

Chapter:

Salt Analysis & Compound's Identification



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Chemistry with MJS

Chemistry Preparation by MJS

CHAP:

SALT ANALYSIS &

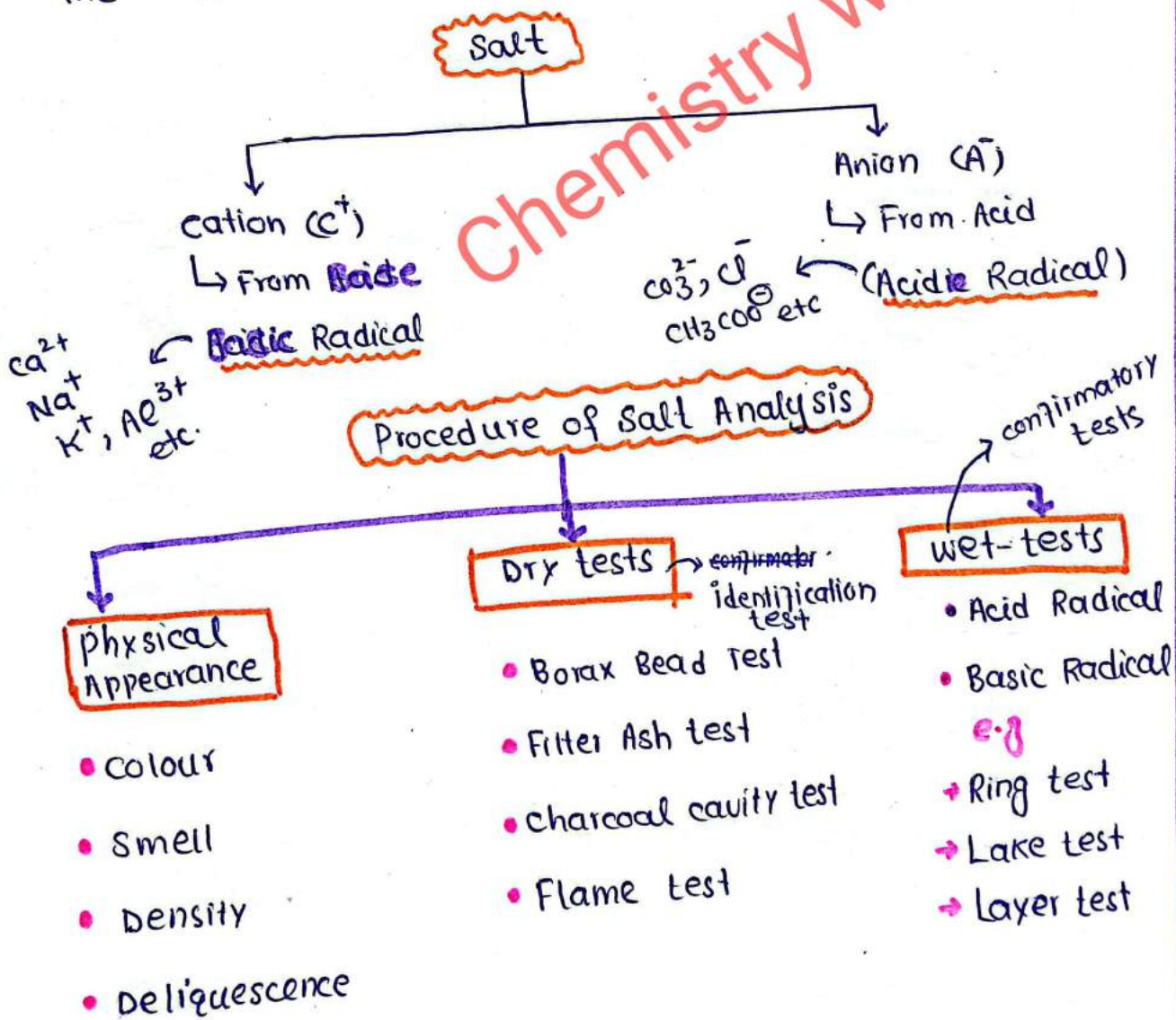
COMPOUNDS IDENTIFICATION

SALT Analysis / Qualitative Analysis:

The Analysis which involves the detection, identification & confirmation of radicals present in the salt mixture called Qualitative Analysis OR Salt Analysis.

Salt:

Ionic compound which is formed by the neutralization of an Acid with a base.



DRY TEST: (identification/detection tests)

The test which is directly performed with a dry salt without making its solution called Dry test.

