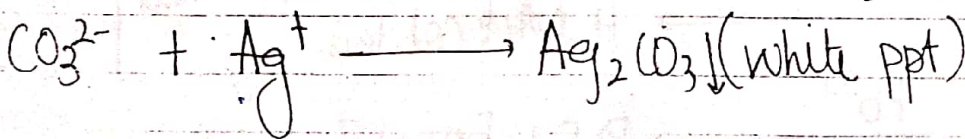
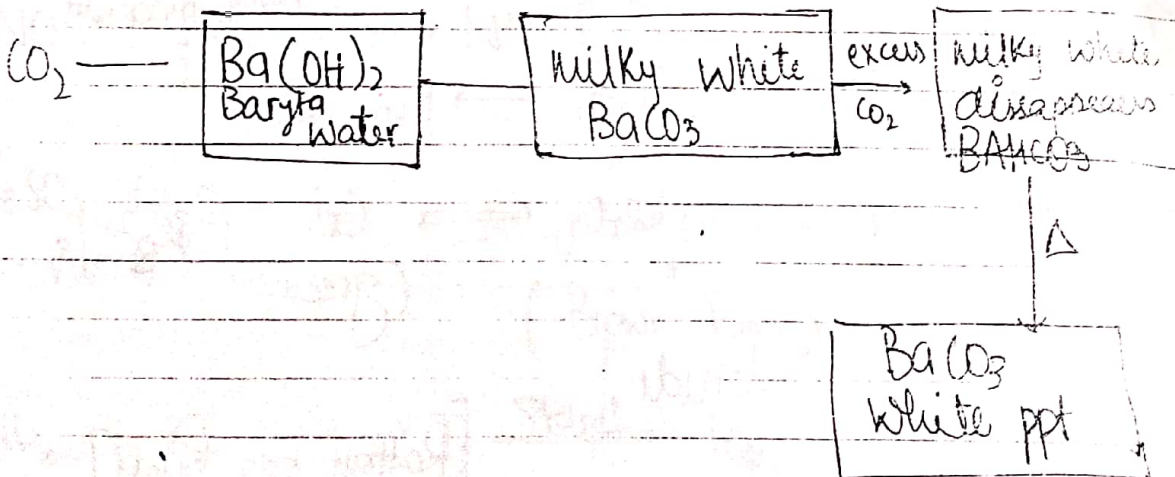
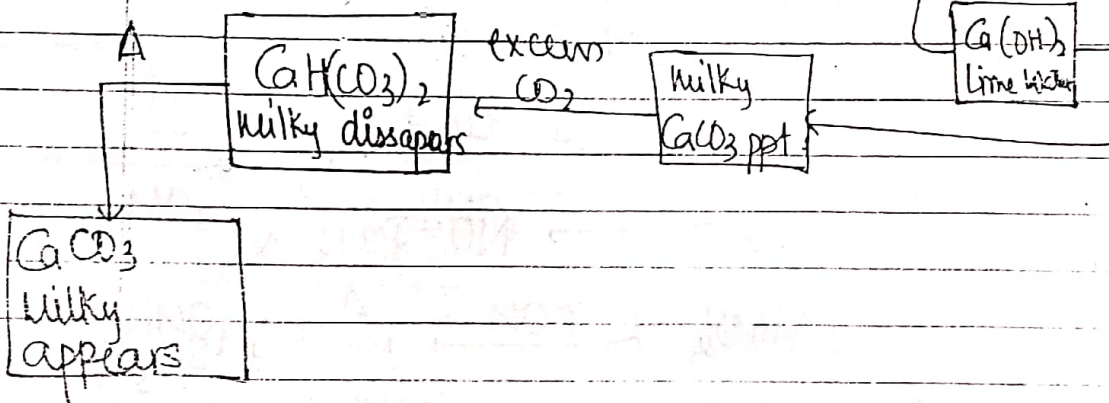
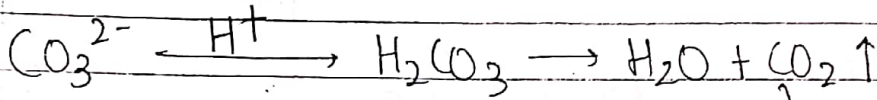
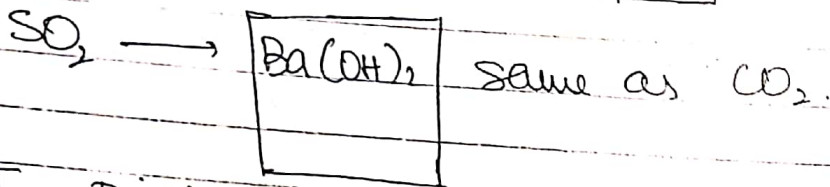
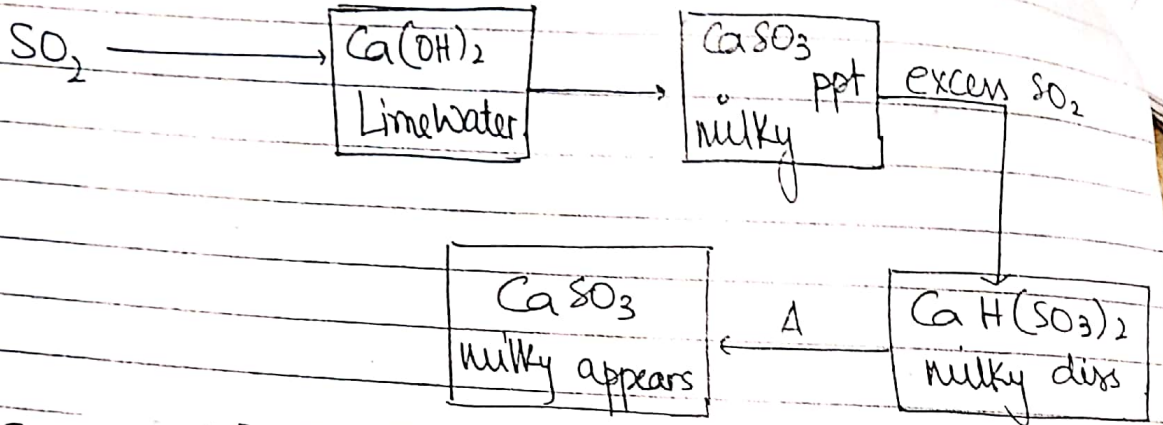
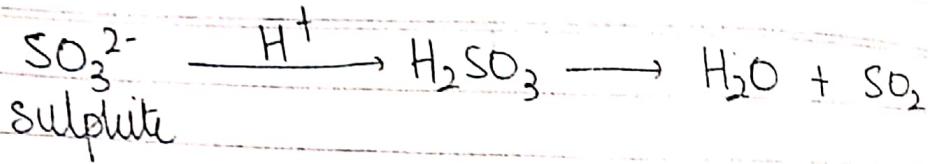


QUALITATIVE ANALYSIS

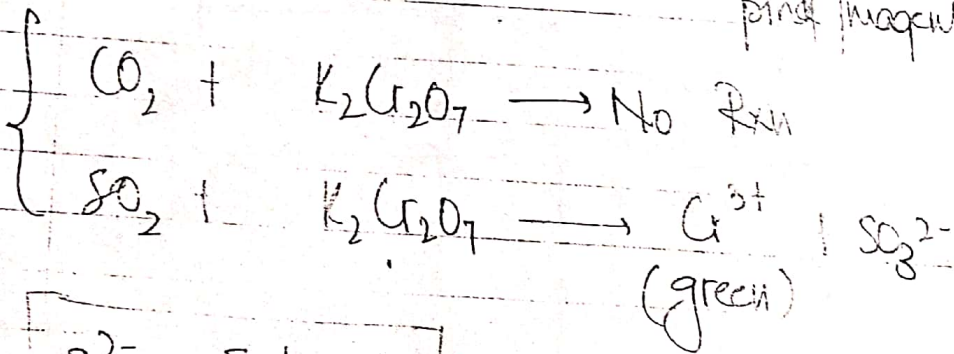
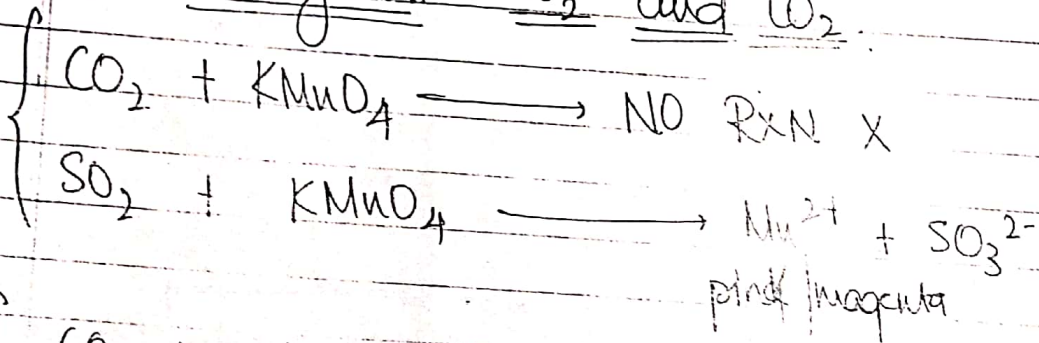
Anion	dil Acid, gas	CH_3COO^- , CO_3^{2-} , SO_3^{2-} , S^{2-} , NO_2^-
	Conc Acid, gas	X^- [Cl^- , Br^- , I^-], NO_3^-
	individual	SO_4^{2-} , PO_4^{3-}



