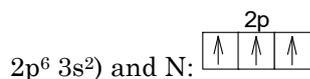


SOLUTION
INORGANIC CHEMISTRY
REVIEW ASSIGNMENT - 2

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PERIODIC PROPERTIES & CHEMICAL BONDING

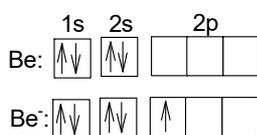
89. (D) Al^{3+} is the smallest ion. Smaller the ion, greater will be the hydration and hence larger the hydration energy.
90. (A) Since E_1 is very small compared to E_2 ($E_2 \gg E_1$) the element cannot be a chalcogen or a halogen. Again $E_2 \gg E_1$. So it cannot be an alkaline earth metal. Since E_1 is very small. It follows that the element is an alkali metal which readily attains inert gas configuration by losing one electron.
91. (D) For the radius ratio $\frac{r^+}{r^-}$ to be minimum, r^+ must be smallest and r^- must be the largest. While Cl^- is larger than F^- , Ca^{2+} is smaller than K^+ .
92. (B) Adding 1 more electron to atoms with just completed shells or just half-filled outermost levels is highly endothermic. Hence the electron affinities are zero or negative in the case of $\text{He}(1s^2)$, $\text{Mg}(1s^2 2s^2$



93. (B) Oxygen is the first member of the group with very small size and hence has high electron density and repels incoming electron very vigorously so that oxygen has the least value of electron affinity in the group (less than even that of Po). As usual the second element in the group viz. sulphur has maximum value of electron affinity.
94. (D) C^- is the most stable ion. C^- ion has the stable configuration with just half-filled 2p-orbital.



Stability of just half-filled 2p orbital. Be^- ion is the least stable. Because by adding 1 electron to the completely filled 2s orbital, we have to move to an orbital of much higher energy, viz 2p. Hence the process, $\text{Be} + 1e^- \longrightarrow \text{Be}^-$ is highly endothermic.



Just completely filled 2s orbital. Added electron goes to a new orbital (2p) of higher energy.

95. (C) MgSO_4 is more soluble in water than BaSO_4 because the hydration energy of smaller Mg^{2+} ion exceeds its lattice energy. BaSO_4 is practically insoluble because its lattice energy for exceeds its hydration energy.
96. (A) – (t); (B) – (p, q, r, s); (C) – (p); (D) – (r)
- (A) $\text{O}_{(g)}^- + e^- \longrightarrow \text{O}_{(g)}^{2-}$ is an endothermic process as the electron must overcome the repulsion by the negative O⁻ ion.
- (B) Born Haber cycle helps in determination of bond and lattice energies and electron affinity.
- (C) Pauling's first scale of electronegativity is based on calculation using bond energy data.
- (D) $\text{N}_2 + 3\text{F}_2 \longrightarrow 2\text{NF}_3$ is an exothermic process.

METALLURGY & HYDROGEN

97. (A) – (s); (B) – (p, q); (C) – (p, r); (D) – (s, t)
- $\text{TiCl}_4 + 2\text{Mg} \longrightarrow \text{Ti} + 2\text{MgCl}_2$
- $\text{Fe}_2\text{O}_3 + 2\text{Al} \longrightarrow 2\text{Fe} + \text{Al}_2\text{O}_3$
- $3\text{Mn}_3\text{O}_4 + 8\text{Al} \longrightarrow 9\text{Mn} + 4\text{Al}_2\text{O}_3$
- $\text{Fe}_2\text{O}_3 + 3\text{C} \longrightarrow 2\text{Fe} + 3\text{CO}$
- $\text{PbO} + \text{C} \longrightarrow \text{Pb} + \text{CO}$
- $\text{Ti} + 2\text{I}_2 \longrightarrow \text{TiI}_4$; $\text{TiI}_4 \xrightarrow{\Delta} \text{Ti} + 2\text{I}_2$
- $\text{Th} + 2\text{I}_2 \longrightarrow \text{ThI}_4 \xrightarrow{\Delta} \text{Th} + 2\text{I}_2$
98. (C) In calcination, the ore is heated below its melting point in absence of or limited supply of air. In calcination carbonates are decomposed to CO_2 .
99. (A) CuSO_4 is the activator while pine oil is a foaming agent. NaCN is a depressant, Ethyl xanthate acts as collector.
100. (B) Electrolysis of molten LiH liberates hydrogen at the anode as hydrogen is present as H^- in LiH (So choice 1 is wrong). Being very small Li^+ can polarize H^- and form covalent hydride (Choice 2 is correct). Since H^- ion occupies holes in lattice of metal without destroying the metal lattice the