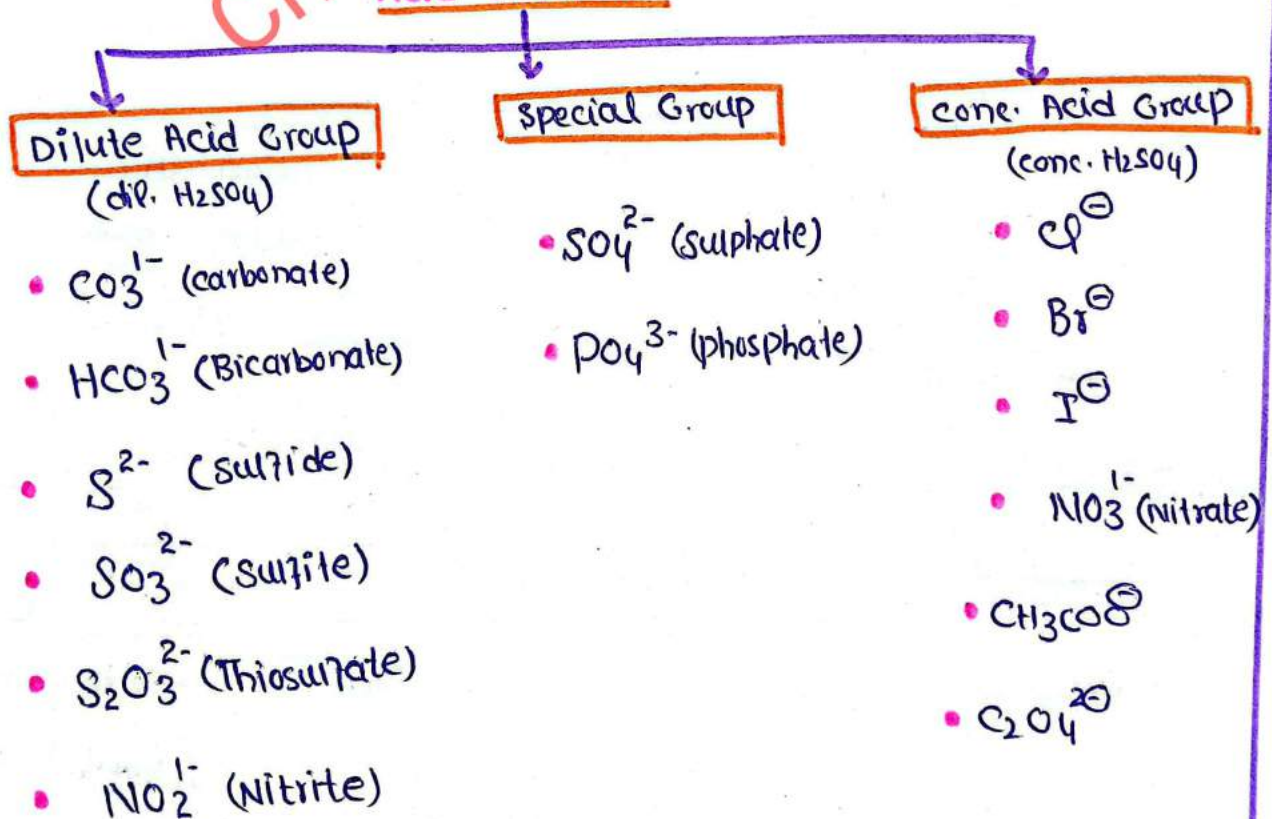
- physical tests.
- identification of salts
- Flame test, Borax Bead test, Filter Ash test, charcoal cavity test.

Wet TEST: → (confirmatory tests)

A test which is performed with the solution of salt.

e.g. Ring test, Lake test, Layers test etc.

Acid Radicals



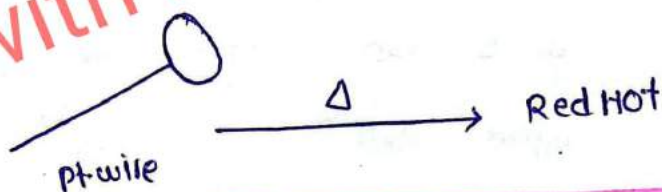
Total No. of Acidic Radicals = 14

Important DRY TESTS

* Borax Bead Test:

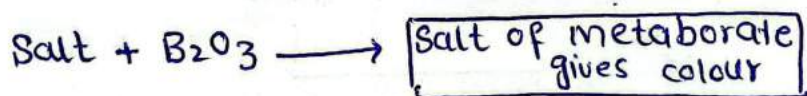
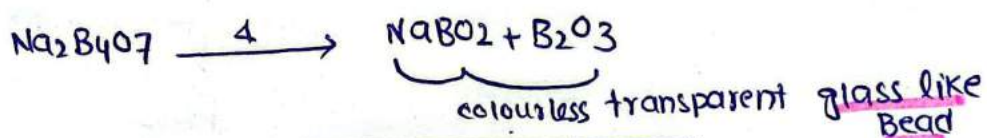
• This test is used to detect the coloured metallic cations.

Salt is taken on pt-wire which is inserted into a small loop. Small amount of Borax is taken on loop & heated on oxidizing & Reducing Flame - The colour of Bead is noted.

