Nishant Jindal

Zero group

NH_4^+ = all soluble except few Complex

$$NH_4^+ + NaOH \xrightarrow{\text{(alkaline solution)}} \underline{NH_3} + H_2O$$

Pungent smell Basic gas

NH_4^+ + $Na_3[Co(NO_2)_6]$ → $(NH_4)_3[Co(NO_2)_6]$ yellow

H_2PtCl_6 → $(NH_4)_2[PtCl_6]$ yellow

$NaHC_4H_4O_6$ → $NH_4HC_4H_4O_6$ White

Red Colour

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VI group.

K^+ = all simple salts are soluble except $KClO_4$ and few complex salt insoluble

Test $HClO_4$

✓ $K^+ + HClO_4 \longrightarrow KClO_4$ White

K^+ —
- $Na_3[Co(NO_2)_6]$ → $K_3[Co(NO_2)_6]$ yellow ppt fisher salt
- H_2PtCl_6 → $K_2[PtCl_6]$ yellow ppt
- $NaHC_4H_4O_6$ → $KHC_4H_4O_6$ White ppt.

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Dist between NH_4^+ / K^+

$(NH_4^+ + K^+) + HClO_4 \longrightarrow NH_4ClO_4 + KClO_4$

NH_4ClO_4: Soluble; $KClO_4$: white ppt

$KClO_4$ —filtered→ NH_4ClO_4 + $KClO_4$ (residue)

$NH_4ClO_4 \xleftarrow{NaOH} NH_3$

$NH_3 \xrightarrow{K_2HgI_4/OH^-}$ Nessler's reagent

$\left[Hg \begin{smallmatrix} O \\ NH \end{smallmatrix} Hg \right] I$ (Brown ppt.)

Na^+ = all simple salts are soluble except $NaHCO_3$ (sparingly soluble)

few complex salts are insol.

Test with KH_2SbO_4

$$Na^+ + KH_2SbO_4 \longrightarrow NaH_2SbO_4 + K^+$$

White ppt.

Test with Magnesium uranyl acetate –

$$Na^+ + 3UO_2^{+2} + 9CH_3COO^- + Mg^{+2} \longrightarrow NaMg(UO_2)_3(CH_3COO)_9$$

Yellow ppt

Mg^{+2}

$$Mg^{+2} + NH_4OH + NH_4Cl + HPO_4^{-2} \longrightarrow \underset{\text{White ppt.}}{Mg(NH_4)PO_4}$$

$$Mg(NH_4)PO_4 \xrightarrow{\Delta} Mg_2P_2O_7 + NH_3 + H_2O$$

White residue

Note ⇒ above white ppt ($Mg(NH_4)PO_4$) can not be formed in absence of NH_4Cl because in presence of NH_4Cl $\bar{O}H$ ↓ so $Mg(OH)_2$ does not form.

$Mg^{+2} + Na_2CO_3 \longrightarrow MgCO_3 \cdot Mg(OH)_2$

White ppt (Basic carbonates)

$Li^{+} + Na_2CO_3 \longrightarrow Li_2CO_3$

Carbonate

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I group

$PbCl_2$, Hg_2Cl_2, $AgCl$ + dissolve in water and boil and filtered

White ppt of I group cation

- filtrate [$PbCl_2$]
- residue ($AgCl$ | Hg_2Cl_2)
- dissolve in NH_3 solution and filtered
  - $[Ag(NH_3)_2]^+$ (filtrate)
- Hg_2Cl_2, then Hg_2^{+2} Confirm

