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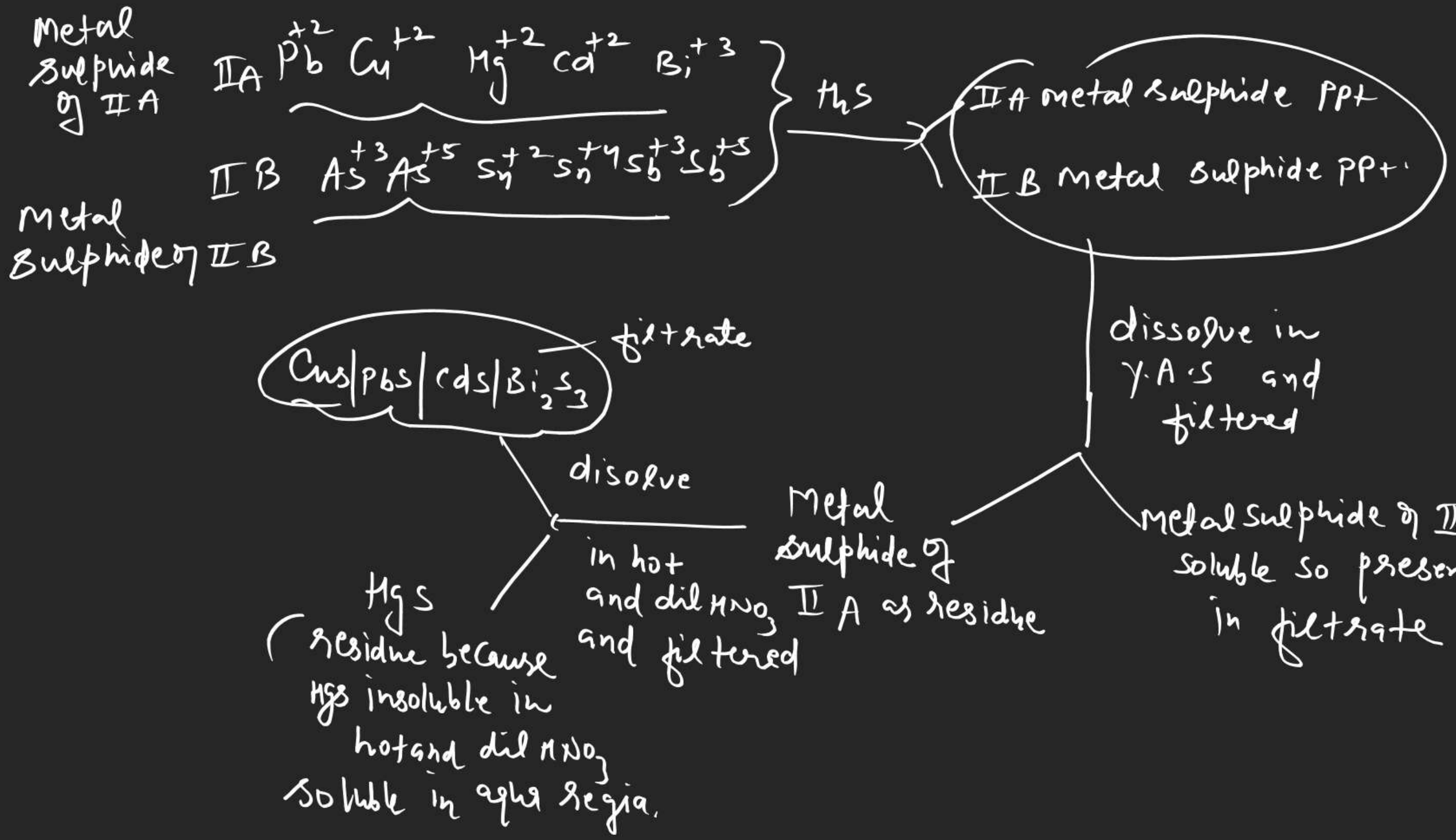


Metal Sulphide of II B soluble in Y.A.S as well as C.A.S except SnS which is soluble in Y.A.S but insoluble in C.A.S

Y.A.S = yellow ammonium sulphide

$(NH_4)_2S_x$

$x = 2$ to 5 or 6

C.A.S = Colourless ammonium Sulphide.