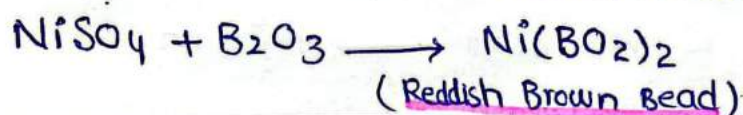
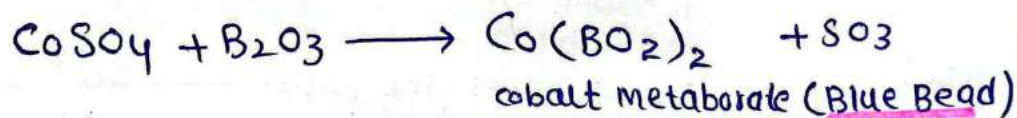


Metals	oxidizing Flame		Reducing Flame	
	Hot	cold	Hot	cold
Cu	Green	Blue	colourless	Brown Red
Co	Blue	Blue	Blue	Blue
Ni	Reddish (violet)	Reddish (Brown)	Grey	Grey
Cr	Bright green	Bright green	Bright green	Bright Green

Chemistry:



e.g



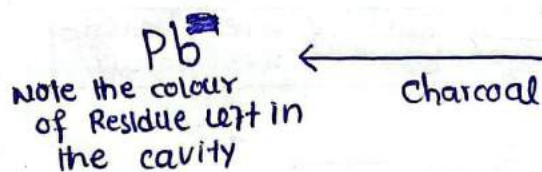
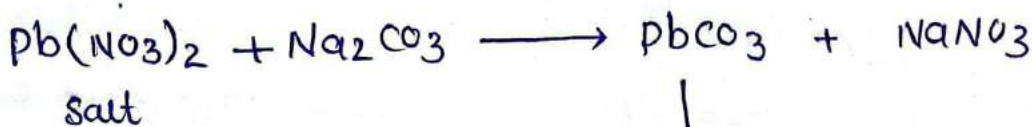
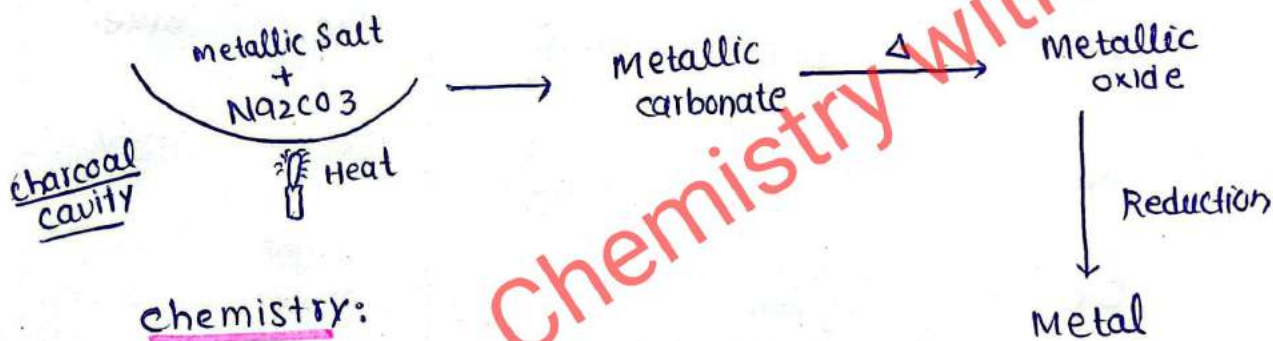
* Filter Ash test:

This test is used for colourless salt.



Observations	salt
Green Ash	Zn^{2+}
Blue Ash	Al^{3+}
pink Ash	Mg^{2+}
Bluish green	Sn^{2+}

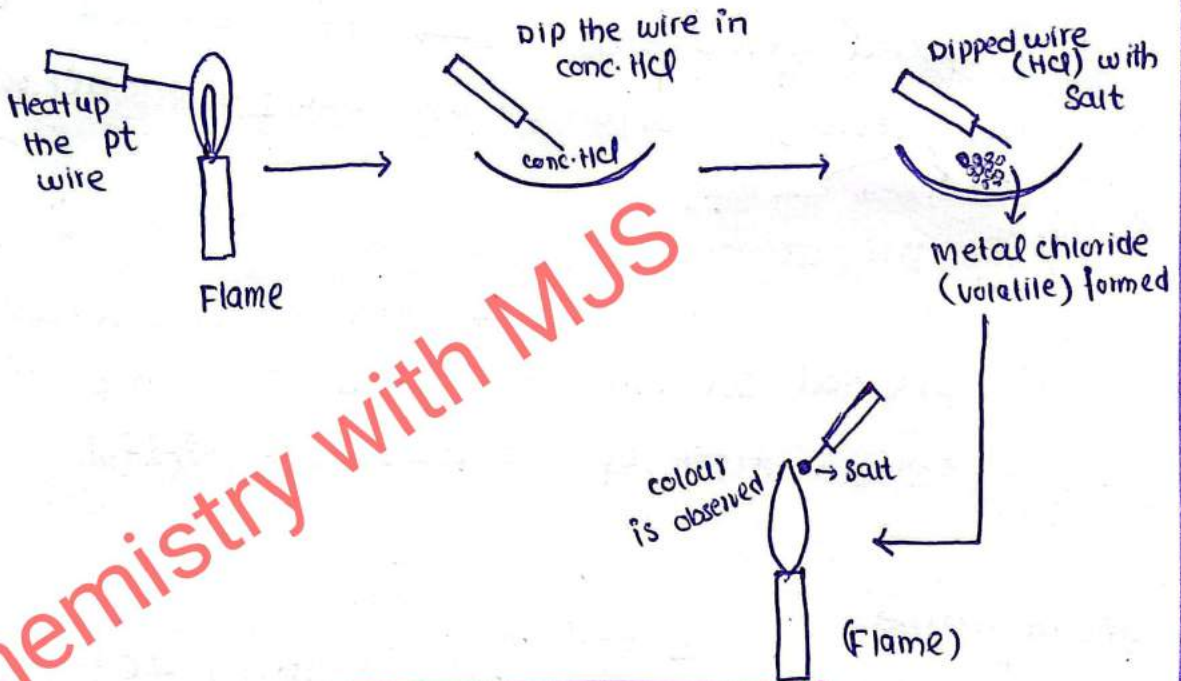
* Charcoal cavity Test:



