V) is a strong oxidizing agent than Sb (V)
18. NCl_3 gets hydrolysed easily while NF_3 does not.
19. PH_3 has lower boiling point than NH_3.
20. NH_3 form hydrogen bond but PH_3 does not.
21. Pentahalides of group 15 are more Covalent than trihalides
22. N_2 is less reactive at room temperature.
23. NH_3 act as Lewis base.
24. Ammonia act as ligand.
25. Bond angle in PH_4^+ is higher than that in PH_3.
26. NO_2 dimerises to form N_2O_4
27. NO_2 is coloured but N_2O_4 is colourless.
28. H_3PO_3 is diprotic acid.
29. H_3PO_2 and H_3PO_3 act as as good reducing agents while H_3PO_4 does not.
30. CN^- ion is known but CP^- ion is not known.
31. Red phosphorous is less reactive than white Phosphorous.
32. Pentavalent Bismuth(Bi(V)) is a strong oxidizing agent.
33. In the structure of HNO_3 ,the N-O bond (121pm) is shorter than N-OH bond(140pm)
34. NCl_3 is an endothermic compound while NF_3 is an exothermic one.
35. PH_3 forms bubbles when passed slowly in water but NH_3 dissolves.
36. Nitric acid becomes brown in colour when released in air.
37. The N – O bond in NO_2^- is shorter than the N – O bond in NO_3^-
38. N – N single bond is weaker than P-P single bond.
39. NH_3 has a higher proton affinity than PH_3
40. Arrange the following in increasing order of the property indicated:

(a) NH_3, PH_3, AsH_3, SbH_3, BiH_3 (Thermal stability)

(b) NH_3, PH_3, AsH_3, SbH_3, BiH_3 (Bond dissociation enthalpy)
(c) NH_3, PH_3, AsH_3, SbH_3, BiH_3 (Reducing character)
(d) NH_3, PH_3, AsH_3, SbH_3, BiH_3 (Basic character)

41. Write the reaction of: Thermal decomposition of sodium azide.
42. On heating $Pb(NO_3)_2$ a brown gas is evolved which undergoes dimerization on cooling.Identify the gas.
43. Mention the conditions required to maximize the yield of ammonia?
44. Draw the structure of Ammonia?
45. Draw the structure of N_2O, NO, N_2O_3, NO_2 , N_2O_4, & N_2O_5.
46. What is the covalence of nitrogen in N_2O_5?
47. Illustrate how copper metal can give different products on reaction with HNO_3.
48. Metals like Cr, Al do not dissolve in nitric acid. Why
49. Write main differences between the properties of white phosphorus and red phosphorus.
50. In what way can it be proved that PH_3 is basic in nature?
51. What happens when white phosphorus is heated with concentrated NaOH solution in an inert atmosphere of CO_2?
52. Write the name and draw the shape of following of following H_3PO_4, H_3PO_3, H_3PO_2 & $(HPO_3)_3$.
53. What is the basicity of H_3PO_4, H_3PO_3, H_3PO_2?
54. How do you account for the reducing behaviour of H_3PO_2 on the basis of its structure?
55. Complete the reactions

(a) $NaN_3 \rightarrow$
(b) $N_2(g) + H_2(g) \xrightarrow{773K}$
(c) $NaNO_3 + H_2SO_4 \longrightarrow$
(d) $Cu + HNO_3(\text{dilute}) \longrightarrow$
(e) $Cu + HNO_3(\text{conc.}) \longrightarrow$
(f) $Zn + HNO_3(\text{dilute}) \longrightarrow$
(g) $Zn + HNO_3(\text{conc.}) \longrightarrow$
(h) $I_2 + HNO_3 \longrightarrow$
(i) $C + HNO_3 \longrightarrow$
(j) $S_8 + HNO_3\ (\text{conc.}) \longrightarrow$
(k) $P_4 + HNO_3\ (\text{conc.}) \longrightarrow$
(l) $H_3PO_3 \xrightarrow{Heat}$

GROUP 16 ACCOUNT FOR THE FOLLOWING (56 TO 81)

56. The negative value of electron gain enthalpy of oxygen atom is less than that of sulphur
57. Dioxygen is a gas but Sulphur is a solid.
58. Oxygen molecule has formula O_2 while Sulphur S_8
59. Oxygen generally exhibit oxidation state of –2 only whereas other members of the family exhibit +2, +4, +6 oxidation states also.
60. H_2S acts as only reducing agent but SO_2 acts as a reducing as well as an oxidizing agent.
61. S shows greater tendency for catenation than selenium.
62. Sulphur has greater tendency for catenation than oxygen.
63. Inspite of nearly the same electronegativity, oxygen forms hydrogen bonding while chlorine does not.
64. H_2O is a liquid while H_2S is a gas.
65. H_2S is less acidic than H_2Te.
66. H_2S is more acidic than H_2O.
67. H_2O has higher boiling point than H_2S.
68. SF_6 is known but SH_6 is not known.

