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$Cl^- / Br^- / I^\ominus$ = all are soluble except $Ag^+ / Hg_2^{+2} / Cu_2^{+2} / Pb^{+2}$

Reducing Power order

HI > HBr > HCl > HF

Test with acid →

$Cl^- + Conc.H_2SO_4 \longrightarrow HCl \xrightarrow[Conc.\ H_2SO_4]{remains} X$

$Br^- + Conc.H_2SO_4 \longrightarrow HBr \xrightarrow[Conc.H_2SO_4]{remains} Br_2$

$I^\ominus + Conc.H_2SO_4 \longrightarrow HI \xrightarrow[Conc.H_2SO_4]{remains} I_2$

Acid formation — Redox

Note ⇒ HCl is weak Reducing agent
So it does Not involve in Redox
but HBr and HI both are good R.A so Redox occurs and Br_2 and I_2 form.

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Test with $MnO_2 + Conc.H_2SO_4$

$Cl^- + MnO_2 + Conc.H_2SO_4 \longrightarrow Cl_2$

greenish-yellow

Note ⇒ Pure HCl Pure HBr_2 and Pure HI

Can be produce by treating it

With Conc. H_3PO_4 because Conc. H_3PO_4 is

a non oxidising acid.

Test with $AgNO_3$

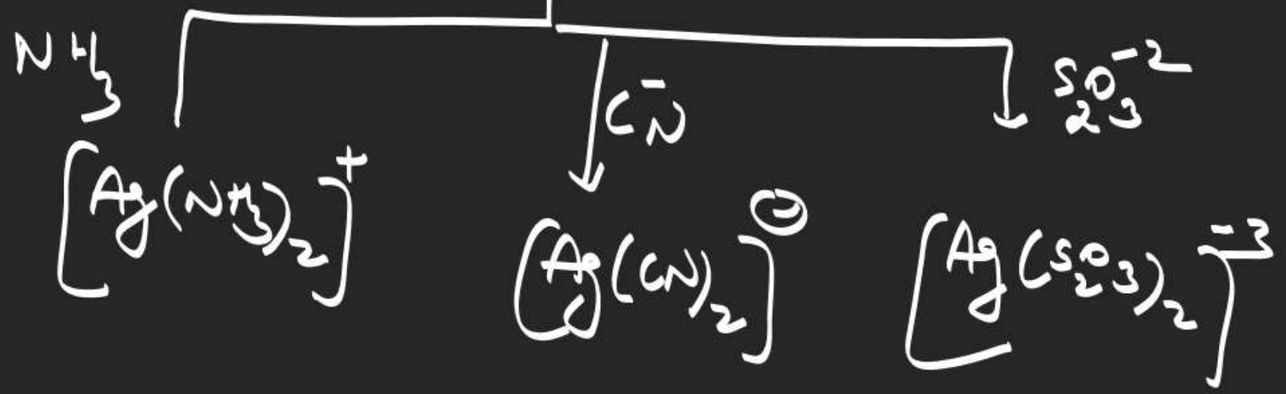
Note ⇒ Ag_2CO_3 sol. in $\bar{C}N$

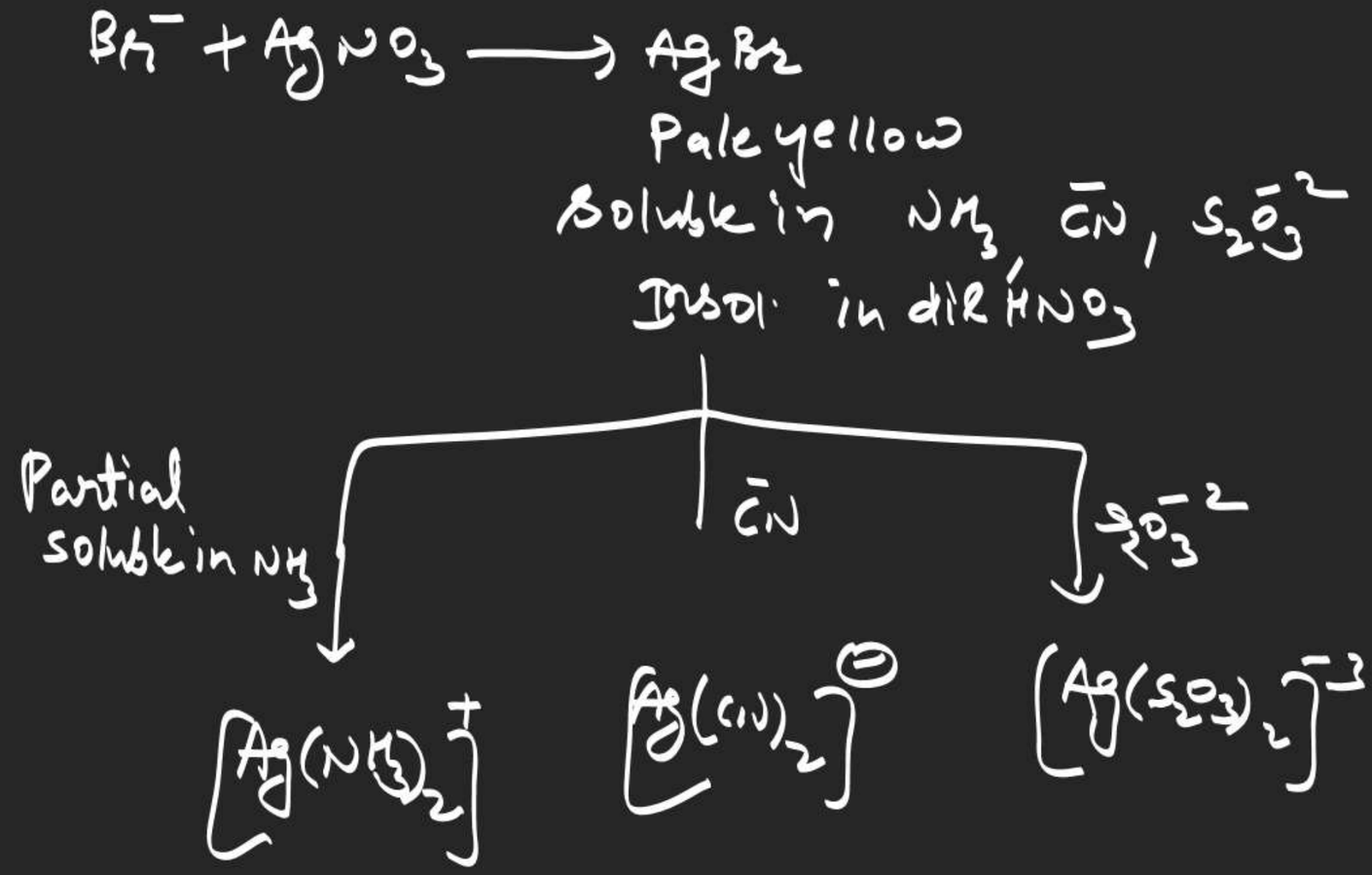
$$Cl^- + AgNO_3 \longrightarrow AgCl$$

White ppt.

Soluble in NH_3 sol. but, $\bar{C}N$, $S_2\bar{O}_3^{-2}$

in soluble in HNO_3





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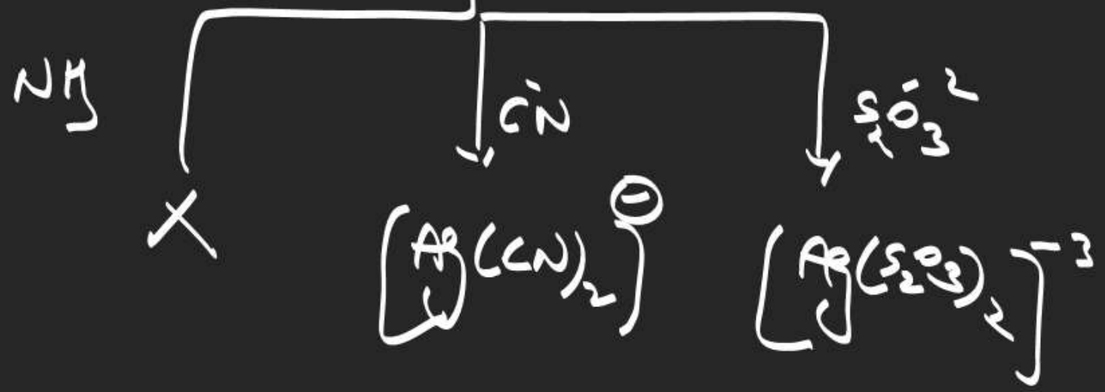
$I^- + AgNO_3 \longrightarrow AgI$

yellow ppt.

Insoluble in dil HNO_3 and NH_4OH.