- inferences**
- white Bead marks the paper $\longrightarrow Pb^{2+}$ salt
 - Bright white Bead $\longrightarrow Ag^+$ salt

Flame test:

- Generally Alkali & Alkaline Earth metals impart colour to the flame.
- We make the paste of salt with conc. HCl so that ^{their} chlorides will form. These chlorides are more volatile (vapourize easily) than other anions. → not H₂SO₄
- We use pt-wire in the flame test b/c pt-wire itself does not impart any colour. We cannot use the glassrod or copper wire b/c Both impart characteristics colour.



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20/12

Metals	colour of Flame
Na ⁺	yellow
K ⁺	violet (Lilac)
Ba ²⁺	Apple Green
Ca ²⁺	Brick Red
Cu ²⁺	Bluish Green
Li ⁺	Crimson Red
Ni ²⁺	Brown

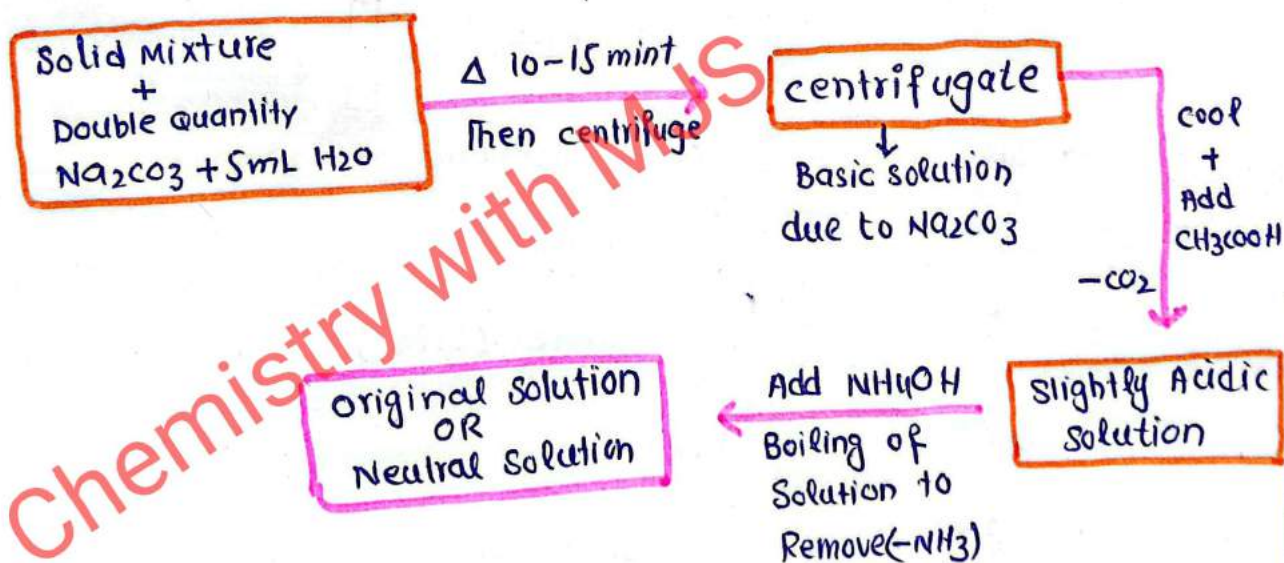
Acid Radicals

- All Acid Radicals are detected by dry tests except special group Radicals e.g. SO_4^{2-} & PO_4^{3-} .
 - Acid group Radicals are confirmed by wet tests.
 - **Dilute Acid Group Radicals** → detected by dil. H_2SO_4 or dil. HCl
 - **Concentrated Acid Group Radicals** → detected by conc. H_2SO_4 (conc. HCl can not be used)
 - **Special Group Radicals** → not detected by $\text{BaCl}_2 + \text{conc. HCl}$ solution.
- X Dry tests, detected by $\text{BaCl}_2 + \text{conc. HCl}$ solution.
 dil. H_2SO_4 conc. H_2SO_4