density of ionic hydrides is greater than those of the metals (Choice 3 is correct). Ionic hydrides are stoichiometric (Choice 4 is wrong).

101. (A) The stability of hydrides H – X increases across any period. The stability depends on electronegativity and size of X.
102. (C) Eu^{2+} ($4f^7$) and Yb^{2+} ($4f^{14}$) have stable configuration with just half filled and completely filled 4f levels respectively. They form stoichiometric hydrides similar to CaH_2 . Thus EuH_2 and YbH_2 are stoichiometric hydrides.

s-BLOCK ELEMENTS

103. (C) Lithium sulphates does not form alums since alums contain $[\text{X}(\text{H}_2\text{O})_6]^+$, $[\text{Y}(\text{H}_2\text{O})_6]^{3+}$ and SO_4^{2-} ions where X^+ is monovalent having a coordination number 6 but Li^+ does not have C.N. = 6. Lithium does not show photoelectric effect as its ionization potential is very high.
104. (C) $2\text{LiNO}_3 \rightarrow \text{Li}_2\text{O} + 2\text{NO}_2 + \frac{1}{2} \text{O}_2$
105. (B), (D) Amalgam formation is exothermic. Because of their large size alkaline earth metals do not form complexes (except Be). So statements (A) and (C) are incorrect while (B) and (D) are correct.
106. (A) Among alkali metals, Li^+ is the smallest ion and evolves highest heat of hydration, which overcomes the lattice energy of the ionic LiClO_4 and dissolves the same,
107. (A) – (p); (B) – (r); (C) – (q); (D) – (s)
Anhydronite is $\text{Mg}(\text{ClO}_4)_2$ which is a dehydrant.
Nitrolim is $\text{CaCN}_2 + \text{C}$, a fertilizer.
Anhydrite is (anhydrous) CaSO_4
Schonite is $\text{K}_2\text{SO}_4 \cdot \text{MgSO}_4 \cdot 6\text{H}_2\text{O}$, a mineral of Magnesium.
108. (B) Being a very small ion, Li^+ does not allow the spread of negative charge of O^{2-} ion towards a second oxygen atom. Hence it forms only Li_2O but not Li_2O_2 not LiO_2 .
109. (D) The superoxide of potassium KO_2 is used in space ships and submarines as a source of oxygen for breathing.

110. (A), (B), (D) Beryllium sulphate is more soluble while MgSO_4 is less soluble because the hydration energy of Be^{2+} is much higher than that of Mg^{2+} (Choice (A) is correct). Choice (B) is also correct. Choice (D) is correct as the superoxide are all coloured. RbO_2 , with O_2^- is paramagnetic because of the unpaired electron (3 – electron bond). So, choice (C) is wrong.