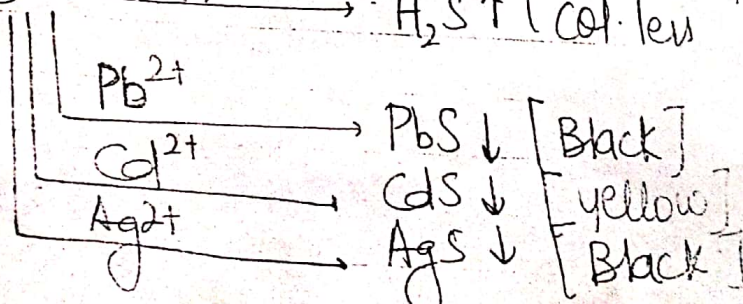
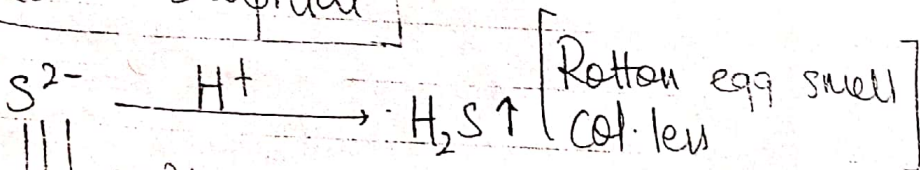
Vigneta
Hera



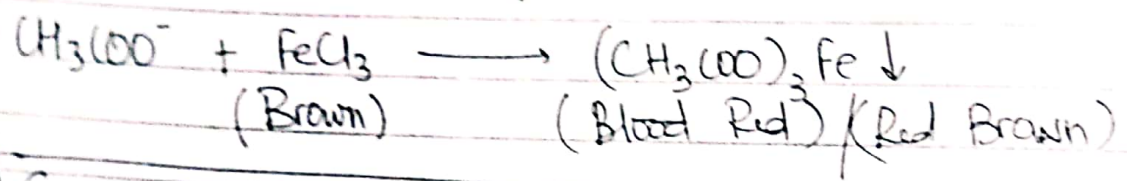
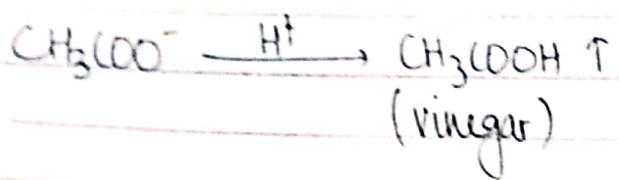
To Distinguish SO₂ and CO₂



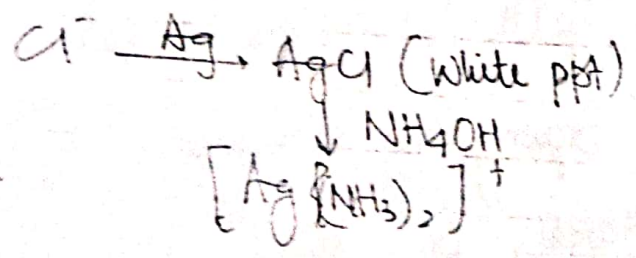
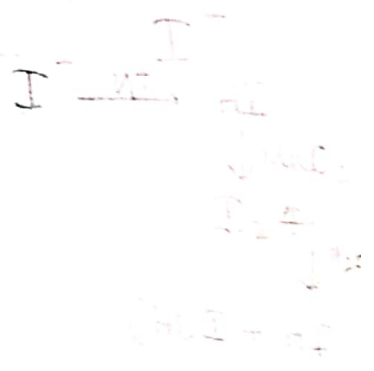
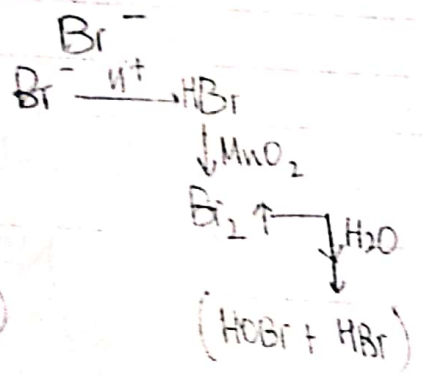
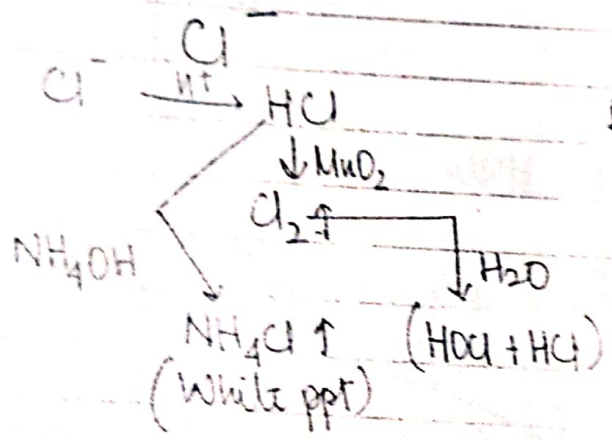
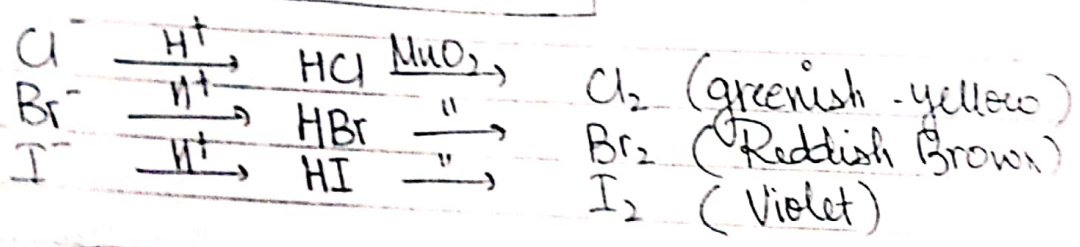
S²⁻ Sulphide



CH₃COO⁻ - Acetate ion

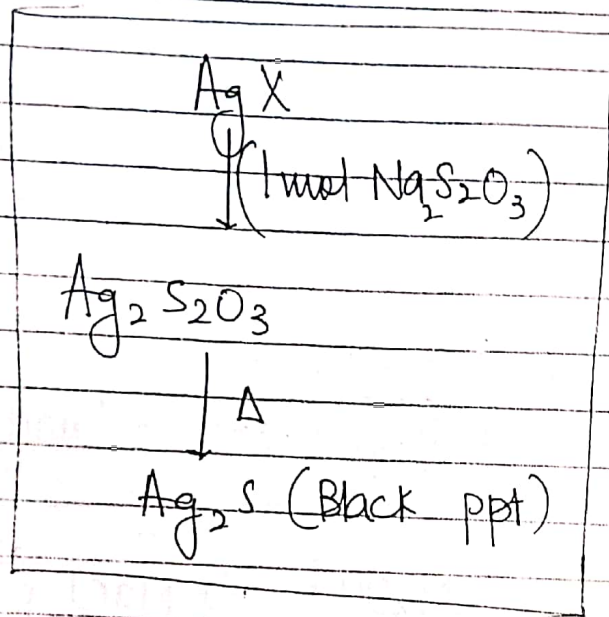
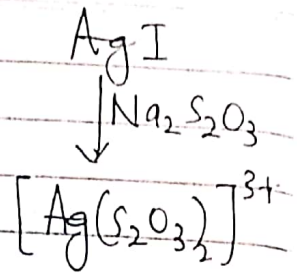
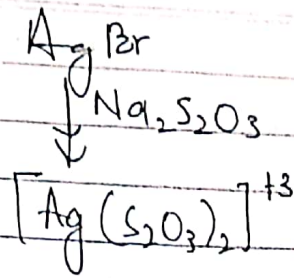
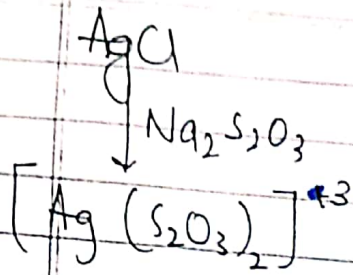


