Qualitative Analysis

Preparation of Original Solution .
The mixture should be dissolved in an suitable solvent. The choice of solvents can have the following sequence.1.Cold Water, 2. Warm water, 3. Dilute HCl, 4. Concentrated HCl, 5. Dilute HNO_3, 6. Concentrated HNO_3, and 6. Aquaregia. The solution prepared by dissolving the mixture in the solvent is referred to a the original solution or O.S.

	EXERIMENT	OBSERVATION	INFERENCE
0 Group			
	Shake the aqueous mixture solution well with NaOH and note the odour.	Smell of Ammonia NH_3	Presence of NH_4^+ indicated
	To one ml of Nesslers ($K_2[HgI_4]$) reagent add aqueous mixture solution	Brown precipitate of Mercuric Amido Iodide ($NH_2.HgO.HgI$) is obtained.	NH_4^+ Confirmed
I Group			
	a White Precipitate. Dissolve the above precipitate in hot water and perform the following tests	The white ppt. of $PbCl_2$ is soluble in hot water $Pb^{2+} + 2Cl^- \rightarrow PbCl_2$	Pb may be present
	(i) Treat a part of the above solution with K_2CrO_4	Yellow precipitate due to the formation of $PbCrO_4$. $Pb^{2+} + CrO_4 \rightarrow PbCrO_4$.	Pb^{2+} Present
	(ii) To another part of group one solution add KI solution	Yellow precipitate due to the formation of PbI_2 which is soluble in hot water reappears as golden spangles on cooling $Pb^{2+} + I^- \rightarrow PbI_2$	Pb^{2+} Confirmed
II Group			
	b Black Precipitate.(NiS) Dissolve the group II black residue in dil HNO_3 and perform the following tests.		
	If the solution is blue preform the following tests. (i) Add NH_4OH drop wise until it is in excess.	Blue precipitate is formed which dissolves in excess of the reagent. $Cu^{2+} + 2OH^- \rightarrow Cu(OH)_2$ $Cu(OH)_2 + 4NH_4OH \rightarrow [Cu(NH_3)_4](OH)_2 + 4H_2O$.	Cu^{2+}
	(ii) Acidify the second portion with acetic acid and add potassium Ferrocyanide.	Reddish brown precipitate is obtained. $2Cu^{2+} + [Fe(CN)_6]^{4-} \rightarrow Cu_2[Fe(CN)_6]$	Cu^{2+}

	If the solution is colour less perform the following tests. (i) Add KI to one part of the above solution.	Yellow precipitate due to the formation of PbI_2 which is soluble in hot water reappears as golden spangles on cooling. $Pb^{2+} + 2I^- \rightarrow PbI_2$	Pb^{2+} Confirmed
	(ii)Add K_2CrO_4 to another part of the solution	Yellow precipitate due to the formation of $PbCrO_4$ $Pb^{2+} + CrO_4^{2-} \rightarrow PbCrO_4$	Pb^{2+} Confirmed
	B) Yellow precipitate (CdS) Boil the yellow precipitate with yellow ammonium sulphide and divide into two parts .		Presence of Cd^{2+}
	(i) One part of the residue is dissolved in dil HNO_3 and ammonium hydroxide is added dropwise.	White Precipitate soluble in excess.	Presence ofCd^{2+}
	(ii) To the Second part of the above solution pass H_2S.	Yellow precipitate.	Presence ofCd^{2+} Confirmed.
III Group			
	A) Gelatinous white ppt.$Al(OH)_3$. Dissolve the white gelatinous precipitate by boiling with NaOH solution and divide it into two parts.		
	(i) To the first part add NH_4Cl and boil	White precipitate	Al^{3+} present
	(ii) To the second part add dil. HCl ,litmus solution and excess of NH_4OH	A blue lake	Presence of Al^{3+} confirmed.
	Ash test: Group III residue + 3 drops of conc. HNO_3 + 3 drops of Cobalt nitrate. Dip a rolled filter paper in this solution and burn in the flame	A Blue tinted ash is obtained. $2Al(OH)_3 \rightarrow Al_2O_3 + 3H_2O$. $2\ Al_2O_3 + 2Co(NO)_3 \rightarrow 2CoO.Al_2O_3 + 4NO_2 + O_2$	Presence of Al^{3+} confirmed.
	A)Gelatinous brown ppt.$Fe(OH)_3$. Dissolve the ppt. in dil HCl and divide it into two parts.		