69. SF_6 is much less reactive than SF_4
70. SF_4 is easily hydrolysed,SF_6 is not easily hydrolysed.
71. SCl_6 is not known but SF_6 is known.
72. Sulphur vapours exhibits paramagnetism.
73. In solution of sulphuric acid in water the $K_{a2} << K_{a1}$.
74. All the bonds in the molecules of SF_4 are not equal
75. SF_6 is kinetically an inert substance.
76. OF_6 is not known
77. H_2S acts as only reducing agent but SO_2 acts as a reducing as well as an oxidizing agent.
78. Inspite of similar electronegativity, oxygen forms hydrogen bonding while chlorine does not
79. Ozone is thermodynamically less stable than oxygen.
80. Ozone (O_3) act as a powerful oxidising agent
81. Sulphurous acid act as a reducing agent.
82. Arrange the following in increasing order of property indicated.
    (a)H_2O H_2S H_2Se H_2Te (Boiling point)
    (b) H_2O H_2S H_2Se H_2Te.(Acidic Strength)
    (c) H_2O H_2S H_2Se H_2Te.(Bond Angle)
83. Write the name and draw the shape of following of following: H_2SO_4, H_2SO_3 $H_2S_2O_8$ and $H_2S_2O_7$
84. Draw the shape of SF_6 & SF_4
85. Describe the manufacture of Sulphuric Acid by contact Process.
86. Write the conditions to maximize the yield of Sulphuric Acid by contact Process.
87. Name the two most important allotropes of Sulphur.Which one of the two is stable at room temperature? What happens when the stable form is heated above 370K.
88. Which aerosols deplete Ozone.
89. How is Ozone (O_3) estimated quantitatively?
90. On addition of ozone gas to KI solution, violet vapours are obtained.why
91. How the supersonic jet aeroplanes are responsible for the depletion of ozone layers.
92. Complete the reactions
    (a) $I^-(aq) + H_2O(l) + O_3(g) \rightarrow$
    (b) $Fe^{3+} + SO_2 + H_2O \rightarrow$
    (c) $SO_2 + MnO_4^- + H_2O \rightarrow$
    (d) $C_{12}H_{22}O_{11} \xrightarrow{Conc H_2SO_4}$
    (e) $Cu + H_2SO_4$ (Conc.) $\longrightarrow$
    (f) $S + H_2SO_4$ (Conc.) $\longrightarrow$
    (g) $C + H_2SO_4$(conc.) $\longrightarrow$

GROUP 17 ACCOUNT FOR THE FOLLOWING (93 TO 120)

93. Interhalogen compounds are more reactive than related elemental halogens.
94. ICl is more reactive than Cl_2
95. Halogens are strong oxidizing agent.
96. Among the halogens F_2 is a strongest oxidising agent.
97. F_2 is a stronger oxidising agent than Cl_2
98. The negative value of electron gain enthalpy of fluorine is less than that of Chlorine.
99. Halogens are coloured.
100. Bond dissociation enthalpy of F_2 is less than Cl_2.