CONCENTRATED ACID

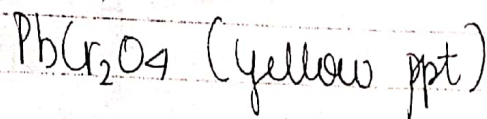
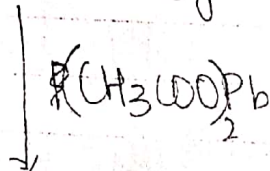
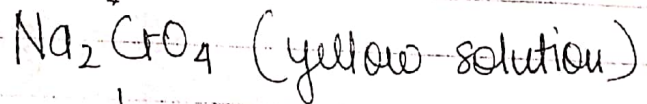
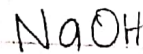
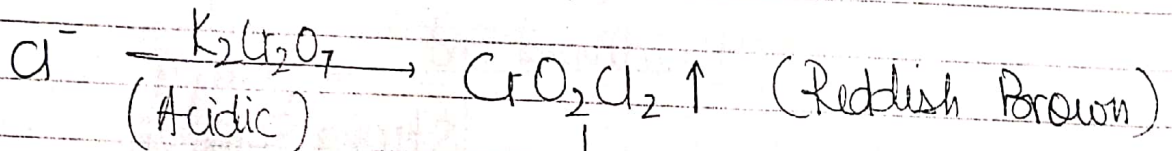


← "

← "

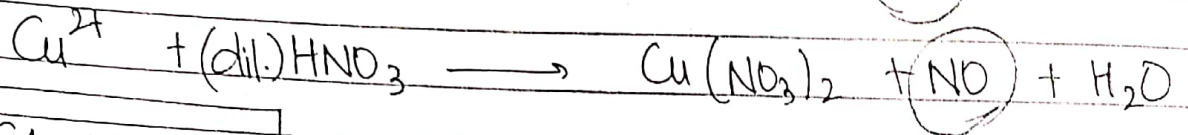
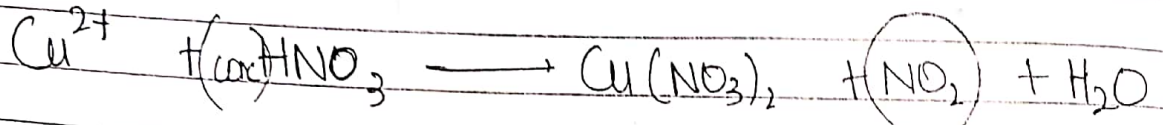
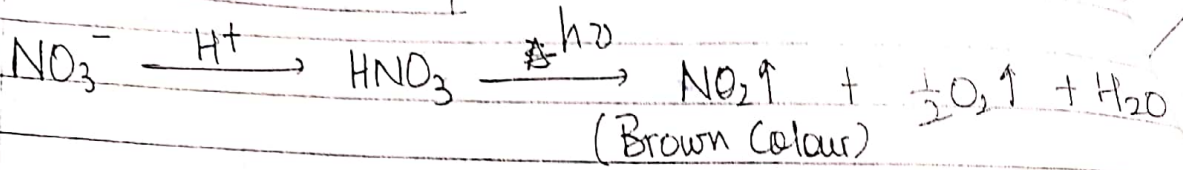


CHROMYL CHLORIDE TEST:



Chlorides of (Ag, Hg, Sn, Pb, Sb) don't show chromyl chloride

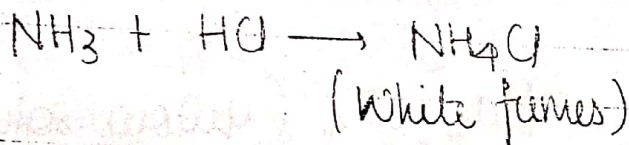
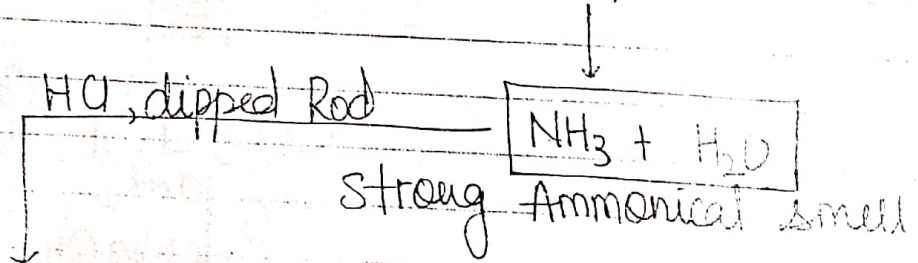
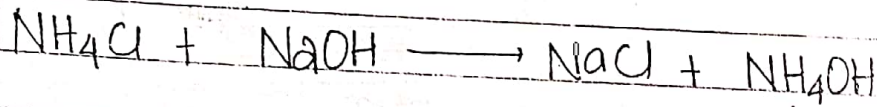
NITRATE: NO₃⁻



CATIONS:

GROUP ZERO:

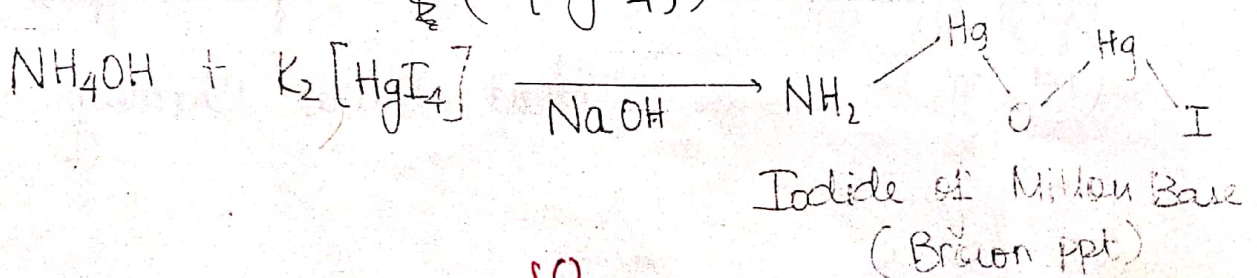
Cations: NH₄⁺



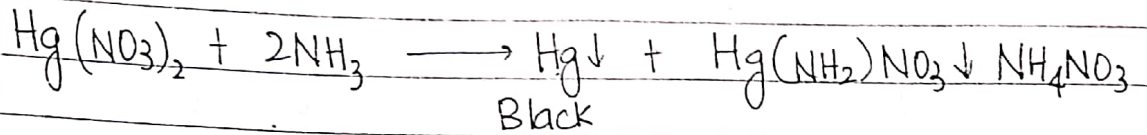
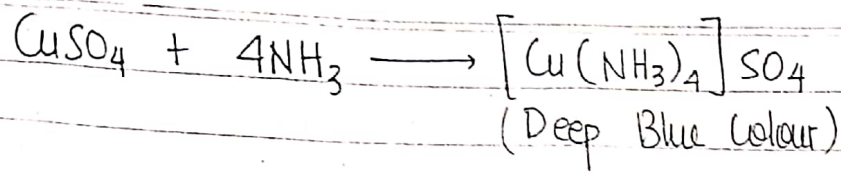
CONFIRMATORY FOR ZERO GROUP:

Salt solution + Nestler's Rgt \longrightarrow Brown ppt.

(K₂[HgI₄])



(6)