	(i) To one part of the above precipitate add Potassium Ferrocyanide solution.	A blue (Prussian blue) coloured solution or precipitate is formed. $Fe^{3+} + 3\,[Fe(CN)_6]^{4-} \rightarrow Fe_4[Fe(CN)_6]_3$	Presence of Fe^{3+} indicated.
	(ii) To the second part add Potassium thiocyanide.	Blood red coloration $Fe^{3+} + 3CNS^- \rightarrow Fe(CNS)_3$	Presence of Fe^{3+} confirmed.
IV Group			
	A)Black precipitate.(NiS) Conformation for Ni^{2+} Dissolve the black precipitate in dil. HCl add NH_4Cl and NH_4OH and divide into two parts:		Presence of Ni^{2+}
	(i) To the first part add Dimethyl Glyoxime	Rose Red Precipitate.	Presence of Ni^{2+} Confirmed.
	(ii) Through the second part pass H_2S gas.	A black precipitate is formed	Presence of Ni^{2+} Confirmed.
	B)Dull White precipitate. Conformation for Zn^{2+} Dissolve the white ppt. in dilute HCl, to this solution NaOH is first added in drops then in excess until the ppt. dissolves.		
	(i) To one part add Acetic acid and potassium Ferrocyanide.	White precipitate is formed. $Zn^{2+} + [Fe(CN)_6]^{4-} \rightarrow Zn_2[Fe(CN)_6]$	Presence of Zn^{2+} confirmed.
	(ii) Pass H_2S and filter	White precipitate is formed	Presence of Zn^{2+} confirmed.
	Ash test: Group IV residue + 3 drops of conc. HNO_3 + 3 drops of Cobalt nitrate. Dip a rolled filter paper in this solution and burn it in the non luminous part of the flame.	Green tinted ash is formed.	Presence of Zn^{2+} confirmed
	C) Conformation of Mn^{2+}. Buff precipitate is heated with PbO_2 and conc. HNO_3 and dilute with water.	The supernatant liquid turns pink due to the formation of permanganic acid. $2Mn(NO_3)_2 + 5PbO + 6HNO_3 \rightarrow 5Pb(NO_3)_2 + 2HMnO_4 + 2H_2O$	Presence of $^{Mn2+}$ confirmed.

V Group			
	White precipitate: Dissolve the group V precipitate in minimum quantity of Acetic acid and divide into three parts. Keep aside a part of the group precipitate for Flame test.	.	
	c To one part of the above soln. Add K_2CrO_4.	A Yellow precipitate is formed. $Ba^{2+} + CrO_4^{2-} \rightarrow BaCrO_4$	Presence of Ba^{2+} confirmed.
	d To the second part add $CaSO_4$ and boil.	A White precipitate is formed. $Sr^{2+} + SO_4^{2-} \rightarrow SrSO_4$	Presence of Sr^{2+} confirmed
	e To the third part add Ammonium Oxalate	A White precipitate is formed. $Ca^{2+} + C_2O_4^{2-} \rightarrow Ca\ C_2O_4$	Presence of Ca^{2+} confirmed
	Flame test: The group V residue is treated with conc. HCl and a Nichrome / Platinum wire dipped in the above solution is shown into the non luminous part of the flame.	f Apple Green flame g Crimson Flame h Brick Red Flame	i Ba^{2+} Confirmed j Sr^{2+} confirmed k Ca^{2+} confirmed
VI Group			
	White Crystalline ppt. Group VI ppt. is dissolved in minimum quantity of dil HNO_3 and few drops of conc. HNO_3 and Cobalt Nitrate are added. A rolled filter paper is dipped in the above solution and burned in the non luminous part of the flame.	A pink tinted ash is obtained.	Presence of magnesium is confirmed.
	Magneson reagent test: The group VI residue is dissolved in dil. HCl to this a few drops of Magneson reagent is added followed by NaOH.	A blue precipitate is formed.	Magnesium is confirmed. Mg^{2+}