$(NH_4)_2S$

Metal sulphide of II B soluble in non oxidising acid as well as strong alkaline solution except As_2S_3

As_2S_3 which is soluble in strong alkaline solution but Insoluble in non oxidising acid.

$$\underset{(OA)}{Cu^{+2}} + \underset{(RA)}{I^{\ominus}} \longrightarrow Cu^{+} + I_2$$

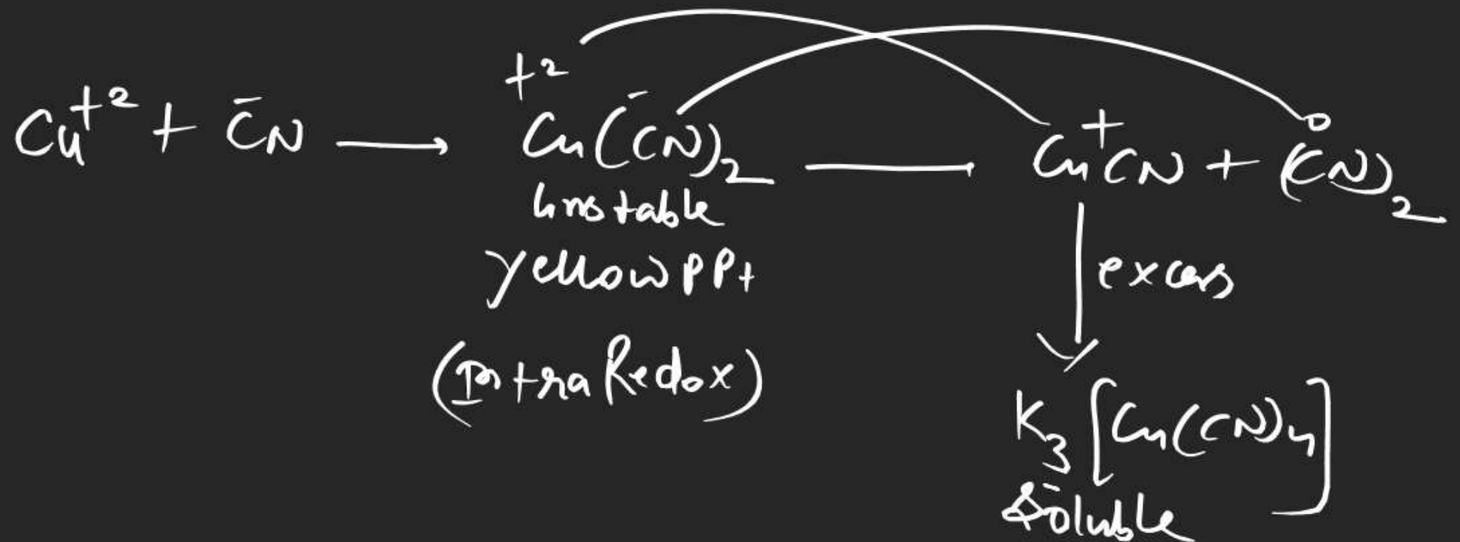
$Cu^{+} \xrightarrow{I^-}$ White PPt Cu_2I_2

$I_2 \xrightarrow{I^-} I_3^{\ominus}$ Brown Colour

Iodometry test

$$\left(Cu_2I_2 + I_3^{\ominus}\right) + S_2O_3^{-2} \longrightarrow \underset{\text{White PPt}}{Cu_2I_2} + S_4O_6^{-2} + I^{\ominus}$$

(Col. less)



one When Cu^{+2} react with KCN
Which of the following product will form

(1) $K_2[Cu(CN)_4]$
(2) $K_3[Cu(CN)_4]$
(3) Cu^{+2} gets Reduced and $\bar{C}N$ gets oxidised.
(4) (2) and (3)

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$Cu^{+2} + SCN^- \longrightarrow \underset{\text{Black}}{Cu(SCN)_2} \longrightarrow \underset{\text{White}}{CuSCN} + (SCN)_2$

$Cu^{+2} + NaOH \longrightarrow \underset{\text{light Blue ppt.}}{Cu(OH)_2} \xrightarrow{\text{excess}} \text{Insoluble}$