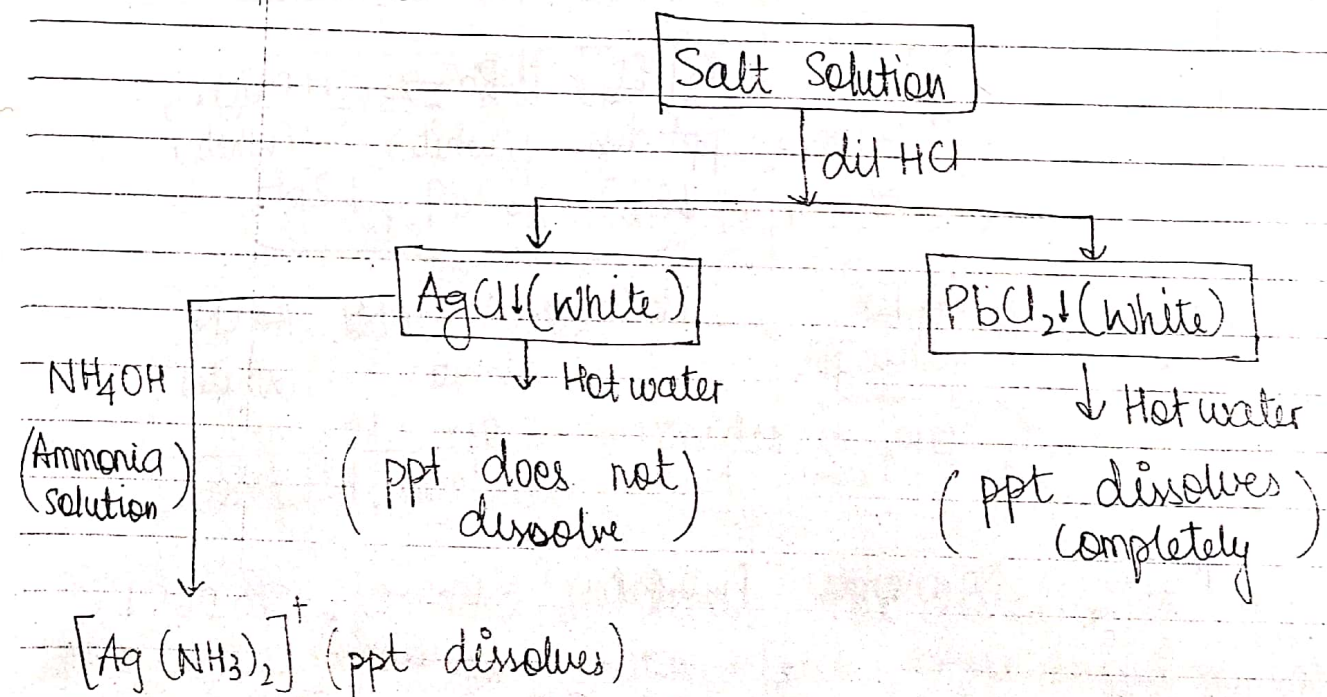


GROUP 1: CATIONS

Cations: Ag^+ , Pb^{+2}

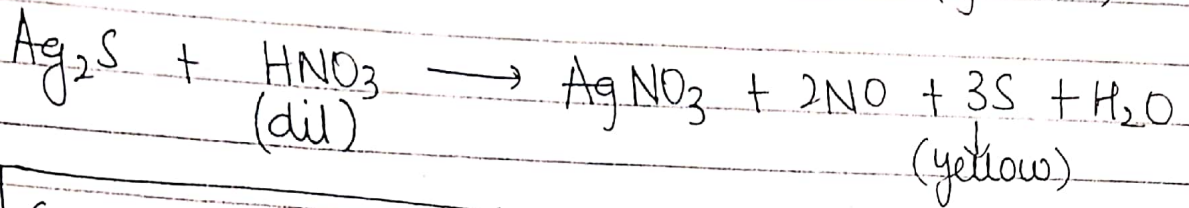
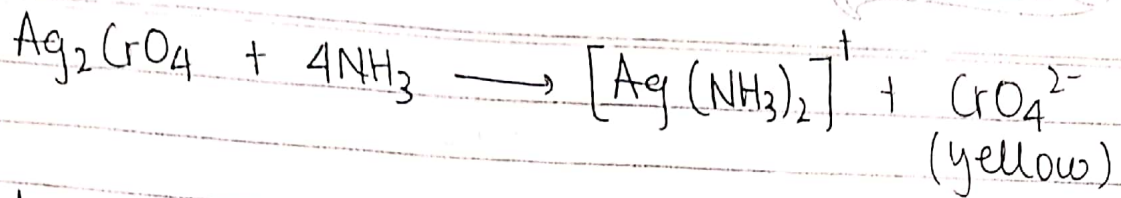
Group Reagents: dil. HCl

(Salt solution) $\xrightarrow{\text{dil HCl}}$ $\text{AgCl} / \text{PbCl}_2$ (white ppt)
 $\text{Ag}^+ / \text{Pb}^{2+}$

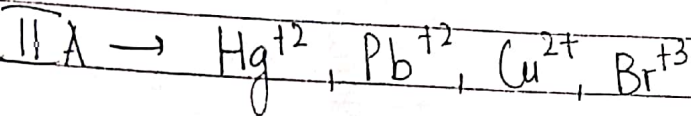


	Action of NH_3	excess NH_3	NaOH	excess NaOH
Pb^{2+}	$\text{Pb}(\text{OH})_2 \downarrow$ white ppt	No change (white ppt)	$\text{Pb}(\text{OH})_2$ white ppt	$\text{Na}_2\text{Pb}(\text{OH})_6$
Ag^+	$\text{AgOH} \downarrow$ $\text{Ag}_2\text{O} \downarrow$ (brown ppt)	$(\text{Ag}[\text{NH}_3]_2)^+$ Brown ppt dissolves	$\text{AgOH} \downarrow$ $\text{Ag}_2\text{O} \downarrow$ (brown ppt)	No change

	KI	excess KI	$\text{Na}_2\text{S}_2\text{O}_3$	NaCN
Pb^{2+}	$\text{PbI}_2 \downarrow$ yellow ppt	$\text{K}_2[\text{PbI}_4]$ ppt diss.	$\text{PbS}_2\text{O}_3 \downarrow$ (white)	$\text{Pb}(\text{CN})_2$ (white)
Ag^+	$\text{AgI} \downarrow$ yellow ppt	No Change	$\text{Ag}_2\text{S}_2\text{O}_3 \downarrow$ (white)	AgCN (white)
Pb^{2+}	No change	Na_2CO_3 $\text{PbCO}_3 \downarrow$ $\text{Pb}(\text{OH})_2 \downarrow$	$\text{Na}_2\text{Cr}_2\text{O}_7$ $\text{PbCrO}_4 \downarrow$ (yellow ppt)	$\text{H}_2\text{S Gas}$ $\text{PbS} \downarrow$ (Black)
Ag^+	No change	Na_2CO_3 $\text{Ag}_2\text{CO}_3 \downarrow$ (yellow ppt)	$\text{Na}_2\text{Cr}_2\text{O}_7$ Ag_2CrO_4 (Red ppt)	$\text{H}_2\text{S Gas}$ $\text{Ag}_2\text{S} \downarrow$ (Black)

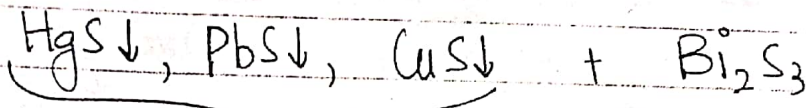
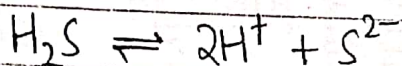


GROUP 2: CATIONS



Pb^{+2} is kept in both groups because, PbCl_2 is partially soluble in GR1 but fully soluble in GR2.

GROUP REAGENT: Dil HCl + H_2S



Black ppt

Blackish Brown ppt

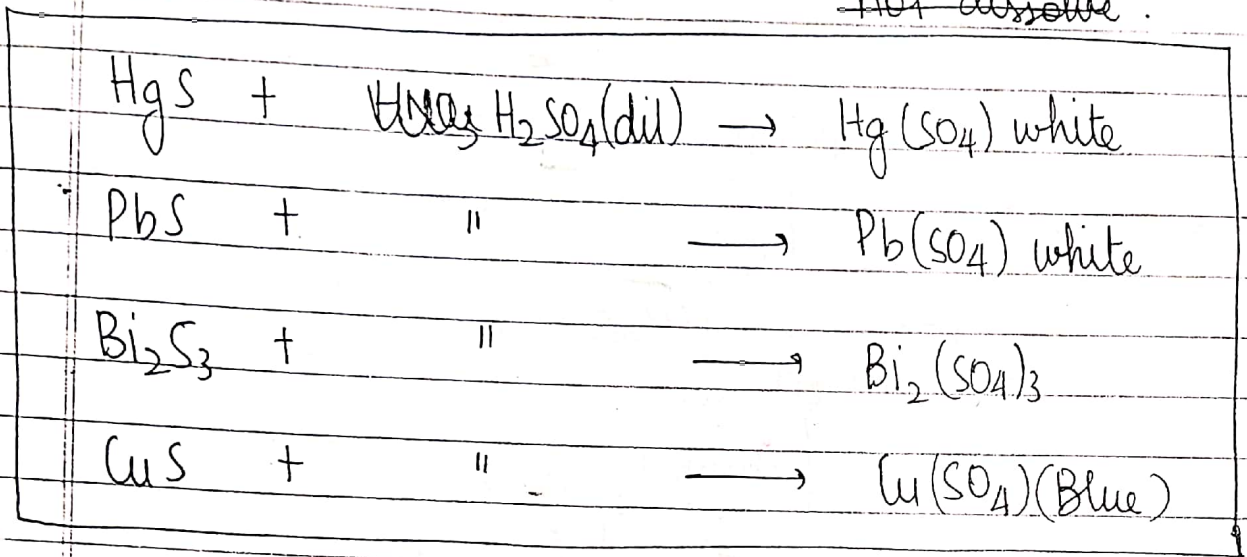
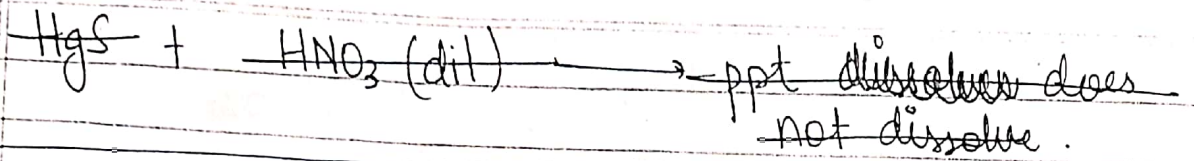
K_{sp} of GR2 sulphides is low hence $[\text{S}^{2-}]$ should be low.