* preparation of original solution *

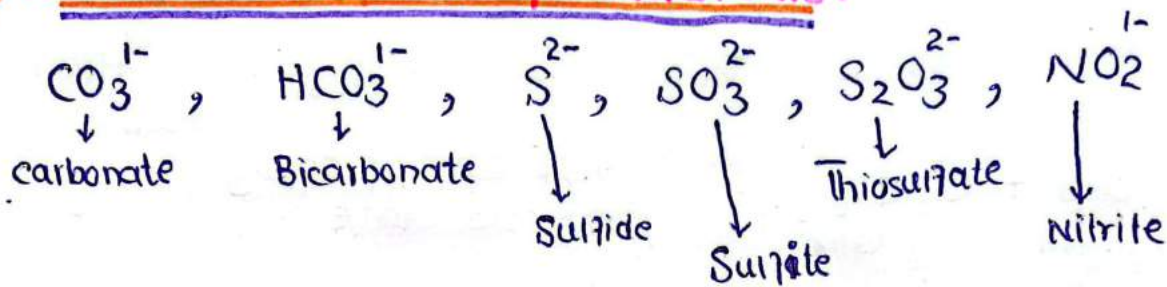
↳ called Neutral solution

- original solution is used for the confirmation of Radicals (wet tests)



Chemistry with MJS

A) : Dilute Acid Group Radicals:



Detection tests / DRY TESTS:

(Mixture + dil. HCl) → Group Reagent

CO_3^{1-} & HCO_3^{1-} → colourless, odourless gas comes out, which turns the lime water milky. The evolved CO_2 gas indicates the CO_3^{1-} & HCO_3^{1-} Radicals.

S^{2-} → colourless gas (H_2S) with rotten egg smell, turns lead acetate paper black. The evolved H_2S gas indicates the S^{2-} group.

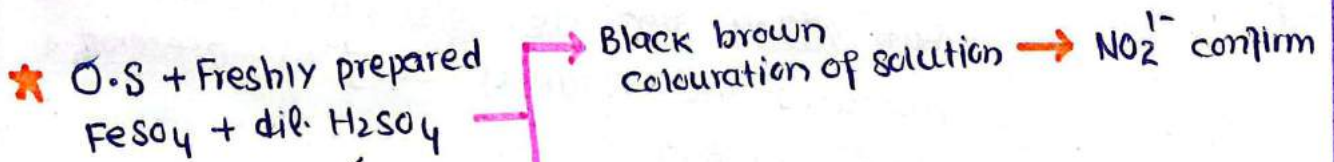
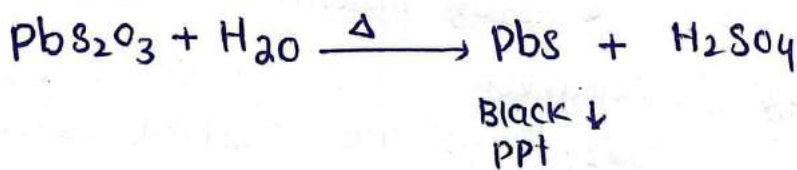
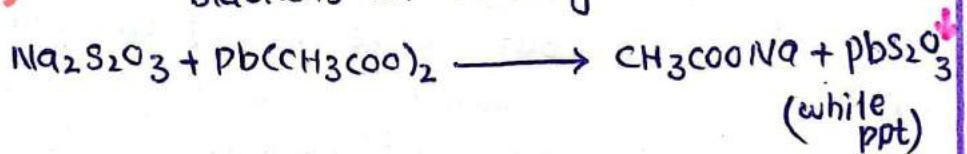
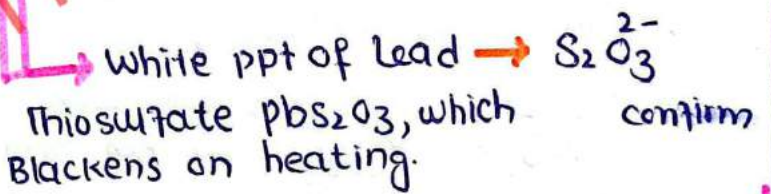
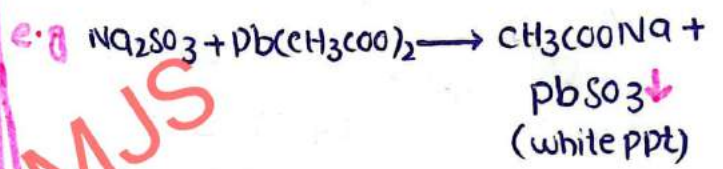
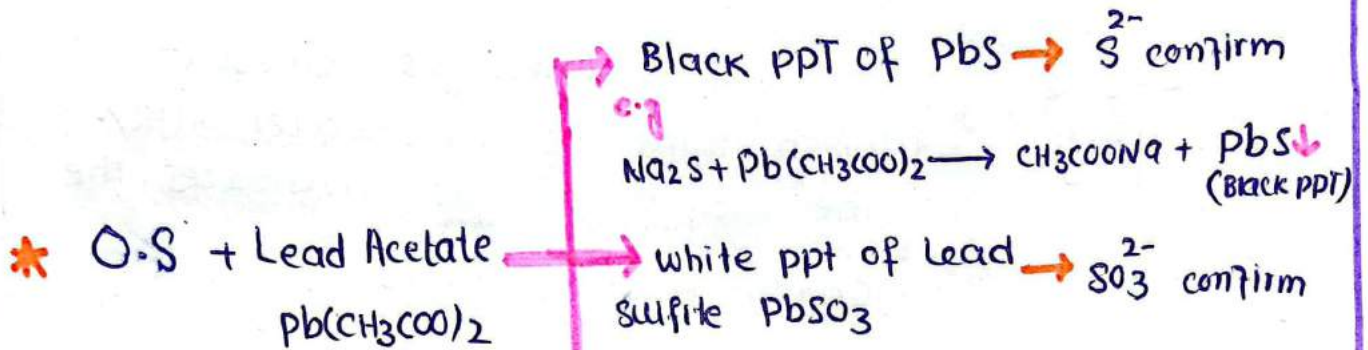
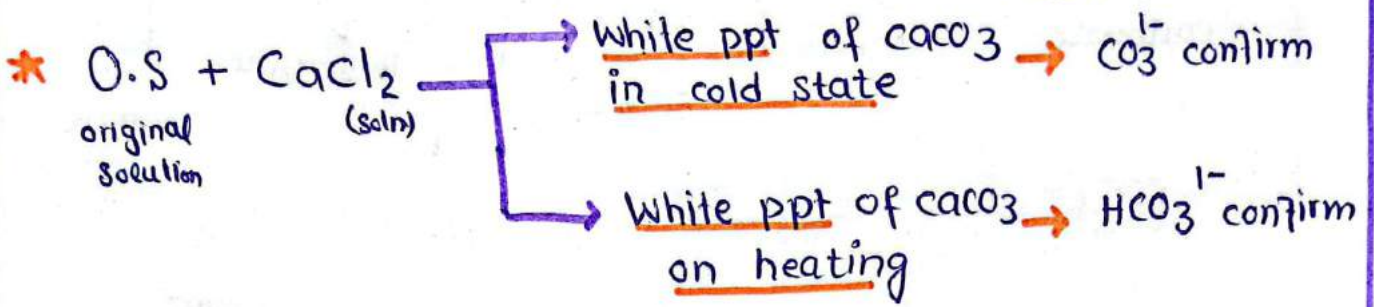
SO_3^{2-} → colourless gas with pungent suffocating smell (SO_2) turns the acidified $\text{K}_2\text{Cr}_2\text{O}_7$ paper green. But no yellow ppt observed in test tube, indicates the Radical SO_3^{2-} is present & $\text{S}_2\text{O}_3^{2-}$ Absent.