$CuSO_4 + NH_4OH \longrightarrow \underset{\text{Basic Copper Sulphate}}{CuSO_4 \cdot Cu(OH)_2} \xrightarrow{\text{excess}} \underset{\text{Switzer's salt}}{[Cu(NH_3)_4]SO_4}$

light Blue ppt. — Deep Blue

$Cu^{+2} + H_2S \longrightarrow \underset{\text{Black}}{CuS}$ [Soluble in hot and dil HNO_3 and excess of KCN]

$CuS + KCN \longrightarrow [Cu(CN)_4]^{-3}$ Soluble

$$Cu^{+2} + K_4[Fe(CN)_6] \longrightarrow Cu_2[Fe(CN)_6]$$

Chocolate Brown ppt.

$$Cu^{+2} + K_3[Fe(CN)_6] \longrightarrow Cu_3[Fe(CN)_6]_2$$

green ppt.

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$Cd^{+2} + CN^- \longrightarrow \underset{\text{White}}{Cd(CN)_2} \xrightarrow[KCN]{\text{excess}} \underset{\text{Soluble}}{K_2[Cd(CN)_4]}$

$Cd^{+2} + NaOH \longrightarrow \underset{\text{White ppt.}}{Cd(OH)_2} \xrightarrow{\text{excess}} \text{Insol.}$

$Cd^{+2} + NH_4OH \longrightarrow Cd(OH)_2 \xrightarrow[NH_4OH]{\text{excess}} \underset{\text{Soluble}}{[Cd(NH_3)_4]^{+2}}$

$Cd^{+2} + H_2S \longrightarrow \underset{\text{yellow ppt.}}{CdS}$

(distin. bet Cu and Cd)

$Cd^{+2} + K_4[Fe(CN)_6] \longrightarrow \underset{\text{Bluish White ppt.}}{Cd_2[Fe(CN)_6]}$

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Hg^{+2}

$Hg^{+2} + I^{\ominus} \longrightarrow \underset{\text{(Scarlet Red)}}{HgI_2} \xrightarrow{\text{excess}} \underset{\text{Soluble}}{[HgI_4]^{-2}}$

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

$Hg^{+2} + NaOH \longrightarrow \underset{\text{yellow PPt}}{HgO} \xrightarrow{\text{excess}} \text{Insol.}$

$Hg(NO_3)_2 + NH_4OH \longrightarrow \underset{\text{White PPt.}}{HgO \cdot Hg(NH_2)NO_3} \xrightarrow[NH_4OH]{\text{excess}} \text{Insol.}$

$Hg^{+2} + H_2S \longrightarrow \underset{\text{White}}{Hg_3S_2Cl_2} \longrightarrow \underset{\text{(BLACK)}}{HgS}$

Test with $SnCl_2$

$$Hg^{+2}Cl_2 + Sn^{+2}Cl_2 \longrightarrow Hg_2Cl_2 + SnCl_4$$

(O.A) (R.A)

$$Hg_2Cl_2 + SnCl_2 \longrightarrow Hg + SnCl_4$$

White ppt — Black

Test with $Co(SCN)_2$

$$Hg^{+2} + Co(SCN)_2 \longrightarrow Co[Hg(SCN)_4]$$

Blue ppt.