Soluble in CN^- / $S_2O_3^{-2}$



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Test with $Pb(NO_3)_2$

$Cl^- + Pb(NO_3)_2 \longrightarrow PbCl_2$ White — sparingly soluble in cold water but complete soluble in warm water

$Br^- + Pb(NO_3)_2 \longrightarrow PbBr_2$ White — soluble in hot water

$I^- + Pb(NO_3)_2 \longrightarrow PbI_2$ Yellow — Soluble in boil water

Order of sol. NH_3 / Water (polar solvent)

$AgCl > AgBr > AgI$

$PbCl_2 > PbBr_2 > PbI_2$

Layer test for Br^- [specific test for Br^-]

Br^- + dropwise Cl_2 water added ⟶ Br_2, impart orange Red colour due to formation Br_3^- ⟶ (organic solvent: $CHCl_3/CCl_4$ / C_6H_6) ⟶ Reddish Brown layer

Note ⇒ excess amount of Cl_2 water Not use because Br_2 will oxide

$$Br_2 + \underset{\text{excess}}{(Cl_2 + H_2O)} \longrightarrow \overset{+}{B}r\overset{-}{Cl}$$

(yellow soln)

layer for I^- (specific test for I^-)

$$I^{\ominus} + (Cl_2 + H_2O) \xrightarrow[\text{dropwise}]{} I_2 \xrightarrow[\text{Solvent+}]{\text{organic}} \text{Violet layer}$$

I_2 which impart Brown col. due to formation of I_3^-

Note ⇒ excess amount of Cl_2 water not use because I_2 will oxidised

$$I_2 + (Cl_2 + \text{water}) \longrightarrow \underset{\text{(Col. less)}}{HIO_3}$$

if Br^- and I^- both present

then violet layer comes first

followed by Reddish Brown

if Reddish Brown layer comes first

it means $I^\ominus$ absent.

Note → Because $I^\ominus$ is Strong R.A than the Br^-

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Chromyle chloride test (specific test for Cl^-)

Solid mix + conc. H_2SO_4 + solid $K_2Cr_2O_7$ $\xrightarrow{\Delta}$ CrO_2Cl_2 (d^3, tet. Col. charge transfer)

(Reddish Brown fumes)

$NaCl + conc.H_2SO_4 \longrightarrow HCl$

$K_2Cr_2O_7 + conc.H_2SO_4 \longrightarrow CrO_3$

$CrO_3 + HCl \longrightarrow CrO_2Cl_2$

CrO_2Cl_2 + CH_3COOH → (yellow ppt) $PbCrO_4$

CrO_2Cl_2 + $Pb(CH_3COO)_2$ + diphenylcarbazide → Violet Col.

CrO_2Cl_2 + NaOH → Na_2CrO_4 (yellow solution)

Na_2CrO_4 + H_2O_2 + diphenylether or amyl alc. → CrO_5 (Blue colour)

Ans Why CH_3COOH use?

to neutrialize NaOH solution because $PbCrO_4$ is amphoteric

Ans Why only CH_3COOH?

$PbCrO_4$ is Insoluble in CH_3COOH

Imp. points

① test tube must be dry because CrO_2Cl_2 (can hydrolysed.

$$CrO_2Cl_2 + H\text{-}OH \longrightarrow H_2CrO_4$$

(Chromic acid)

② NO_2^- / NO_3^- → must absent

$$NO_2^- / NO_3^- + Cl^- \longrightarrow \underline{NOCl}$$

(Tilden Reagent)
Nitrosyl chloride

→ ClO_3^- must absent

$ClO_3^- + Cl^- \longrightarrow ClO_2$
(Explosive)

— Hg_2Cl_2 | $HgCl_2$ → donot perform Chromyl chloride test because of High polarising power of Hg