101. Fluorine exhibit oxidation state of –1 only whereas other halogens exhibit +1, +3, +5, +7 oxidation states also.
102. Fluorine never exhibit positive oxidation state.
103. Fluorine never acts as the central atom in the polyatomic interhalogen compounds
104. Compounds of Fluorine with oxygen are called fluorides of oxygen and not the oxides of fluorine.
105. ClF_3 exists but FCl_3 does not
106. NCl_3 gets hydrolysed but NF_3 does not
107. HI in aqueous solution is strong acid than HF.
108. HF is the weakest acid among hydrohalo-acids inspite of the fact that fluorine is most electronegative.
109. HF is least volatile whereas HCl is most volatile among all halogens
110. HF has higher boiling point than HCl
111. Most of the reactions of fluorine are exothermic.
112. When HCl reacts with finely powdered iron, it forms ferrous chloride and not ferric chloride.
113. $SnCl_4$ is more covalent than $SnCl_2$.
114. Fluorine forms only one oxoacid, HOF.
115. Metal fluorides are more ionic than its chlorides.
116. Chorine water has both oxidizing and bleaching properties.
117. Chorine water on standing loses its yellow colour.
118. Sea is the greatest source of some halogens
119. Perchloric acid is stronger acid than sulphuric acid.
120. O_2 & F_2 both stabilize higher oxidation states of metals but O_2 exceeds F_2 in doing so.
121. Give the reason for bleaching action of Cl_2
122. Deduce the molecular shapes of following on the basis of VSEPR theory. (a)BrF_5 (b) ClF_5 (c) IF_7 (d) BrF_3 (e) ClF_3 (f) I_3^-
123. Write the name and draw the shape of following of following: $HClO_4$, $ClO_4^-HClO_3$, $HClO_2$, and HClO
124. Arrange the following in increasing order of property indicated.

(a) HCl HF HBr HI. (Acidic Strength)
(b) F_2 Cl_2 Br_2 I_2 Bond dissociation enthalpy
(c) HBr HCl HF HI. (boiling point)
(d) HOF HOCl HOBr HOI. (Acidic Strength)
(e) $HClO_4$ $HClO_3$ $HClO_2$ HClO (Acidic Strength)

125. Write the reactions of F_2 and Cl_2 with water.
126. Complete the reactions
    a) $Br_2 + F_2$ (Excess) →
    b) $Cl_2 + F_2$ (Excess) →
    c) $F_2 + H_2O$ →
    d) NH_3 (excess)+ Cl_2 →
    e) $NH_3 + Cl_2$ →
    f) NaOH(Cold and dilute)+Cl_2→
    g) NaOH(Hot & conc)+Cl_2→
    h) $Ca(OH)_2$+Cl_2→
    i) $Ca(OCl)_2$+HCl→
    j) $Br_2 + 2\ X^- \rightarrow 2Br^- + X_2$ (What is X)

Mahendra Kalra , 9462305605 ,kalra1977@gmail.com

GROUP 18 ACCOUNT FOR THE FOLLOWING (127 TO 139)

127. Noble gases are mostly chemically inert.
128. Noble gases have comparatively largest atomic sizes.
129. Noble gases have very low boiling points
130. Of the noble gases only Xenon is known to form real chemical compounds.
131. Noble gases form compounds with fluorine and oxygen only.
132. Helium is used for inflating aeroplane tyres & filling balloons for meteorogical observations.
133. Helium is used in diving apparatus.
134. Neon is generally used for warning signals.
135. It has been difficult to study the chemistry of radon
136. Xe does not forms compounds such as XeF_3 and XeF_5.
137. Xe forms compounds such as XeF_2 ,XeF_4 and XeF_6
138. No Chemical compound of helium is known.
139. XeF_2 has a linear structure & not a bent angular structure
140. Draw the shape of following of following: XeF_2 XeF_4, XeF_6, $XeOF_4$, and XeO_3.
141. Give the formula and describe the structure of a noble gases species which is isostructural with (i) BrO_3^- (ii) ICl_4^-(iii) IBr_2^-
142. Write chemical equation when Xe and PtF_6 are mixed together.
143. Does the hydrolysis of XeF_6 lead to a redox reaction?
144. Complete the reactions:
    a) $XeF_4 + O_2F_2 \rightarrow$
    b) $XeF_2 + H_2O(l) \rightarrow$
    c) $XeF_4 + H_2O \rightarrow$
    d) $XeF_6 + H_2O$ (Partial hydrolysis) $\rightarrow$
    e) $XeF_6 + H_2O$ (complete hydrolysis) $\rightarrow$
    f) $XeF_2 + PF_5 \rightarrow$
    g) $XeF_4 + SbF_5 \rightarrow$