HCl is used to arrest the dissociation of H_2S due to common ion effect experienced by $[\text{H}^+]$.
 $\therefore \text{S}^{2-}$ conc obtained is low.

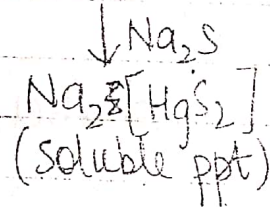
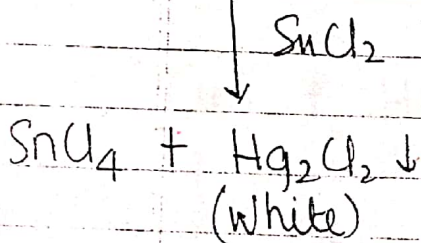
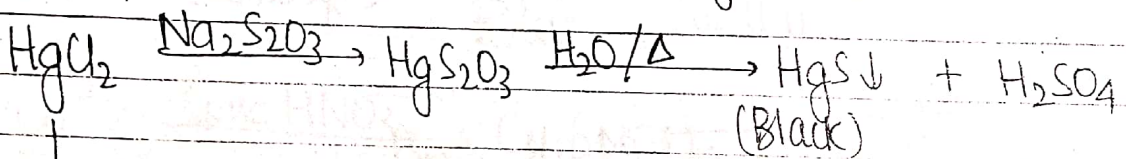
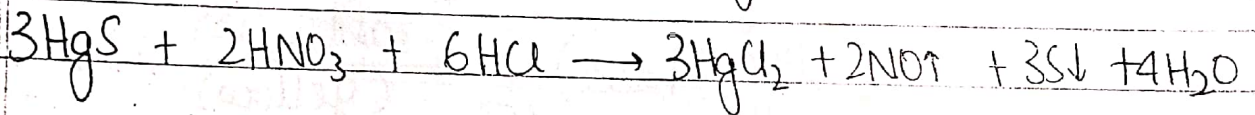
YAs → Yellow Ammonium Sulphide $[(NH_4)_2S_x]$
 used to distinguish IIA from IIB.

PPT of IIB dissolves ~~in YAs~~ in YAs, and IIA does not.

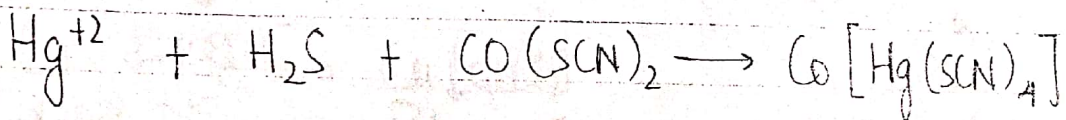
	Action of NH_3	Excess of NH_3	NaOH	excess NaOH	KI	Excess of KI
HgS	Hg·NH ₂ OH ↓ (white)	No X	Hg(OH) ₂ ↓ HgO ↓ (Red ppt)	No X	HgI ₂ ↓ (scarlet Red)	K ₂ (HgI ₄) Red colour PPT soluble
Ag PbS	Pb(OH) ₂ ↓ (white)	No X	Pb(OH) ₂ (white)	Na ₂ Pb(OH) ₄ (ppt diss.)	PbI ₂ ↓ (yellow)	K ₂ (PbI ₄) soluble
Bi ₂ S ₃	Bi(OH) ₃ (white)	No X	Bi(OH) ₃ (white)	No X	BiI ₃ (white) (Black)	K(BiI ₄) soluble (orange sol.)
CuS	Cu(OH) ₂ (Blue)	[Cu(NH ₃) ₄] ⁺ Blue (dissolves)	Cu(OH) ₂ (Blue)	No X	CuI ₂ (white)	CuI ₂ + KI ₃ (Brown sol.)

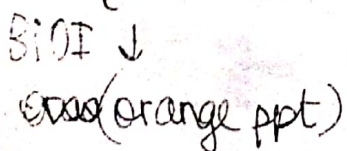
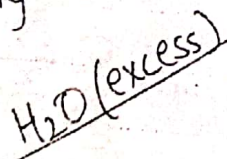
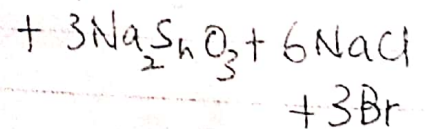
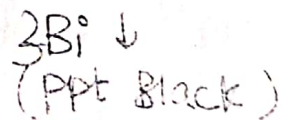
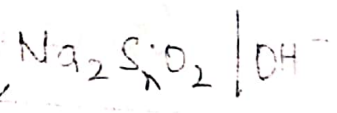
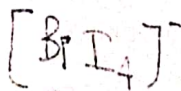
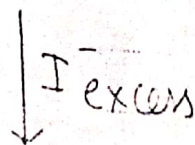
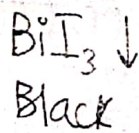
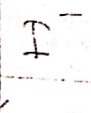
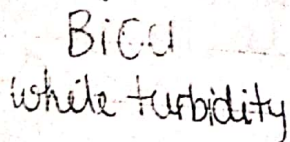
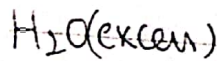
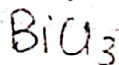
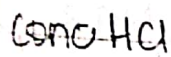
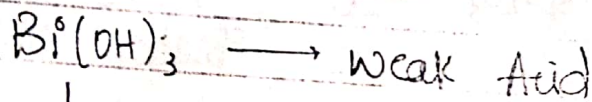
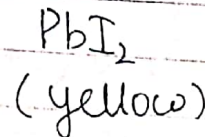
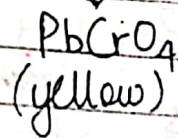
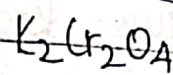
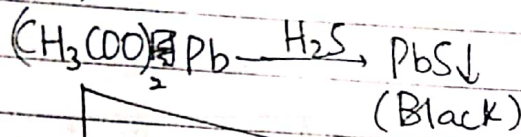
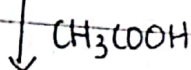
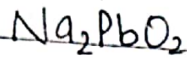
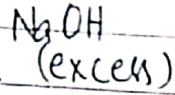
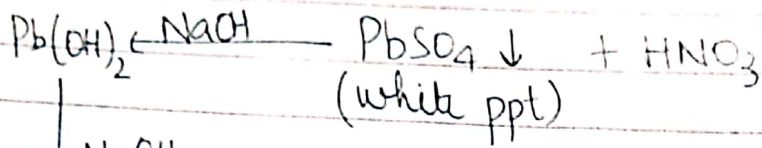
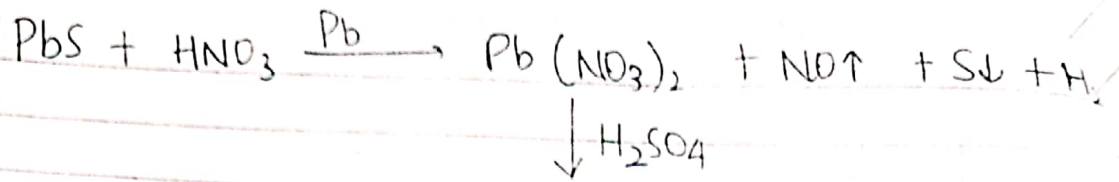


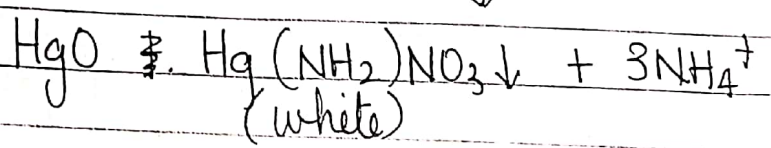
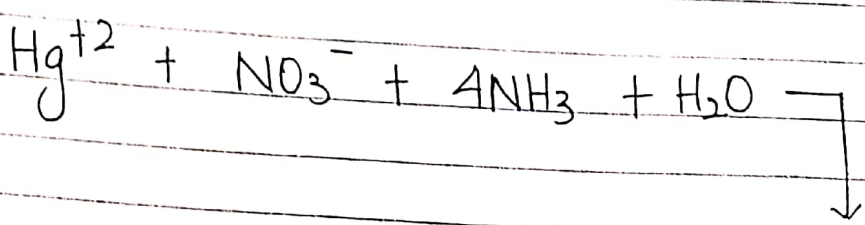
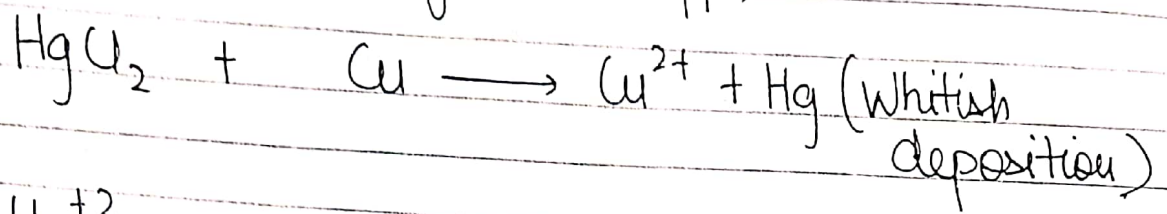
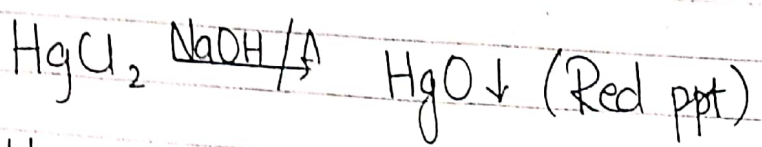
HgS dissolves in Aqua-Regia