$\text{S}_2\text{O}_3^{2-}$ → colourless gas with pungent smell (suffocating) SO_2 turns the acidified $\text{K}_2\text{Cr}_2\text{O}_7$ paper green. But yellow ppt are observed in test-tube indicates the Radical $\text{S}_2\text{O}_3^{2-}$ is present & SO_3^{2-} Absent.

NO_2^{1-} → reddish brown gas (NO_2) with pungent smell turns FeSO_4 solution black indicates the NO_2^{1-} Radical

Confirmatory Tests / Wet Tests:

↳ Original solution is used.



cone. H_2SO_4 for NO_3^{-}

Ring Test

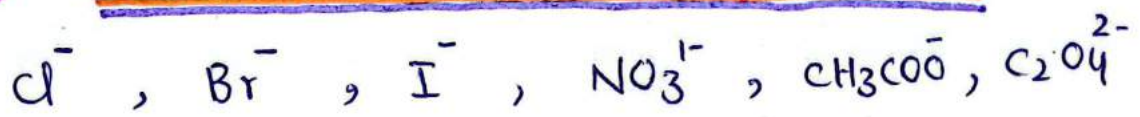
Dark brown Ring is formed at the junction of two solutions

Note that NO_3^{-} is cone. Acid group Radicals.

↓ NO_3^{-} confirmed

Chemistry with MJS

B) Concentrated Acid Group Radicals:



(Mixture + Conc. H_2SO_4) → Group Reagent
∴ Detection Tests:

$\text{Cl}^- \Rightarrow$ The colourless gas evolved (HCl) with pungent smell gives white dense fumes of NH_4Cl with NH_4OH indicates the radical Cl^-

$\text{Br}^- \Rightarrow$ Reddish brown vapours $(\text{Br}_2) \rightarrow$ fumes are evolved, which turns the starch paper yellow, indicates Br^- radical.

$\text{I}^- \Rightarrow$ Violet vapours are evolved, which turns the starch paper blue, indicates I^- radical.