Unit: 8: THE d- AND f-BLOCK ELEMENTS

1. **What are transition elements? Write two characteristics of the transition elements.**
2. Calculate the number of unpaired electrons in the following gaseous ions: **Mn^{3+}**,Cr^{3+}, $V^{3+}$and Fe^{2+}. Which one of these is the most stable in aqueous solution.
3. **How would you account for the following :**
   a) Zn, Cd and Hg are not considered as transition elements. Why
   b) Scandium is a transition element but Zinc is not.
   c) Copper atom has completely filled d orbital ($3d^{10}$) in its ground state, yet it is transition element.
   d) Silver atom has completely filled d orbital ($4d^{10}$) in its ground state, yet it is transition element.
4. **Explain giving a suitable reason for each of the following**
   a) Transition elements exhibit higher enthalpies of atomization.
   b) In the series Sc(Z = 21) to Zn (Z = 30), the enthalpy of atomisation of zinc is the lowest
   c) Transition metals have high melting and boiling points.
   d) Fe has higher melting point than Cu.
   e) Chromium group elements have highest melting points.
   f) Transition elements are much harder than alkali metals.
   g) Zinc is soft whereas Cr is hard.
   h) Chromium is a typical hard metal while mercury is a liquid.
   i) There occurs much more frequent metal –metal bonding in compounds of heavy transition elements(3^{rd} series).
   j) Metal –metal bonding is more frequent for the 4d & 5d series of transition metals than that for the 3d series.
5. **Assign reasons for the following :**
   a) Transition element form generally coloured compounds.
   b) Sc^{+3} is colourless, while Ti^{3+} is Coloured
   c) Zn^{+2} salts are white ,but Cu^{+2} are blue.
   d) Cu^{+} salts are colourless while Cu^{2+} salts are Coloured
   e) The Transition metals ions such as Cu^{+} Ag^{+} Sc^{+3} are colourless.
6. Predict which of the following will be colored in aqueous solution? Ti^{3+},V^{3+},Cu^{+},Sc^{3+}, Mn^{2+}, Fe^{3+}& Co^{2+}.
7. Out of Ag_2SO_4,CuF_2,MgF_2 and CuCl which compound will be coloured and why?
8. **Explain the following observations.**
   a) Transition metals show paramagnetic behavior.
   b) Mn^{2+} exhibits maximum paramagnetism
9. (a) Explain Variation in magnetic behaviour of Transition Metals along 3d transition series.
   (b) Calculate the magnetic moment of a divalent ion in aqueous solution if its at.no is 25.
   (c) Calculate the 'spin only' magnetic moment of M^{2+}ion *(Z* = 27)
10. Explain Variation in Atomic Size of Transition Metals along 3d transition series.
11. **Account for the following :**
   a) Members of second (4d) and the third (5d) series in each group of transition elements have similar radii.
   b) Zr and Hf exhibit similar properties.
   c) Although Zr belongs to 4d and Hf belongs to 5d transition series but it is quite difficult to separate them.
   d) Radius of Fe^{+2} is less than Mn^{+2}.
12. **Assign reasons for the following**
   a) There is in general increase in density of element from titanium to copper
   b) Transition metal ions form complex ions.
   c) Most of the transition metals and their compounds possess catalytic properties.

d) Transition metals form interstitial compounds.
e) Most of the transition metals form alloys.

13. Explain briefly how +2 state becomes more and more stable in the first half of the first row transition elements with increasing atomic number?
14. **Explain the following observations.**
    a) Transition element show variable oxidation state.
    b) Mn Shows the highest oxidation state of +7 among 3d series elements.
    c) The greatest number of oxidation states are exhibited by the elements in the middle of transition series.
    d) Mn Shows the highest oxidation state of +7 with oxygen but with fluorine it shows the highest oxidation state of +4.
    e) Highest fluoride of Mn is MnF_4 whereas the highest oxide is Mn_2O_7.
    f) Mn^{2+}compounds more stable than Fe^{2+}towards oxidation to their +3 state.
15. **Account for the following :**
    a) Of the $3d^4$species, $Cr^{2+}$is strongly reducing while Mn^3 is strongly oxidising.
    b) $Cr^{2+}$is strong reducing agent.
    c) Cr^{2+} is a stronger reducing agent Fe^{2+}.
    d) The lowest oxide of transition metal is basic, the highest is amphoteric/acidic.
    e) Mno is basic while Mn_2O_7 is acidic in nature.
    f) CrO_4^{2-} is a strong oxidizing agent while MnO_4^{-2} is not
    g) The increasing oxidising power of oxoanions are in the $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$
16. **Explain the following observations:**
    a) The $E^o(M^{2+}/M)$ values are not regular for the first row transition metals.
    b) E^0value for the Mn^{3+}/Mn^{2+}couple much more positive than that forCr^{3+}/Cr^{2+}or Fe^{3+}/Fe^{2+}
    c) E^0value for the Mn^{2+}/Mn much more than expected.
    d) E^0value for the Cu^{2+}/Cu is positive .
17. **Assign reasons for the following**
    a. Transition metal exhibit higher oxidation state in oxides and fluorides.
    b. Highest fluoride of Mn is MnF_4 wheras the highest oxide is Mn_2O_7
    c. The highest oxidation state is exhibited in oxoanions of a metal.
18. **Account for the following**
    a) Irregular variation of ionization enthalpies (first and second) in the first series of the transition elements.
    b) +3 state of Mn is of little importance.
    c) The Third ionization enthalpy of manganese is exceptionally high,
    d) First Ionization enthalpy of Cr is lower than that of Zinc.
    e) Mn^{+3}undergoes disproportionation reaction easily.
    f) d^1 configuration is very unstable in ions.
19. **Account for the following :**
    a) Cu^+ ion is not stable in aqueous solutions.
    b) Cu^+ ion has d^{10} configuration while Cu^{+2} has d^9configuration,still Cu^{+2} is stable in aqueous solutions
    c) Cobalt (II) is stable in aqueous solution but in the presence of complexing reagents it is easily oxidized.
    d) Cobalt (II) is easily oxidized in the presence of strong ligands.
    e) Although Co^{2+} ion appears to be stable ,it is easily oxidized to Co^{3+} ion in the presence of a strong ligand.
    f) Unlike Cr^{3+},Mn^{+2},Fe^{+3} and the subsequent other M^{2+} ions of the 3d series of elements ,the 4d and the 5d series metals generally do not form stable cationic species.