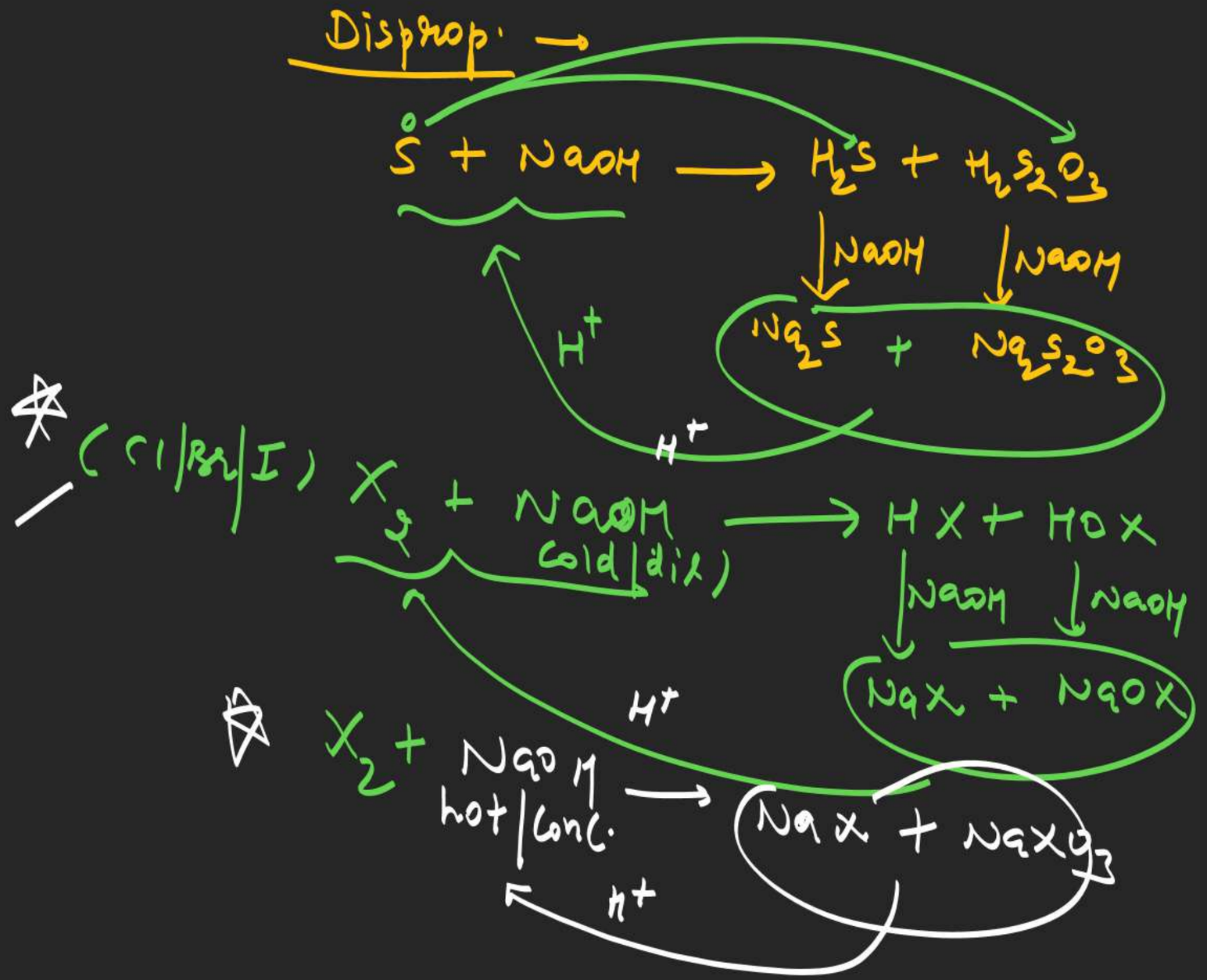
Pt | Au | Ag | Bi | Sb | Pb → X

$Sn^{+2}Cl_2$ ✓

$Sn^{+4}Cl_4$ ✗

✓

$NH_4^+Cl^-$ ✓



$$P_4 + NaOH \longrightarrow \overset{-3}{P}H_3 + NaH_2\overset{+1}{P}O_2$$

(Phosphine) (Sodium hypophosphite)

Test with $CuSO_4$

$$Cu^{+2} + I^{\ominus} \longrightarrow Cu^{+} + I_2$$

(O.A) (R.A)

Cu^{+} + I^- → Cu_2I_2 + $I_3^{\ominus}$

(Cu_2I_2: White ppt; $I_3^{\ominus}$: Brown colour)

[Iodometry test]

$$\underbrace{Cu_2I_2 + I_3^{\ominus}}_{\text{Brown colour}} + S_2O_3^{-2} \longrightarrow \underbrace{Cu_2I_2}_{\text{White ppt.}} + S_4O_6^{-2} + I^{\ominus}$$

Test with $HgCl_2$

$I^{\ominus} + HgCl_2 \longrightarrow HgI_2$ (Scarlet Red) $\xrightarrow[KI]{excess} [HgI_4]^{-2}$ (Soluble)

HgI_2 (Scarlet Red) $\xrightarrow{127^{\circ}C}$ HgI_2 (Yellow Sublimate) $\xrightarrow{Cool}$ HgI_2 (Yellow)

on Rubbing → HgI_2 (Scarlet Red)