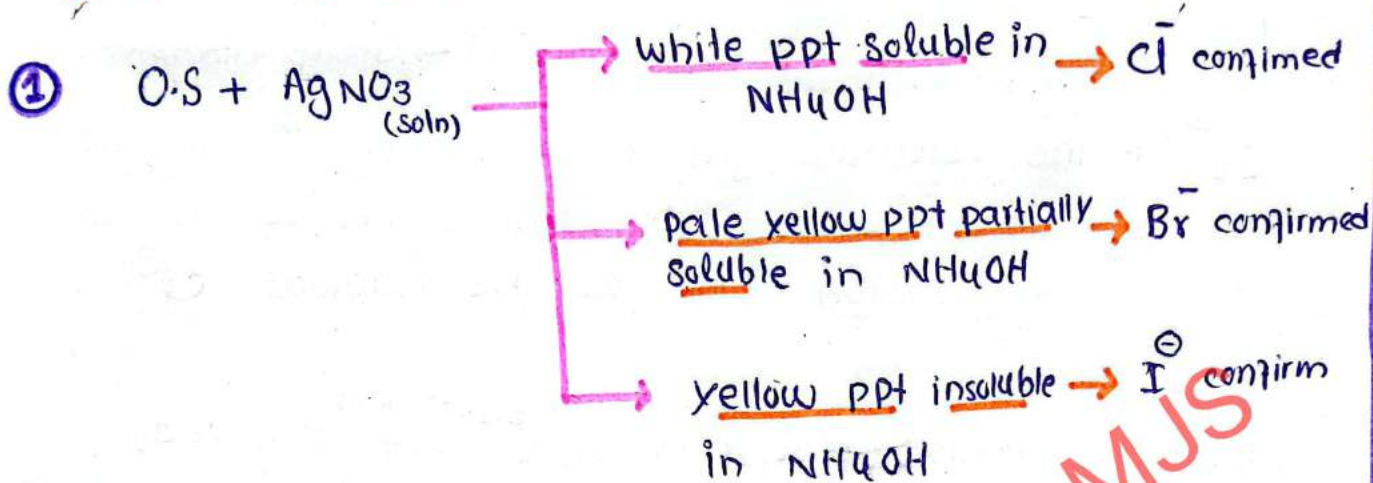
$\text{NO}_3^- \Rightarrow$ Reddish brown gas (NO_2) with pungent smell turns FeSO_4 solution black indicates NO_3^- radical.

$\text{CH}_3\text{COO}^- \Rightarrow$ A colourless gas evolved with vinegar like smell indicates the radical CH_3COO^-

$\text{C}_2\text{O}_4^{2-} \Rightarrow$ colourless, odourless gas (CO) which burns at the mouth of the test tube with a blue flame turns lime water milky, indicates the $\text{C}_2\text{O}_4^{2-}$ radical.

Confirmatory Tests | Wet Tests:

≡ For Cl^- , Br^- , I^-

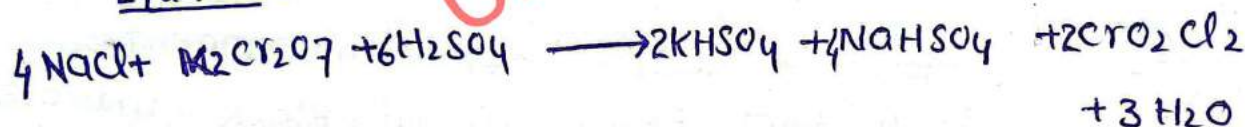


② Chromyl chloride test: → For Cl^\ominus

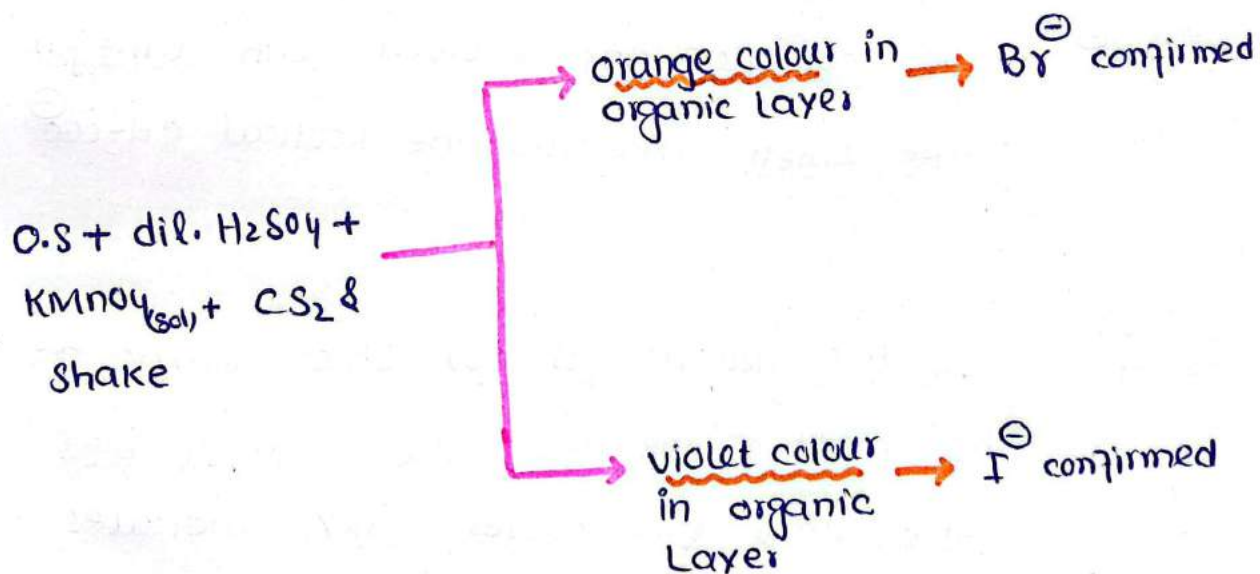
Salt + $\text{K}_2\text{Cr}_2\text{O}_7$ (solid) + conc. H_2SO_4 → Reddish brown vapours of chromyl chloride are evolved confirm the Cl^\ominus radical.