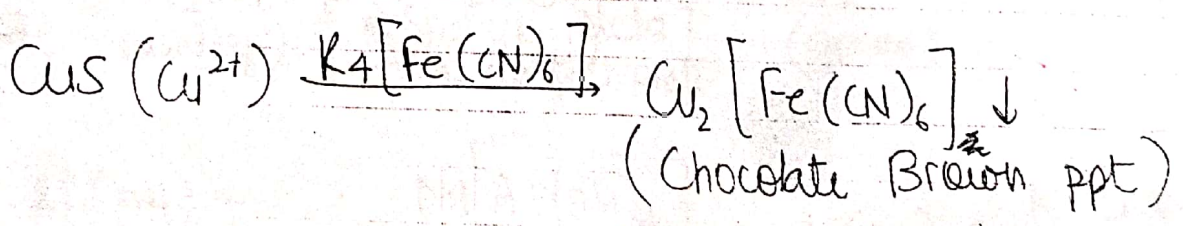
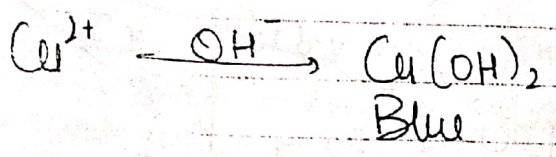
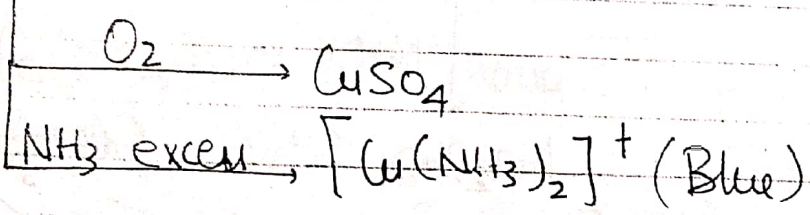
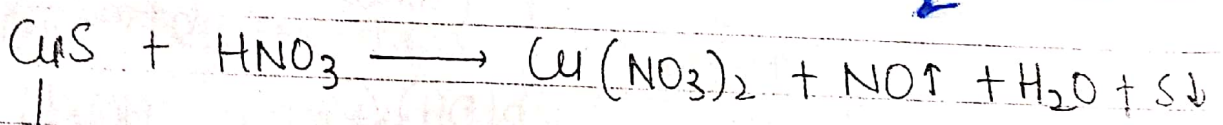
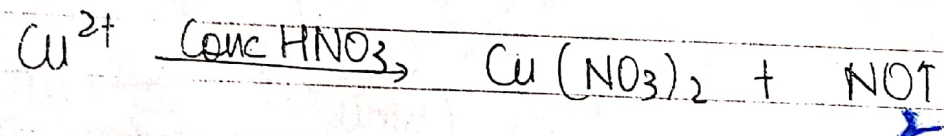
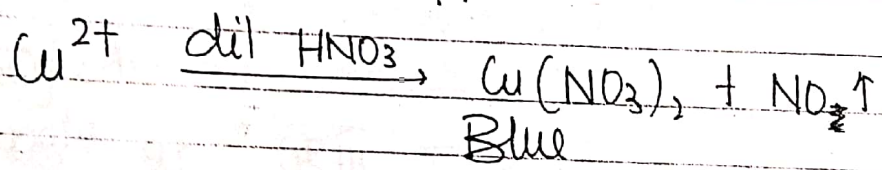
Cobalt (II) Thiocyanate test

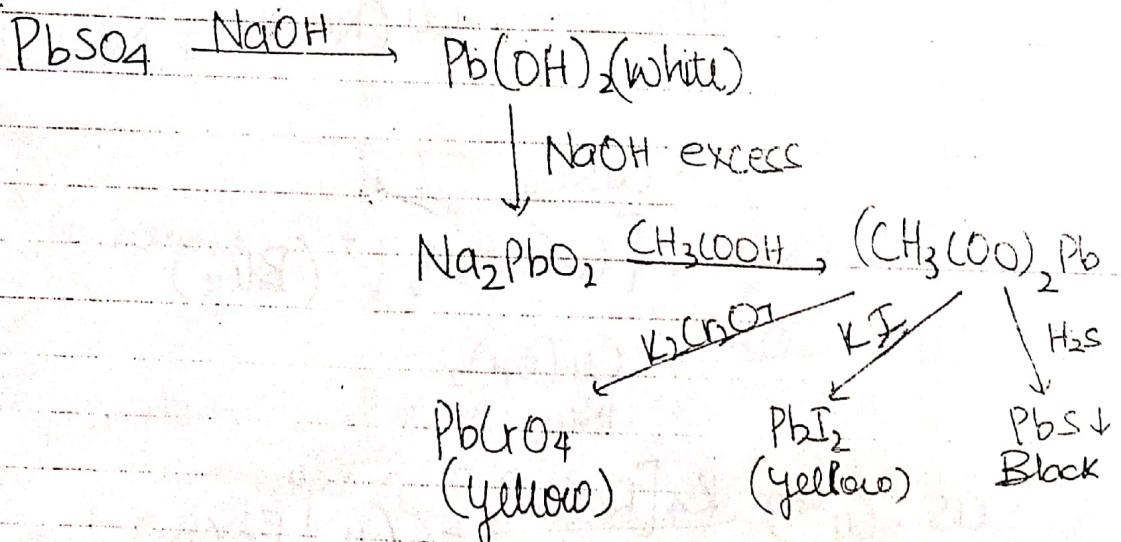
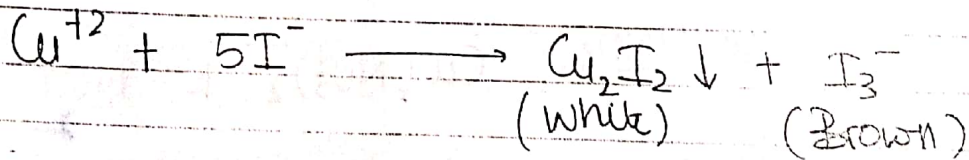
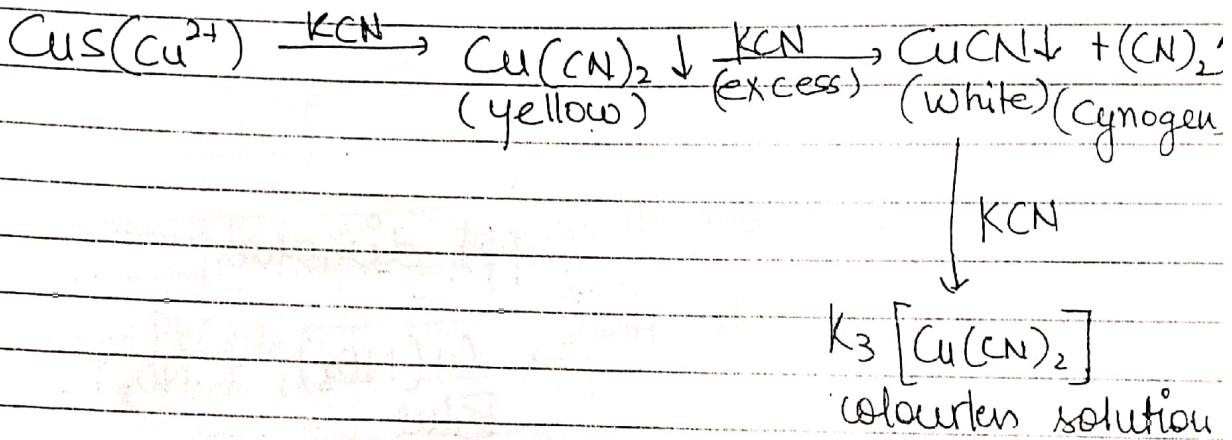
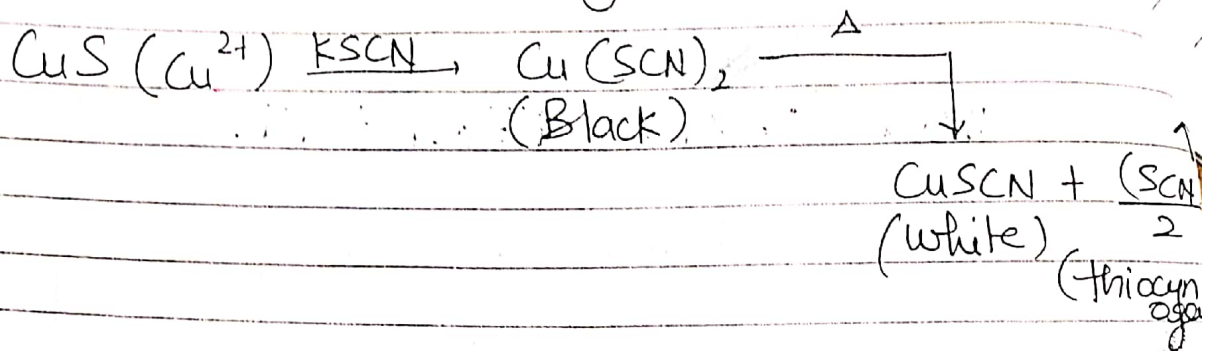
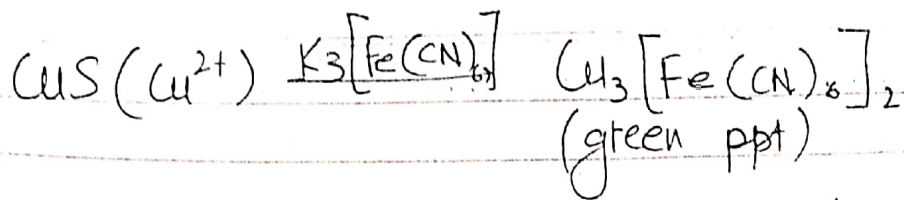