White ppt turns black on standing

Hg_2Cl_2 + NH_4OH ($NH_3 + H_2O$) → Hg + $Hg(NH_2)Cl$

Black — White

Black

Hg_2Cl_2 = Calomel

$HgCl_2$ = Corrosive Sublimate

Hg → all salt poisonous

Key point

P Block cation + excess of KI → Soluble

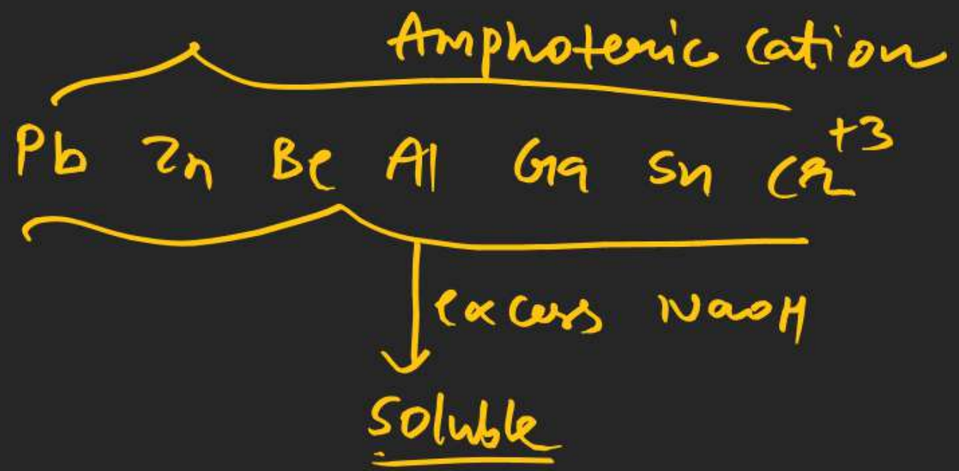
→ D Block + excess of KI → Insoluble

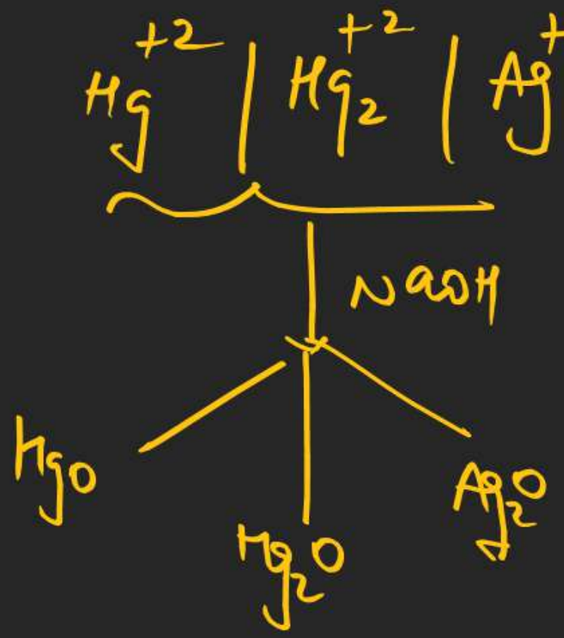
→ except $HgI_2 + I^- \longrightarrow [HgI_4]^{-2}$ (Soluble)

D-Block Cation + excess of NH_3 / CN^- → Soluble

except for NH_3

Fe^{+2} | Fe^{+3} | Hg_2^{+2} | Hg^{+2} | Mn^{+2} | Cr^{+3}





$Pb^{+2} + KI \longrightarrow \underset{\text{yellow ppt}}{PbI_2} \xrightarrow[KI]{\text{excess}} [PbI_4]^{-2}$

$Pb^{+2} + KCN \longrightarrow \underset{\text{White ppt}}{Pb(CN)_2} \xrightarrow[CN^-]{\text{excess}} \text{Insol.}$

$Pb^{+2} + NaOH \longrightarrow \underset{\text{White ppt.}}{Pb(OH)_2} \xrightarrow[\eta\, NaOH]{\text{excess}} \underset{\text{Soluble}}{[Pb(OH)_4]^{-2}}$

$[Pb(OH)_4]^{-2} \xrightarrow{H_2O_2} \underset{\text{(Black ppt.)}}{PbO_2}$

$[Pb(OH)_4]^{-2} \xrightarrow{S_2O_8^{-2}} \underset{\text{(Black ppt)}}{PbO_2}$

$\underline{Pb}^{+2} + \underline{NH_4OH} \longrightarrow \underset{\underline{\text{Insol.}}}{Pb(OH)_2} \xrightarrow{\text{excess}}$

$Pb^{+2} + H_2S \longrightarrow Pb_2SCl_2 \xrightarrow{H_2S} PbS + PbCl_2$

$Pb^{+2} + H_2S \longrightarrow Pb_2SCl_2 \xrightarrow{\text{dilution}} PbS + PbCl_2$

$Pb^{+2} + Na_2CO_3 \longrightarrow \underset{\underline{\text{White lead}}}{2PbCO_3 \cdot Pb(OH)_2}$

(needle like White ppt)

$\underset{\text{Black}}{PbS} + H_2O_2 \longrightarrow \underset{\text{White}}{PbSO_4}$

$Ag^+ + KI \longrightarrow \underset{\text{yellow ppt}}{AgI} \xrightarrow[KI]{\text{excess}} \text{Insol.}$

$Ag^+ + KCN \longrightarrow \underset{\text{(white ppt.)}}{AgCN} \xrightarrow[of\ KCN]{\text{excess}} \underline{\text{Soluble}}\ [Ag(CN)_2]$

$Ag^+ + NaOH \longrightarrow \underset{\text{Brown}}{Ag_2O} \xrightarrow{\text{excess}} \text{Insol.}$

$Ag^+ + NH_4OH \longrightarrow \underset{\text{(Brown)}}{Ag_2O} \xrightarrow{\text{excess}} \underline{\text{Soluble}}\ [Ag(NH_3)_2]^+$