GROUP 13 & 14

111. (A) Since the size of B and F are almost the same, $\text{p}\pi\text{-p}\pi$ back bonding is maximum in BF_3 . Electron density on boron is increased and hence BF_3 is least in Lewis acidic character. As the size on central atom increase, the back bonding decreases and Lewis acid character increases and InF_3 is most acidic.
112. (C) In NH_3 and $\text{N}(\text{CH}_3)_3$ there is no possibility of $\text{p}\pi\text{-p}\pi$ back bonding as H or C have no d-orbitals. Due to the large size of Ge, the $\text{p}\pi\text{-p}\pi$ back bonding is less $\text{N}(\text{GeH}_3)_3$ and so it is most pronounced in $\text{N}(\text{SiH}_3)_3$.
113. (B)
- | | | | | | |
|----------|------|------|------|------|------|
| Element: | Si < | C* < | Ge < | Sn < | Pb |
| Density: | 2.34 | 3.5 | 5.3 | 7.3 | 11.3 |
- (*for diamond)
114. (A) Because of its semiconducting nature, Si is used in solar cells.
115. (D) $\text{Ti}(\text{OH})_3$ is less basic than TlOH . Ti^{3+} is smaller in size than Tl^+ and hence TlOH with larger Tl^+ ion is more basic than $\text{Ti}(\text{OH})_3$.
116. (C) The +2 state is more stable than +4 state in Pb. This is because of the inert pair effect in Pb and not because of non-availability of d orbitals.
117. (A) – (q); (B) – (s); (C) – (r); (D) – (p)
118. (A) Al has the maximum negative reduction potential among 13th group elements. Hence it has the maximum reducing property in the group.
119. (C) $\text{B}(\text{OH})_3$ or H_3BO_3 is a weak monobasic acid and an electron pair acceptor.
 $\text{B}(\text{OH})_3 + \text{HOH} \rightleftharpoons [\text{B}(\text{OH})_4]^- + \text{H}^+$

120. (B) The fluorides of Al, Ga, In and Tl are ionic and have high melting points. Other halides of the elements of the group are largely covalent.

GROUP 15 (N-FAMILY)

121. (B) HNO_3 is oxidizing. But with P^{5+} state being stable than P^{3+} , H_3PO_4 shows no oxidizing property. Due to inert pair effect, +3 state of As and Sb is more stable than +5 state. Hence H_3AsO_4 and H_3SbO_4 are oxidizing.

122. (C)
- | | | | | |
|-------------|---------------|---------------|---------------|---------------|
| Compound: | NH_3 | NF_3 | PF_3 | PH_3 |
| Bond angle: | 107 | 102 | 97 | 94 |

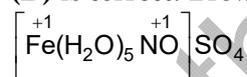
NH_3 : N – H bond pair closest to N due to greatest electronegativity of N. Hence maximum bond angle (107°) in NH_3 due to maximum bond pair-bond pair repulsion
 NF_3 : N – F bond electrons away from N due to greater electronegativity of F than N. Hence second largest bond angle in NF_3 (102°)
 In PF_3 , P – F bonds acquires partial double bond character due to $\text{p}\pi\text{-d}\pi$ back bonding between F and P. Hence the bond angle in PF_3 is larger (97°) than in PH_3 (94°)

123. (B), (C), (D)

(A) is wrong: $\text{PBr}_5 \longrightarrow [\text{PBr}_4]^+ + \text{Br}^-$

(B) and (C) are correct

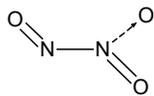
(D) is correct. Brown ring complex is



NO^+ accounts for one. Therefore Fe has +1 charge.

124. (A) – (r); (B) – (t); (C) – (p, q, r, t); (D) – (q)

N_2O (r) is diamagnetic and neutral oxide



N_2O_3 (t) has the structure . It is a blue solid.

N_2O (r) has the structure $\text{N} \equiv \overset{\oplus}{\text{N}} - \overset{\ominus}{\text{O}}$, but a colourless gas.

(NO_2 has no N – N bond, only the dimmer

N_2O_4 has N – N bond)

NO (p), NO_2 (q), N_2O (r) and N_2O_3 (t)

are both oxidizing and reducing. N_2O_5 (anhydride of HNO_3) is only an oxidizing agent not reducing.

NO_2 (q) is paramagnetic (1 unpaired electron)

and oxidizing and is a brown gas.

125. (B) In NF_3 , N has no d orbitals to coordinate with water molecule. Hence it is not hydrolysed. Since P – F bond is stronger than P – O bond. PF_3 is not hydrolysed.