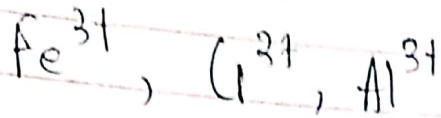


\downarrow CuS Conc HNO_3 ppt dissolves

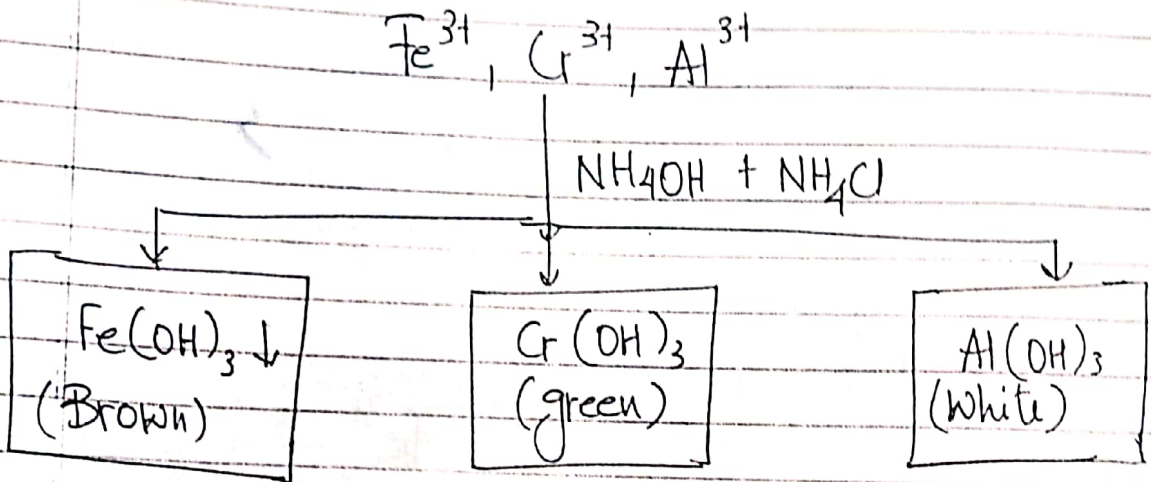




GROUP III: CATIONS:



GROUP REAGENT: $NH_4OH + NH_4Cl$

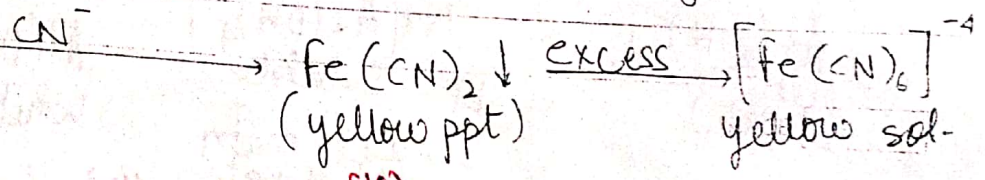
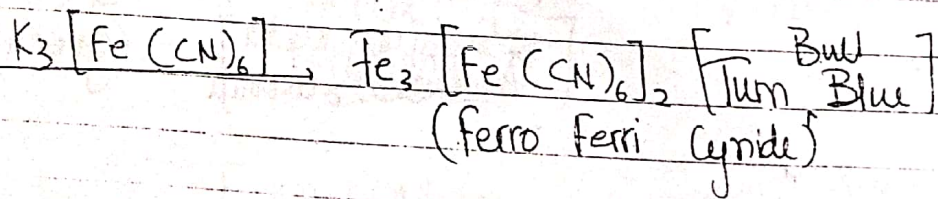
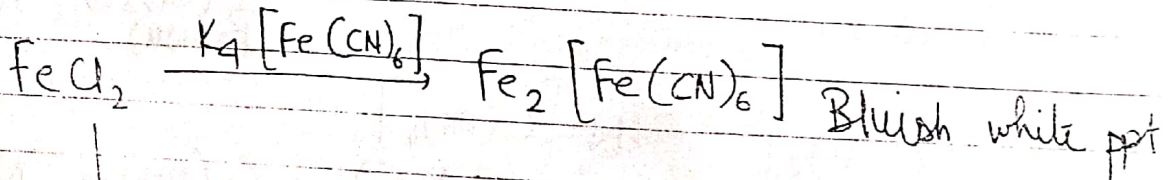
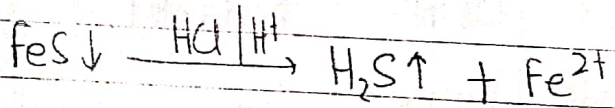
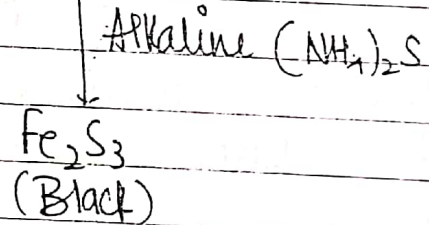
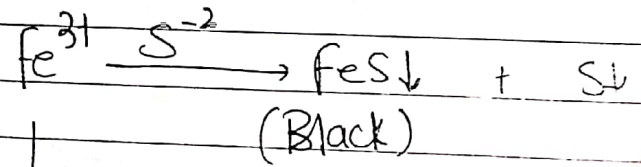
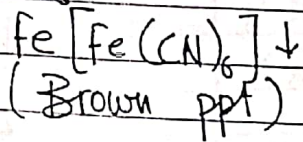
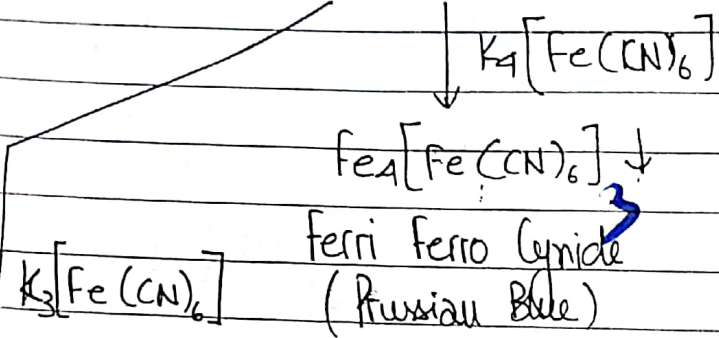
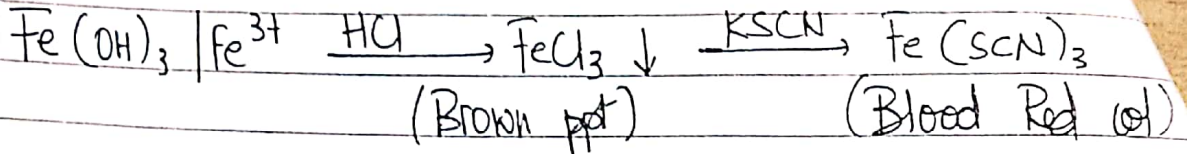


K_{sp} of GR III is low

due to common ion effect of NH_4^+
 OH^- concentration is suppressed.