$Ag^+ + H_2S \longrightarrow \underset{\text{(Black ppt.}}{Ag_2S}$

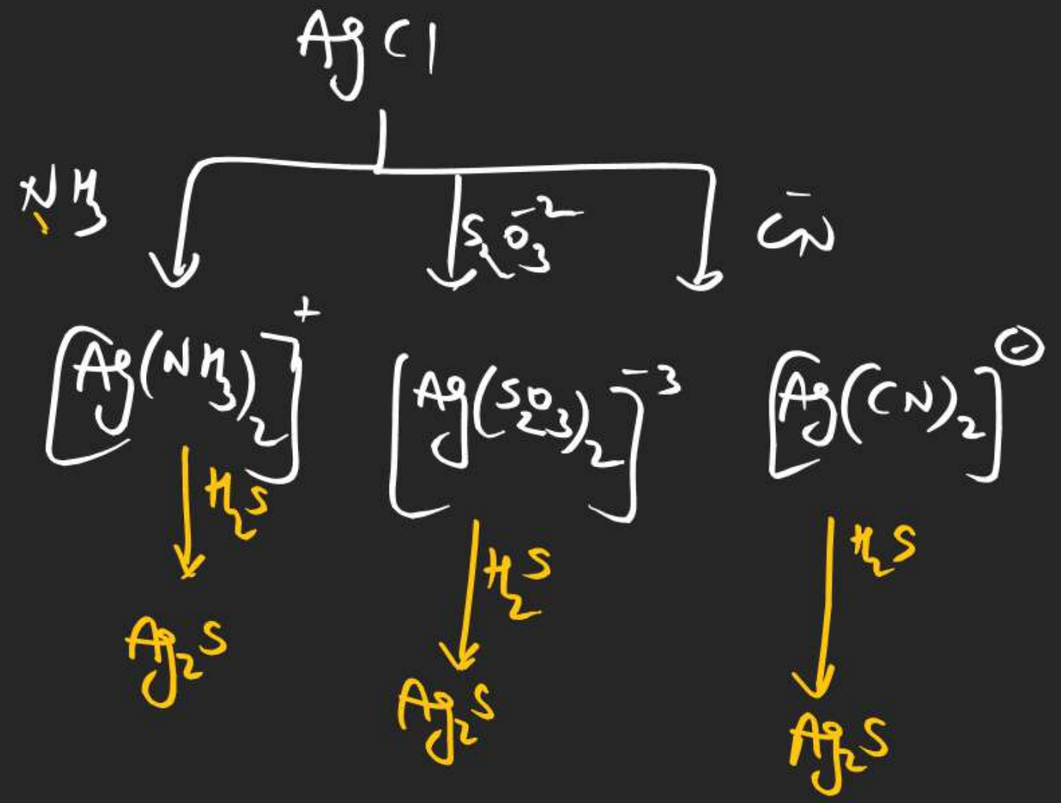
$Ag^+ + \bar{S}CN \longrightarrow AgSCN\ (\text{white})$

$Ag^+ + PO_4^{-3} \longrightarrow Ag_3PO_4\ \text{yellow}$

Ag_2S ⇒ Insoluble in

NH_3, $\bar{C}N$ $S_2O_3^{-2}$ $(NH_4)_2S$ and ammonium polysulphide $(NH_4)_2S_x$

$x = 2$ to 5



$$Ag^{+} + N_2H_4 \cdot HSO_4 \longrightarrow \underset{\text{Black ppt}}{Ag\downarrow} + N_2 + SO_4^{-2}$$

$Hg_2^{+2} + KI \longrightarrow Hg_2I_2$ (green ppt.)

$Hg_2I_2 \xrightarrow{\text{boil}} Hg + HgI_2$

$Hg_2I_2 \xrightarrow{\text{boil with excess KI}} Hg + [HgI_4]^{-2}$ (Soluble)

$Hg_2^{+2} + KCN \longrightarrow Hg + Hg(CN)_2$

Black

$Hg_2^{+2} + NaOH \longrightarrow Hg_2O \xrightarrow{\text{boil}} Hg + HgO$

$Hg_2O \xrightarrow{\text{excess}}$ Insol.

$Hg_2(NO_3)_2 + NH_4OH \longrightarrow Hg + HgO \cdot Hg(NH_2)NO_3$

Black + White → Black

$Hg_2^{+2} \longrightarrow Hg + Hg^{+2}$

$\xrightarrow[NH_4OH]{\text{excess}}$ Insoluble

$$Hg_2^{+2} + H_2S \longrightarrow \underset{\text{Black}}{Hg} + \underset{\text{Black}}{HgS}$$

Hg ⇒ Soluble in aqua regia and sodium disulphide but insoluble in Sodium sulphide

HgS = Soluble in aqua regia and Sodium disulphide and Sodium Sulphide