126. (B) $\text{NCl}_3 + 3\text{H}_2\text{O} \longrightarrow \text{NH}_3 + 3\text{HOCl}$
 (Ammonia is the product)
 $\text{PCl}_3 + 3\text{H}_2\text{O} \longrightarrow \text{H}_3\text{PO}_3 + 3\text{HCl}$ (H_3PO_3 is the product)

127. (D) Due to the very strong pull of N – F bond electrons, electrons pair on nitrogen is least available for protonation. Hence NH_3 is

the weakest Lewis base

GROUP 16 (O-FAMILY)

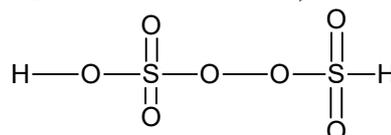
128. (D) Oxygen has the lowest electron affinity (not Te) because of very high repulsion to the incoming electron by the very small oxygen atom.

Element :	O	S	Se	Te
Electron affinity :	140	200	195	190
	(kJ mol^{-1})			

129. (C)
 $\text{Na}_2\text{S}_2\text{O}_3 + 2\text{AgNO}_3 \rightarrow \text{Ag}_2\text{S}_2\text{O}_3 (\text{s}) + 2\text{NaNO}_3$

White precipitate
 $\text{Ag}_2\text{S}_2\text{O}_3 + \text{H}_2\text{O} \rightarrow \text{Ag}_2\text{S} (\text{s}) + \text{H}_2\text{SO}_4$
 Black precipitate

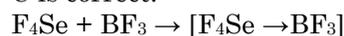
130. (B), (C), (D)
 $\text{H}_2\text{S}_2\text{O}_8$ has O – O bond, not S – S bond



Choice A is wrong.

The oxidation number of S is +6. Choice B is correct.

SeF_4 is an electron donor (Lewis base) as well as electron acceptor (Lewis acid). Choice C is correct.



(Se has a lone pair)

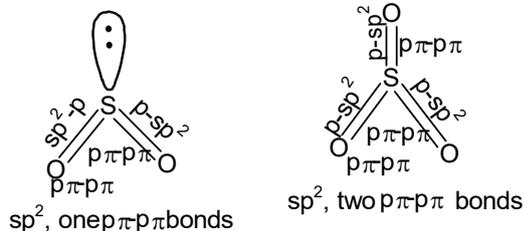
It acts as a Lewis base



Se in SeF_4 accepts 2 electrons (Lewis acid).

SO_2 is a reducer, SeO_2 oxidizes methylenic hydrogen to carbonyl group. So, statement D is correct.

131. (A) – (s); (B) – (q); (C) – (p); (D) – (r)



SO_4^{2-} : S excited :



sp^3 hybridization; pure d orbitals form 2 π - $d\pi$ bonds with oxygen atom

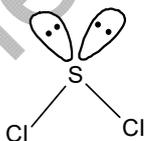
SO_3^{2-} : S excited :



sp^3 hybridization; 3 σ bonds, 1 pure d orbital form π - $d\pi$ bond with oxygen atom

132. (D) Being very large in size and low Te – Te and Po – Po bond energy the bond breaks readily. Hence Te_2Cl_2 and Po_2Cl_2 are not known.

133. (B) SX_2 , the dihalide of chalcogen sulphur has sp^3 hybridized central sulphur atom. It has two bond pairs and two lone pairs. It has a bent (V) shape



134. (C) The order of stability is $\text{SF}_6 > \text{SeF}_6 > \text{TeF}_6$. SF_6 is inert. TeF_6 readily hydrolyses in water. Small size of fluorine and its high electronegativity makes SF_6 very stable. TeF_6 is slightly more reactive than SeF_6 .

GROUP 17 (HALOGENS)

135. (A) $2\text{KClO}_3 + \text{I}_2 \longrightarrow 2\text{KIO}_3 + \text{Cl}_2$

136. (A) Base accepts proton. HNO_3 accepts proton to give H_2NO_3^+

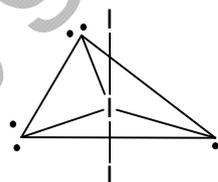
137. (B), (C), (D)
Statement A is wrong: The reaction between PH_3 and Cl_2 is exothermic (not endothermic)
 $\text{PH}_3 + 3\text{Cl}_2 \longrightarrow \text{PCl}_3 + 3\text{HCl}$; $\Delta H = -x$ cal

Statement B is correct: H – Br bond is weaker than HCl bond. Due to greater electronegativity of Cl than that of Br, HOCl is a stronger acid than HOBr .