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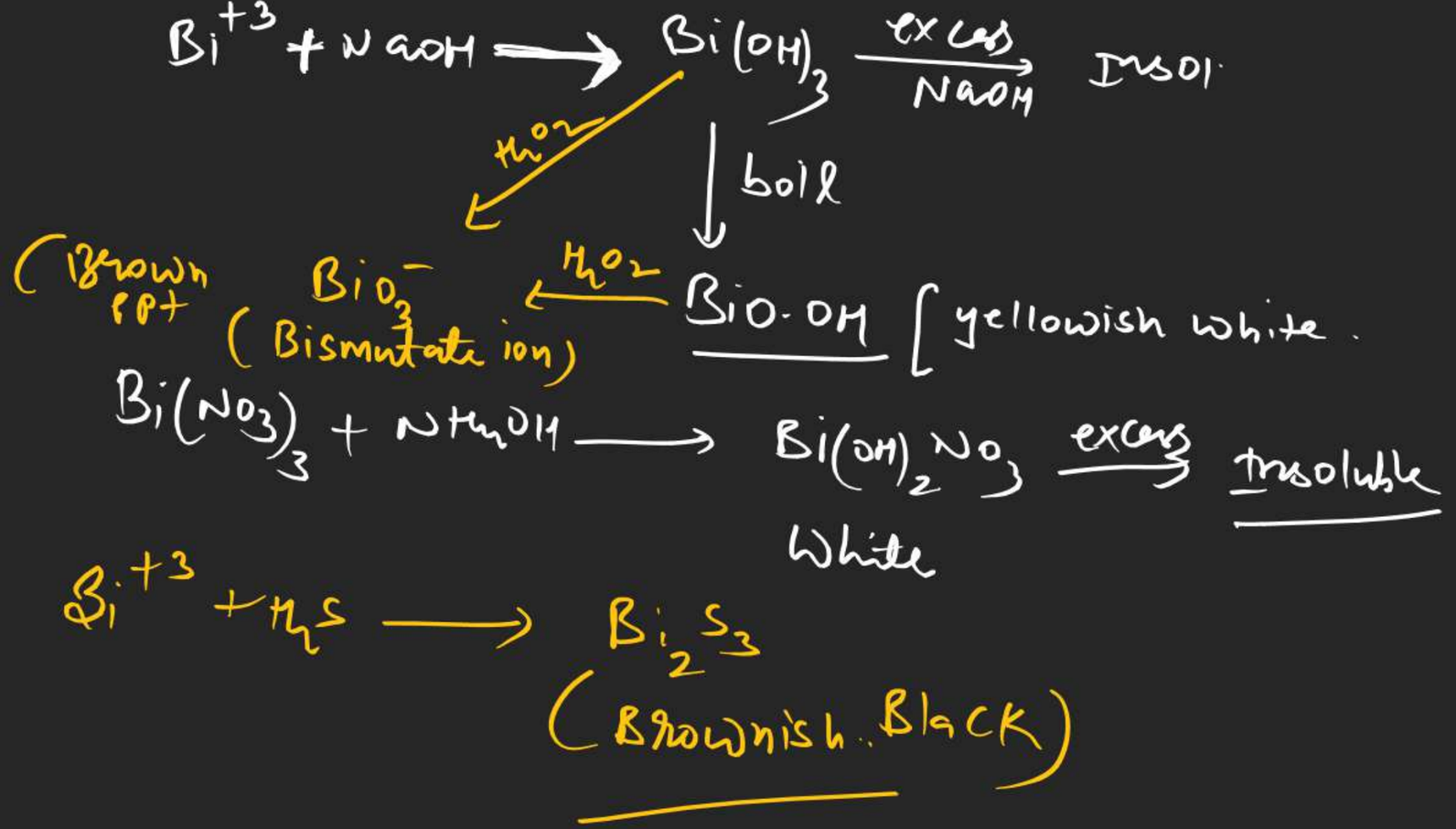
Bi^{+3}

$Bi^{+3} + I^{\ominus} \longrightarrow BiI_3$ (BLACK ppt.) $\xrightarrow[KI]{\text{excess}} [BiI_4]^{\ominus}$ orange solution

BiI_3 (BLACK ppt.) $\xrightarrow{H_2O\ [\text{Hydrolysis}]}$ $BiOI$ orange turbidity

$Bi^{+3} + \bar{C}N \longrightarrow Bi(OH)_3$ (White) $\xrightarrow[KCN]{\text{excess}}$ Insol.

Note $\Rightarrow$ $Bi(CN)_3$ undergoes in hydrolysis.



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Test with Pyrogallol

$$Bi^{+3} + C_6H_3(OH)_3 \longrightarrow BiC_6H_3O_3 + 3H^+$$

yellow ppt.

Test with excess water

White turbidity Of BiOCl insoluble in tartaric acid while SbOCl is soluble

$$BiCl_3 + H_2O \rightleftharpoons BiOCl + 2HCl$$

Bismuthyl chloride (White turbidity)