g) Transistion elements tend to be unreactive with increasing atomic number in the series.

ANSWER THE FOLLOWING:-

1. Name a transition element which does not exhibit variable oxidation states
2. Which of the *3d* transition series metals exhibits the largest number of oxidation states and why
3. What may be the stable oxidation state of the transition element with the following *d* electron configurations in the ground state of their atoms: $3d^3$,$3d^5$, $3d^8$and $3d^4$?
4. Which metal in the first series of transition metals exhibits +1 oxidation state most frequently and why?
5. Name the oxometal anions of the first series of the transition metals in which the metal exhibits the oxidation state equal to its group number.
6. What may be the possible oxidation states of transition metals with the following electronic configuration in the ground states in their atoms?(i)$3d^34s^2$(ii)$3d^54s^2$(iii)$3d^64s^2$
7. Which is a stronger reducing agent Cr^{2+}or $Fe^{2+}$and why?
8. Among Elements of 3d transition series are given as :

Element	**Sc**	**Ti**	**V**	**Cr**	**Mn**	**Fe**	**Co**	**Ni**	**Cu**	**Zn**

Answer the following:

a) Write the element which is not regarded as transition element.why
b) Write the element which can show an oxidation state of +1.
c) Which element is soft and why?
d) Write the element which shows maximum number of oxidation states.
e) Which element has the highest melting point?
f) Which element shows only +3 state?
g) Which element is a strong oxidizing agent in + 3 oxidation state and why.
h) Which element is a strong reducing agent in + 2 oxidation state and why.

Topic: LANTHANOIDS

1. **Give Reasons for the following**

(a) Chemistry of all the lanthanoids are quite similar.
(b) Size of trivalent lanthanoid cations decreases with increase in the atomic number
(c) It is difficult to separate lanthanoid elements in pure state..
(d) Ce^{4+} in aqueous solution is a good oxidising agent.
(e) Ce^{4+} is used oxidising agent in volumetric analysis.
(f) Ce^{3+} can be easily oxidized to Ce^{4+}.
(g) d-block elements exhibit more oxidation states than f block elements.
(h) Eu^{2+} is a strong reducing agent.
(i) La^{3+} and Lu^{3+}do not show any colour in solutions.
(j) Although Zr belongs to 4d and Hf belongs to 5d transition series but it is quite difficult to separate them.

2. What is Lanthanoid contraction? Give its cause. What are its Consequences?
3. Name an important alloy which contains some of the lanthanoid metals. Mention its uses.
4. Explain the chemistry of lanthanoids with reference to (i)electronic configuration (ii)Oxidation state (iii) atomic size and ionic size (iv)chemical reactivity
5. Name the members of the lanthanoid series which exhibit +4 oxidation states and those which exhibit +2 oxidation states.
6. Use Hund's rule to derive the electronic configuration of Ce^{3+}ion, and calculate its magnetic moment on the basis of 'spin-only' formula.