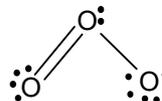
Statement C is correct: In B – F bond, both orbitals (of B and F) are small and comparable in size and hence they overlap to a maximum extent. Also the electronegativity difference is largest between B and F than between the other two pairs.

Statement D is correct: I_3^- has linear shape with sp^3d hybridization and three lone pairs (equatorial). O_3 has a bent structure.

I_3^-



O_3



138. (B) It is not because of the highest electronegativity of fluorine but because of the highest positive reduction potential, that fluoride ion is a very poor reducing agent.

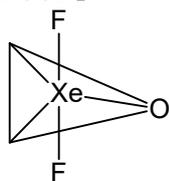
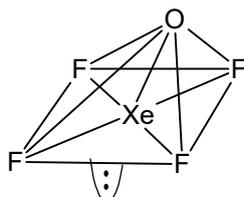
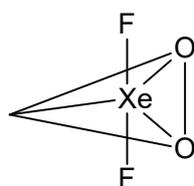
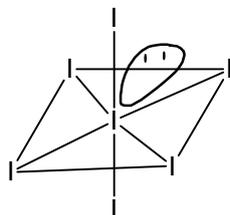
139. (C) Fluorine has very small size and the inter electron repulsion between the two fluorine atoms is very strong so that the bond energy of F_2 is less than those of both Cl_2 and Br_2 .

140. (A)

141. (B) $\text{RbICl}_2 \longrightarrow \text{RbCl} + \text{ICl}$

142. (C) In 1, 3 and 4 the central Xe has sp^3 hybridization. In XeF_4 it is sp^3d^2
 XeO_4 : sp^3 , tetrahedral, no, lone pair
 XeF_4 : sp^3d^2 , octahedral, 2 lone pairs
 XeO_3 : sp^3 , tetrahedral, 1 lone pair
 XeO_2 : sp^3 , tetrahedral, 2 lone pairs

143. A – s; B – r; C – q; D – p


 sp^3d ; bent T shape

 sp^3d^2 ; square pyramidal

 sp^3d ; see saw shape


octahedron

 sp^3d^3 ; distorted

144. (A)

d-BLOCK ELEMENTS

145. (C) Initially as nuclear charge increases, atomic radius decreases. Half way through, the added electron just counterbalances the increased nuclear pull and the atomic radii remain practically same.

146. (D) $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$: It has one d electron ($3d^1 4s^0$) paramagnetic and is coloured purple
 $\text{K}_3[\text{Cu}(\text{CN})_4]$: It is colourless, Cu^+ is ($3d^{10} 4s^0$), so diamagnetic

KMnO_4 : It is deep purple due to charge transfer but has no unpaired electrons. ($3d^0 4s^0$) and so diamagnetic

V_2O_5 : It is colourless and diamagnetic V^{+5} is ($3d^0 4s^0$)

147. (B) Density of Os = 22.6 g/cc. Density of Sc = 3.1 g/cc

148. (A) - (r); (B) - (s); (C) - (p); (D) - (q)

149. (C) In $[\text{NiCl}_4]^{2-}$,

 Ni^{2+} :

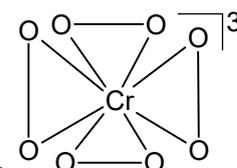
 sp^3 hybridization;

 In $[\text{PdCl}_4]^{2-}$;

 Pd^{2+} :