$$Bi^{+3} + H_2O \rightleftharpoons BiO^+ + 2H^+$$

Bismuthyl cation

$$SbCl_3 + H_2O \rightleftharpoons SbOCl - 2HCl$$

$$Sb^{+3} + H_2O \rightleftharpoons SbO^+ + 2H^+$$

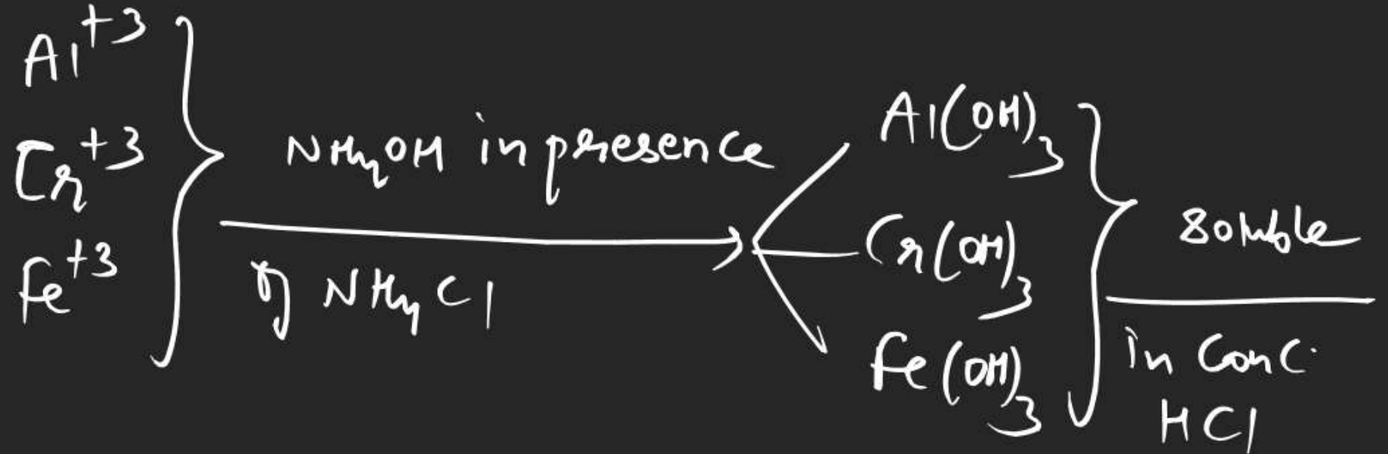
White turbidity

Test with $SnCl_2/OH^-$

$$Bi^{+3} + [Sn(OH)_4]^{-2} \longrightarrow \underset{\text{(Black ppt.)}}{Bi} + [Sn(OH)_6]^{-2}$$

$$Bi^{+3} + HPO_4^{-2} \longrightarrow \underset{\text{White ppt.}}{BiPO_4}$$

III group



$$Al^{+3} + NaOH \longrightarrow \underset{\text{(White ppt}}{Al(OH)_3} \xrightarrow[NaOH]{\text{excess}} \underset{\text{Soluble}}{[Al(OH)_4]^{\ominus}}$$

$$\underset{\text{White ppt}}{Al(OH)_3} + NaOH \rightleftharpoons Na[Al(OH)_4] \text{ or } NaAlO_2 + 2H_2O$$

on addition of acid white ppt reappear due to shifting of eq. in backward direction.

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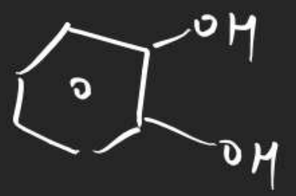
Poly Hydroxyorganic acid