Unit: 9:- COORDINATION COMPOUNDS

1. **Explain giving examples:**
   a) Chelating ligands
   b) ambidentate ligands
   c) bidentate or Didentate ligand
   d) Polydentate ligand
   e) Homoleptic complexes
   f) Heteroleptic complexes
2. A chelating agent has two or more than two donor atoms to bind to a single metal ion. Which of the following is not a chelating agent? (i) thiosulphate (ii) oxalate (iii) glycinato (iv) ethane-1,2-diamine
3. Which of the following species is not expected to be a ligand? (i) NO (ii) NH_4^+ (iii) $NH_2CH_2CH_2NH_2$ (iv) CO
4. **Using IUPAC norms write the formulae for the following**:
   a. potassiumtri(oxalato) chromate (III)
   b. pentaamminenitrito-O-cobalt (III) ion
   c. pentaamminenitrito-N-cobalt(III) ion
   d. iron(III) hexacyanoferrate(II)
   e. mercury tetrathiocyanatocobaltate(III)
   f. tetraammineaquachloridocobalt (III) chloride
   g. tris(ethane–1,2–diamine) chromium(III) chloride
   h. amminebromidochloridonitrito-N-platinate(II)
   i. dichloridobis(ethane–1,2–diamine)platinum(IV) nitrate
5. **Give the formula** of each of the following coordination entities:
   (i) Co^{3+} ion is bound to one Cl^- one NH_3 molecule and two bidentate ligands ethylenediamine(en) molecules
   (ii) Ni^{2+} ion is bound to two water molecule and two oxalate ions
6. When a coordination compound $CrCl_3.6H_2O$ is mixed with $AgNO_3$,2 moles of AgCl are precipitated per mole of the compound.**Write structural formula & IUPAC name of the complex.**
7. When a coordination compound $PtCl_4.6NH_3$ is mixed with $AgNO_3$,4 moles of AgCl are precipitated per mole of the compound.**Write structural formula & IUPAC name of the complex.**
8. **When 1 mol $CrCl_3.6H_2O$ is treated with an excess of $AgNO_3$, 3 mol of AgCl are obtained. Write structural formula & IUPAC name of the complex.**
9. Write the **IUPAC names, Specify the coordination number** of the central Atom of the following:
   a. $[Fe(en_2Cl_2]Cl$
   b. $[CoCl_4]^{2-}$
   c. $[Co(NH_3)_4(H_2O)Cl]Cl_2$
   d. $[Co(NH_3)_5Cl]Cl_2$
   e. $[Cr(H_2O)_2(C_2O_4)_2]^-$
   f. $K_2[PdCl_4]$
   g. $[Ni(CN)_4]^{2-}$
10. Write the name & Using **VBT** Predict the Magnetic behaviour, Hybridization, Shape of following. Also predict whether it is inner or outer orbital complex in case of octahedral complexes.
    a) $[CoF_6]^{3-}$
    b) $[Cr(H_2O)_6]^{3+}$
    c) $[Cr(NH_3)_6]^{3+}$
    d) $[FeF_6]^{3-}$
    e) $[Fe(H_2O)_6]^{3+}$
    f) $[Fe(CN)_6]^{3-}$
    g) $[Fe(CN)_6]^{4-}$
    h) $[Co(NH_3)_6]^{3+}$
    i) $[Ni(H_2O)_6]^{2+}$

j) $[NiCl_4]^{2-}$
k) $[Ni(CN)_4]^2$
l) $[Ni(CO)_4]$
m) $[CoF_4]^{2-}$
n) $[\ Co(C_2O_4)_3]^{3-}$
o) $[Cr(H_2O)_2(C_2O_4)_2]^-$
p) $[CuCl_4]^{2-}$
q) $[Fe(en)_2Cl_2]$
r) $[Zn(H_2O)_6]^{2+}$
s) $[CoCl_4]^{2-}$
t) $[Cr(CO)_6]$
u) $[Fe(CO)_5]$
v) **$[MnF_6]^{4-}$**