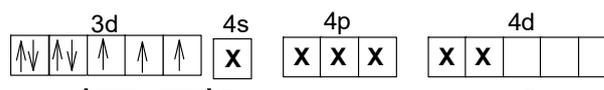
 dsp^2 hybridization

150. (D) In potassium tetraperoxochromate


 (K_3CrO_8) i.e., $[\text{CrO}_8]^{3-}$

 Oxidation number of Cr = $x + 8 - 3 = +5$

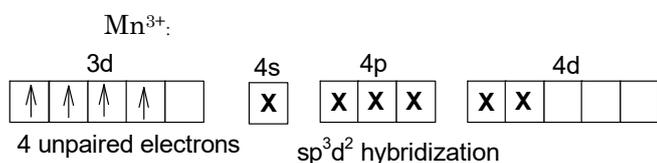
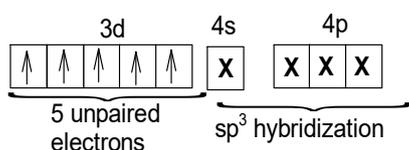
151. (B) In brown ring complex, $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]^{2+}$
 NO is in +1 state; so Fe is also in +1 state
 Fe^{2+} , sp^3d^2 hybridization



152. (C) ZnO on heating loses some oxygen and results in consequent non-stoichiometry (metal excess defect) and yellow colour.

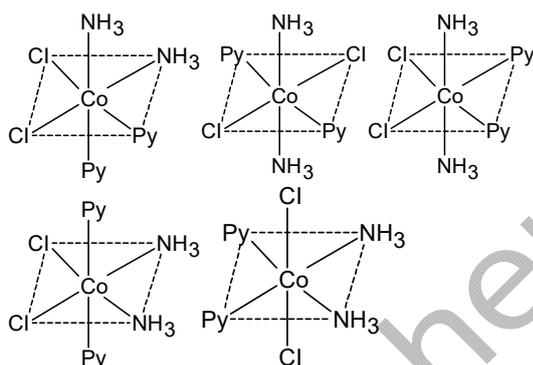
COORDINATION COMPOUNDS

153. (B) $[\text{MnCl}_4]^{2-}$ (Mn as Mn^{2+}):

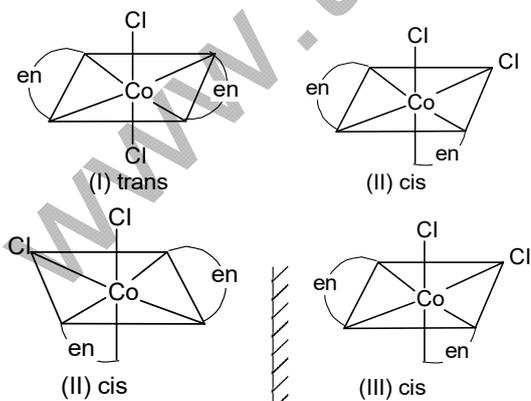


154. (C) Ionisation isomerism:
 $[\text{Cr}(\text{H}_2\text{O})_5(\text{NO}_2)]\text{Cl}_2$ and
 $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}](\text{NO}_2)\text{Cl}$
 Hydrate isomerism: $[\text{Cr}(\text{H}_2\text{O})_5(\text{NO}_2)]\text{Cl}_2$ and
 $[\text{Cr}(\text{H}_2\text{O})_4(\text{NO}_2)\text{Cl}]\text{Cl}(\text{H}_2\text{O})$
 Linkage isomerism: $[\text{Cr}(\text{H}_2\text{O})_5(\text{NO}_2)]\text{Cl}_2$ and
 $[\text{Cr}(\text{H}_2\text{O})_5(\text{ONO})]\text{Cl}_2$

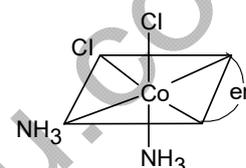
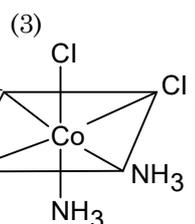
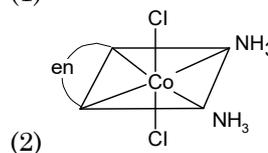
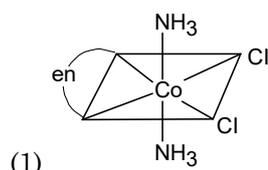
155. (D) There are 5 possible geometrical isomers of the complex $[\text{Co}(\text{NH}_3)_2(\text{Py})_2\text{Cl}_2]^+$ as shown below:



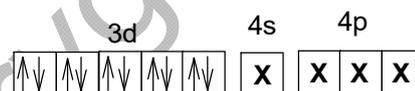
156. (A) – (r); (B) – (q); (C) – (s); (D) – (p)
157. (B) $\text{Co}(\text{en})_2\text{Cl}_2$ will exhibit both optical and geometrical isomerism



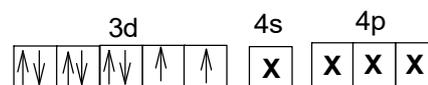
158. (D) In $[\text{Co}(\text{en})(\text{NH}_3)_2\text{Cl}_2]\text{Cl}_2$, there are three geometrical isomers 1, 2, 3. One of them (3) is optically active.



159. (B) In $\text{Ni}(\text{CO})_4$, Ni is in zero oxidation state and CO is a strong ligand
 $\text{Ni}(\text{CO})_4$:

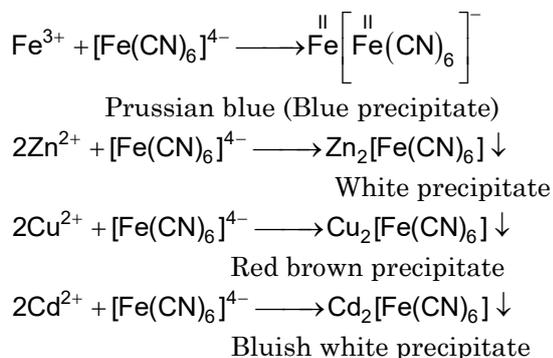


In $\text{Ni}(\text{PPh}_3)_2\text{Cl}_2$, Ni is in +2 state. Both ligands are weak.



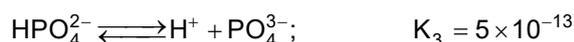
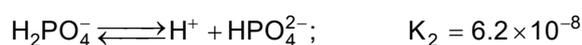
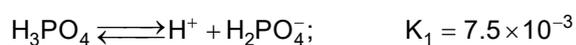
QUALITATIVE ANALYSIS

160. (D) Copper ion gives cupro complex $\text{K}_3[\text{Cu}(\text{CN})_4]$, while cadmium ion, Cd^{2+} gives $\text{K}_2[\text{Cd}(\text{CN})_4]$ with excess KCN.
161. (C) Potassium gives a purple flame colour and yellow precipitate of $\text{K}_3[\text{Co}(\text{NO}_2)_6]$ with sodium cobaltinitrite.
162. (D) On treatment with yellow $(\text{NH}_4)_2\text{S}_2$, II B group sulphides of As, Sb and Bi go into solution. Of the II A group sulphides Pb, Bi, Cu and Cd dissolve in HNO_3 as nitrates. Hence the black residue left behind must be that of Hg^{2+} .
163. (D) AlCl_3 reacts with excess of NaOH to give soluble sodium aluminate. As_2S_3 reacts with excess NaOH to give soluble Na_3AsO_3 . Copper precipitates $\text{Cu}(\text{OH})_2$ and MnS gives initially $\text{Mn}(\text{OH})_2$ and then MnO_2 black precipitate with excess NaOH.
164. (B) $\text{K}_4[\text{Fe}(\text{CN})_6]$ gives precipitates with all except Fe^{2+} .



165. (B) Al will be precipitated in the third group on adding $\text{NH}_4\text{Cl} - \text{NH}_4\text{OH}$ buffer. Bismuth is a second group metal. Hence it will be precipitated as the hydroxide $\text{Bi}(\text{OH})_3$. But Zn (IV group) and Mg (VI group) will not be precipitated as the solubility product of their hydroxides is very high.