tartaric acid

Citric acid

Sulphosalicylic acid



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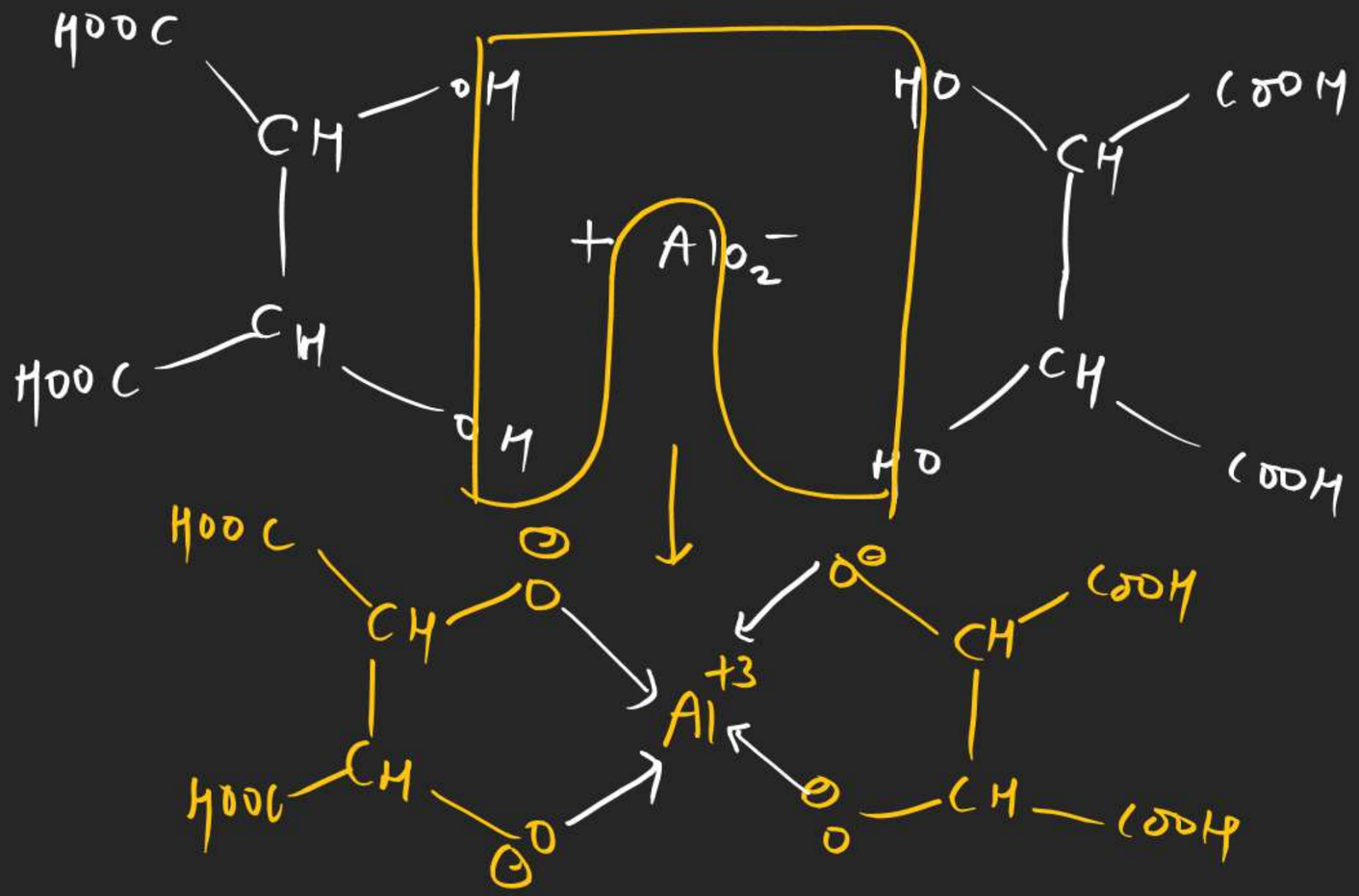
but on addition of polyhydroxo organic acid White ppt disappear due to shifting of eq. in forward direction.



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$Al^{+3} + NH_4OH \longrightarrow Al(OH)_3 \xrightarrow{excess}$ Insoluble

Key point

Al^{+3} Cr^{+3} Mg^{+2} ⇒ Sulphides salts donot exist in their aqeous solution they hydrolysed.

$Al^{+3} + H_2S \longrightarrow Al_2\begin{pmatrix} OH \\ S_3 \\ H \end{pmatrix} \xrightarrow{H^- OH^-} Al(OH)_3 + H_2S$

CO_3^{-2} salts of Fe^{+3} Al^{+3} Cr^{+3} donot exist in their aq-solution because they readily hydrolysed

Some basic acetates of Fe^{+3} Al^{+3} Cr^{+3} are Insoluble

$Al^{+3} + H_2S \longrightarrow \times$

$Al^{+3} + H_2S \xrightarrow{\text{basic}} Al_2(OH)_3 \downarrow + H_2S \uparrow$ ($Al_2S_3 \xrightarrow{H^+ - \bar{O}H}$)

$Al^{+3} + (NH_4)_2S \longrightarrow Al_2S_3 \xrightarrow{H-OH} Al(OH)_3 + H_2S$

$Al^{+3} + Na_2CO_3 \longrightarrow Al(OH)_3$

$Al^{+3} + CH_3COO^- + H_2O \longrightarrow Al(OH)_2CH_3COO$ (White)

$Al^{+3} + PO_4^{-3} \longrightarrow AlPO_4$

★ Lake test → Al^{+3} — gives Red or Blue lake