	NaOH	Excess NaOH	$NH_3(aq)$	Excess NH_3
Fe^{3+}	$Fe(OH)_3 \downarrow$ (Brown)	No change	$Fe(OH)_3 \downarrow$ (Brown)	No change
Cr^{3+}	$Cr(OH)_3 \downarrow$ (Green)	$Na[Cr(OH)_4]$ (green solution) Sodium-meta Aluminate chromate	$Cr(OH)_3 \downarrow$ (green)	No change
Al^{3+}	$Al(OH)_3 \downarrow$ (white)	$Na[Al(OH)_4]$ ppt soluble Sodium meta Aluminate	$Al(OH)_3 \downarrow$ white	No change

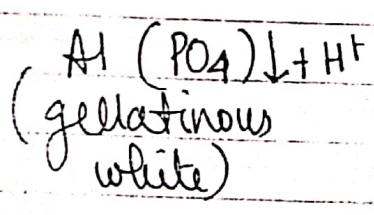
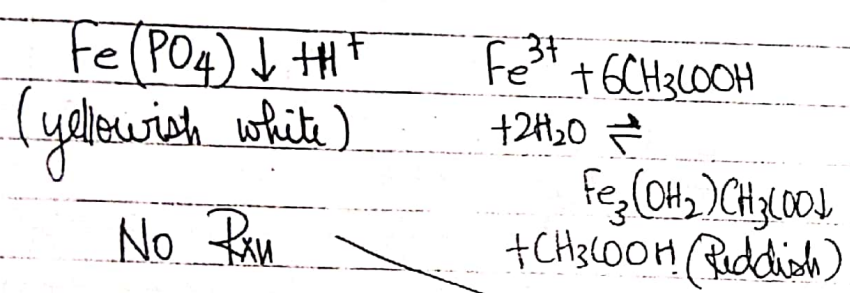
REACTION OF Fe^{3+}



(16)

	KCN/NaCN	Excess KCN	Na ₂ CO ₃	(NH ₃) ₂
Fe ³⁺	Fe(CN) ₃ (Reddish Brown) ppt	Na ₃ [Fe(CN) ₆] (yellow solution)	No Rxn	Fe salt s. Black
Cr ³⁺	No change	No Rxn	Cr(OH) ₃ ↓ No Rxn	Cr(OH) ₃ ↓
Al ³⁺	No Rxn	No Rxn	Al(OH) ₃ ↓	Al(OH) ₃ ↓

HPO₄⁻ CH₃COONa NaOH + Br₂OH
 Na₂O₂ / NaOH
 + Br₂

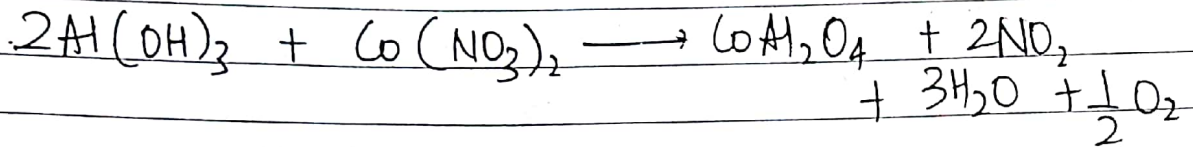


No Rxn
 No Rxn in cold But
 Boiling with excess ppt a white ppt is formed.

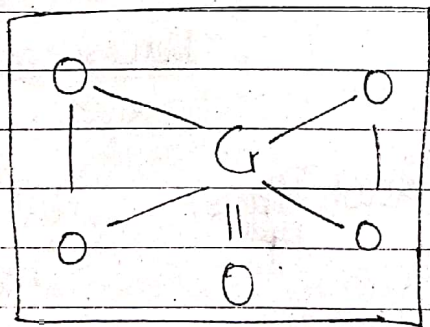
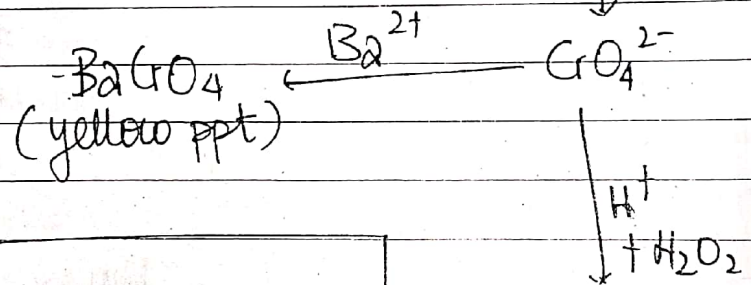
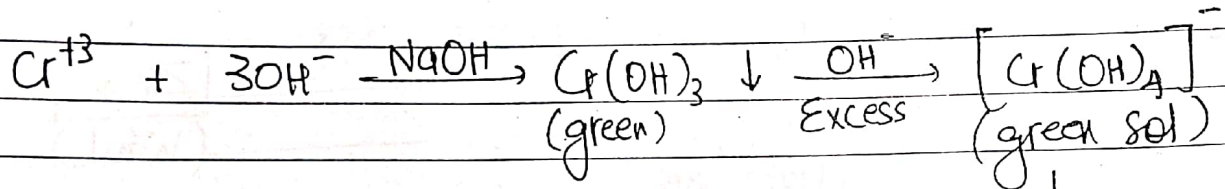
Fl₂ Si₂ O₂₂ (OH)₂
 Cunninghamite

REACTION OF Al^{3+}

Nard's Blue ash test



REACTION OF Cr^{3+}



CrO_5
Blue colour

GROUP - IV

CATIONS: Mn^{2+} , Zn^{2+}

Mn^{2+} , Zn^{2+}

$H_2S/NH_4OH + NH_4Cl$

MnS

Buff ppt
(light pink)

ZnS

(white)

ZnS, MnS

dil HCl, Δ

$MnCl_2$

$ZnCl_2$

MnO_2

(Brown Black)
ppt

NaOH

$Mn(OH)_2$

Na_2ZnO_2

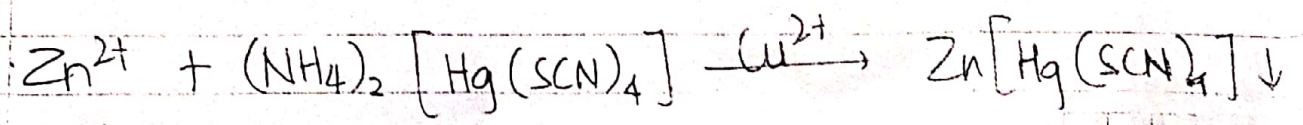
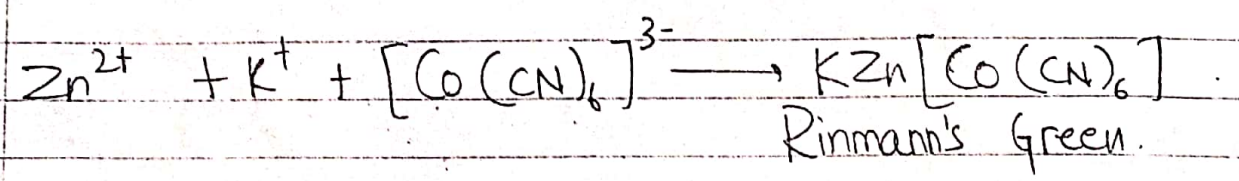
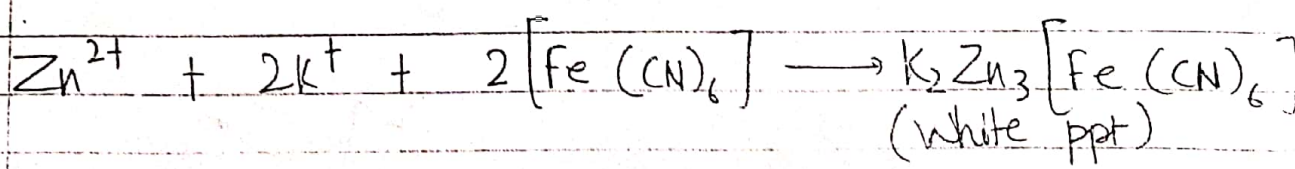
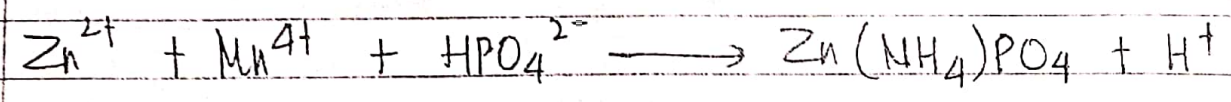
colourless

	NaOH	excess NaOH	NH ₃ sol.	excess NH ₃
Mn ²⁺	Mn(OH) ₂ ↓	Insoluble but on oxidation using MnO(OH) ₂ Black ppt ↓	Mn(OH) ₂	soluble

Zn ²⁺	Zn(OH) ₂ (white)	Na ₂ ZnO ₂ ppt dissolves	Zn(OH) ₂	[Zn(NH ₃) ₄] ²⁺
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	(NH ₄) ₂ S	Na ₂ HPO ₄		
Mn ²⁺	MnS ↓ (Buff)	Mn ₃ (PO ₄) ₂ pink ppt		

Zn ²⁺	ZnS ↓ (white)	Zn ₃ (PO ₄) ₂ (white) soluble in mineral Acid		
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FLAME TEST:

Calcium \rightarrow Brick RedBarium \rightarrow Apple Green