166.



pH at first equivalence point:

$$\text{pH} = \frac{1}{2}(\text{p}K_1 + \text{p}K_2)$$

$$= \frac{1}{2}[(-\log K_1) + (-\log K_2)]$$

$$= \frac{1}{2}[(-\log 7.5 \times 10^{-3}) + (-\log 6.2 \times 10^{-8})]$$

$$= \frac{1}{2}(2.12 + 7.21)$$

$$= 4.67$$

Suitable indicator is methyl red or Congo red.

At the second equivalence point

$$\text{pH} = \frac{1}{2}(\text{p}K_2 + \text{p}K_3)$$

$$= \frac{1}{2}[(-\log K_2) + (-\log K_3)]$$

$$= \frac{1}{2}[(-\log 6.2 \times 10^{-8}) + (-\log 5 \times 10^{-13})]$$

$$= \frac{1}{2}[7.25 + 12.30] = 9.75$$

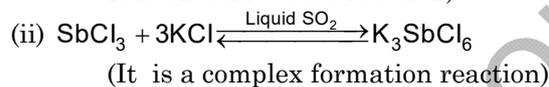
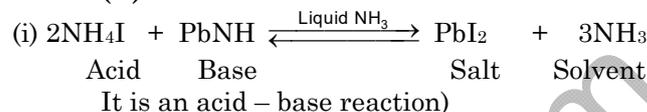
Suitable indicator is Thymolphthalein. [$\text{p}K_{\text{In}} = 9.3$ (colourless to blue)].

167. (A) (i) Hard acids prefer to coordinate with hard bases and soft acids prefer to react with soft bases. I^- ions is a soft ion, which prefers to combine with soft Ag^+ ion to give

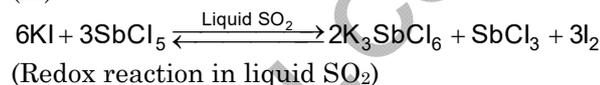
stable AgI_2^- . But hard F^- does not prefer soft Ag^+ . So AgF_2^- is unstable.

(ii) The ion F^- is a hard base and prefers to combine with hard Li^+ ion to give stable CsF while CsF is a soft-hard combination and hence unstable.

(B)



(iii)



168. (A) AlCl_3 has Al^{3+} and 3Cl^- ions in aqueous solution. The small and highly charged Al^{3+} ion, on hydration forms $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$, releases a very large amount of hydration energy ($\Delta H = 466 \text{ kJ mol}^{-1}$). Similarly 3Cl^- ions release ($3 \times -381 = -1143 \text{ kJ mol}^{-1}$)

Total hydration energy released is 5808 kJ mol^{-1} . This far exceeds the high Ionisation energy

$\text{I}_1 + \text{I}_2 + \text{I}_3 = 5114 \text{ kJ mol}^{-1}$. Hence, AlCl_3 easily passes in solution.

(B) In Ga, the 10 d-electrons do not shield the nucleus effectively. Hence the outer electrons are more firmly held by the nucleus and the atom is smaller in size than would otherwise be expected. Hence, Al and Ga have the same atomic radii. In Tl, the inner fourteen 4f electrons provide very poor shielding due to which its atomic size is almost the same as that of In.

(C) The stability of +4 oxidation state decreases and +2 state increases as we move down in group IV from Ge to Pb due to inert pair effect (non-participation of s electron in valency process). The effect increases with increases in size of the metal. Consequently Sn^{2+} and Pb^{+2} are more stable than Sn^{+4} and Pb^{+4} . The inert pair effect is minimum in Ge. Hence, the s electrons are involved in valency process and Ge^{4+} is thus more stable than Ge^{2+} is a strong reducing agent.

(D) In disilyl ethers, $\text{R}_3\text{Si} - \text{O} - \text{SiR}_3$, there is overlap between filled $p\pi$ orbitals of oxygen and empty $d\pi$ orbitals of Si ($p\pi-d\pi$ bonding). The overlap increase with increasing angle. Thus angle in $(\text{C}_6\text{H}_5)_3\text{Si} - \text{O} - \text{Si}(\text{C}_6\text{H}_5)_3$ is nearly 180° (Maximum angle because of strong steric factor due to 3 large R groups).