11. Explain inner & outer orbital complex using suitable examples.
12. Draw diagram to show splitting of d – orbital in octahedral crystal field. Explain the two patterns of filling d^4 in octahedral crystal Field.
13. On the basis of crystal field theory,write the electronic configuration for d^4 ion if $\Delta_o < P$
14. On the basis of crystal field theory,write the electronic configuration for d^4 ion if $\Delta_o > P$
15. On the basis of crystal field theory,write the electronic configuration for d^6 ion if $\Delta_o < P$
16. On the basis of crystal field theory,write the electronic configuration for d^7 ion if $\Delta_o > P$
17. What is crystal field splitting energy? What are the various factors affecting CFSE.How does the magnitude of Δ_0 decide the actual configuration of d-orbital in a coordination entity?
18. **Based on crystal field theory explain why Co(III) forms a paramagnetic octahedral complex with weak field ligands whereas it forms a diamagnetic octahedral complex with strong field ligands.**
19. Explain why $[Ti(H_2O)_6]_3Cl_3$ is coloured. What happens to the colour of $[Ti(H_2O)_6]^3Cl_3$ when heated gradually?
20. What is **spectrochemical series**? Explain the difference between a weak field ligand and a strong field ligand.
21. **Arrange following complex ions in increasing order of crystal field splitting energy (Λ_o) : $[Cr(Cl)_6]^{3-}$, $[Cr(CN)_6]^{3-}$, $[Cr(NH_3)_6]^{3+}$.**
22. Using CFT,draw the energy level diagram ,write electronic configuration of the central atom/ion and determine the magnetic moment value in the following:
    a) $[FeF_6]^{3-}$
    b) $[Fe(H_2O)_6]^{3+}$
    c) $[Fe(CN)_6]^4$-
23. **Account for the Following**:
    a) $[Ni\ (CN)_4]^{2-}$ ion with square planar structure is diamagnetic and the $[NiCl_4]^{2-}$ ion with tetrahedral structure is paramagnetic .
    b) $[NiCl_4]^{2-}$ is paramagnetic while $[Ni\ (CO)_4]$ is diamagnetic though both are tetrahedral.
    c) $[Fe\ (H_2O)_6]^{3+}$ is strongly paramagnetic while $[Fe(CN)_6]^{3-}$ is weakly paramagnetic.
    d) $[Fe\ (H_2O)_6]^{3+}$has a magnetic moment value of 5.92 BM whereas $[Fe(CN)_6]^{3-}$ has a value of only 1.74 BM.
    e) $[Co\ (NH_3)_6]^{+3}$ is an inner orbital complex whereas $[Ni(NH_3)_6]^{+2}$ is an outer complex.
    f) $[Cr\ (NH_3)_6]^{+3}$ is paramagnetic while $[Ni\ (CN)_4]^{2-}$ is diamagnetic.
    g) A solution of $[Ni\ (H_2O)_6]^{2+}$ is green but a solution of $[Ni\ (CN)_4]^{2-}$ is colourless
    h) $[Fe\ (CN)_6]^{3-}$ and $[Fe(H_2O)_6]^{3+}$ are of different colours in dilute solutions

24. **Give reason for the Following:**
    a) Nickel does not form low spin octahedral complexes. [Ans:because Ni has E.C.$3d^8$ $4s^2$,in which two inner d –orbitals are not available which are required to form d^2sp^3 hybridisation]
    b) The ⊓-complexes are known for the transition metal only. [Ans:becauseTransition metals have d orbitals in their atoms or ions in to which the electron pair donated can be donated by ligands containing ⊓ electrons]
    c) Co^{+2} is easily oxidised to Co^{+3} in the presence of a strong ligand. [Ans:because in the presence of strong ligand ,the 3d electrons pair up leaving two orbitals empty to be involved in d^2sp^3 hybridisation]
    d) CO is a stronger ligand than NH_3 for mant metals. [Ans:because in case of CO back bonding takes place in which central atom uses its filled d orbital with empty ⊓* molecular orbital of CO]
    e) Low spin tetrahedral complexes not formed. [Ans: For tetrahedral complexes, the crystal field splitting energy is too low. It is lower than pairing energy so, the pairing of electrons is not favoured and therefore the complexes cannot form low spin complexes.

25. What is meant by stability of a coordination compound in solution? State the factors which govern stability of complexes.
26. Which of the following is the most stable complex species? (i) $[Fe(CO)_5]$ (ii) $[Fe(CN)_6]^{3-}$ (iii) $[Fe(C_2O_4)_3]^{3-}$ (iv) $[Fe(H_2O)_6]^{3+}$
27. What do you understand by stepwise stability constants.& overall stability constant of a coordination compound. How are stepwise and overall stability constant related.
28. Discuss the nature of Bonding in metal carbonyls.