1 : 1

Equation:



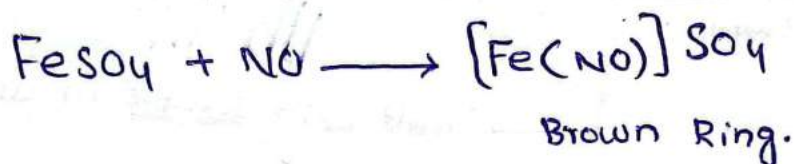
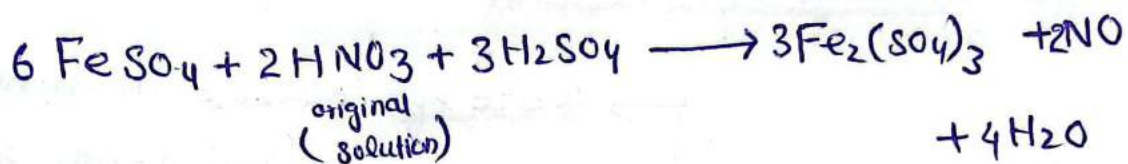
* Layers test: (For Br^- & I^-)



$\text{NO}_3^- \rightarrow$ (Ring test)

O.S + Freshly prepared FeSO_4 (soln) + conc. H_2SO_4

↓
Dark brown Ring is formed at the junction of two solutions which confirms the NO_3^- Radical.

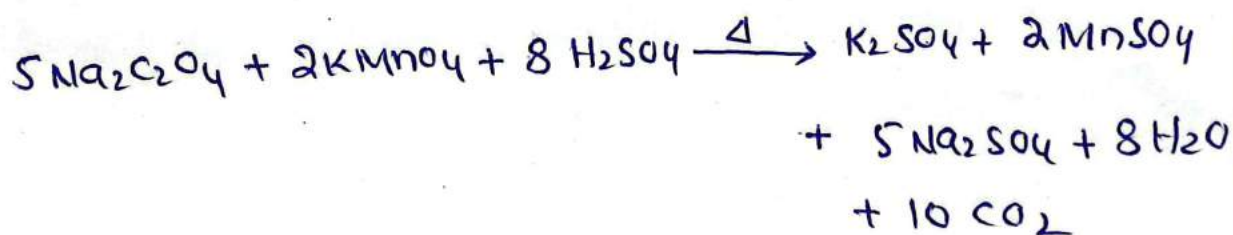
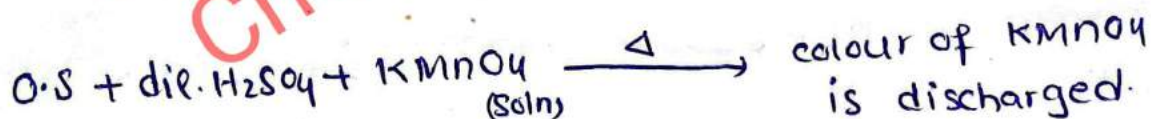


CH_3COO^- (palm test)

Salt + oxalic acid on the palm + 1-2 drops of H_2O & Rub - vinegar smell is observed confirms the CH_3COO^-



$\text{C}_2\text{O}_4^{2-}$



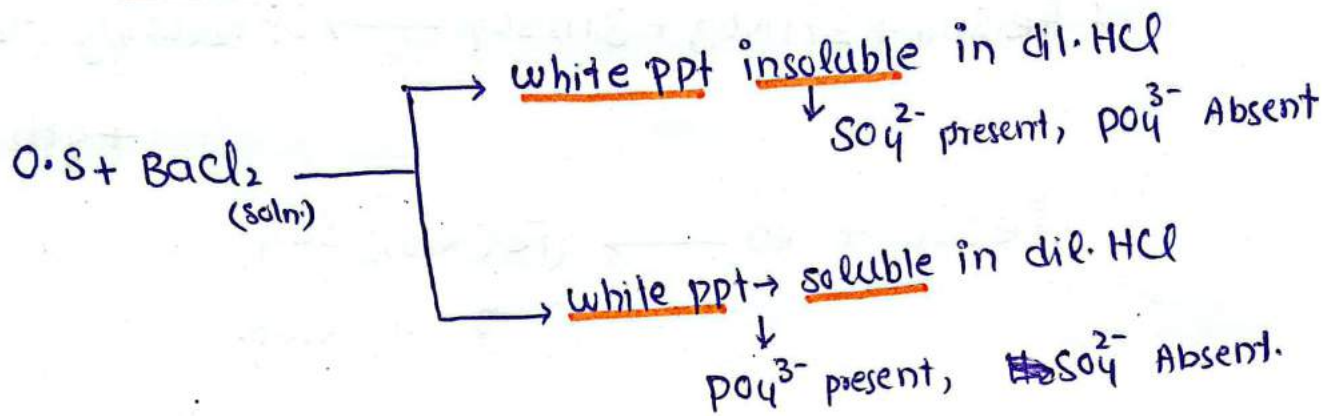
c) Special Group Radical (SO_4^{2-} & PO_4^{3-})

↳ Not detected by dry tests.

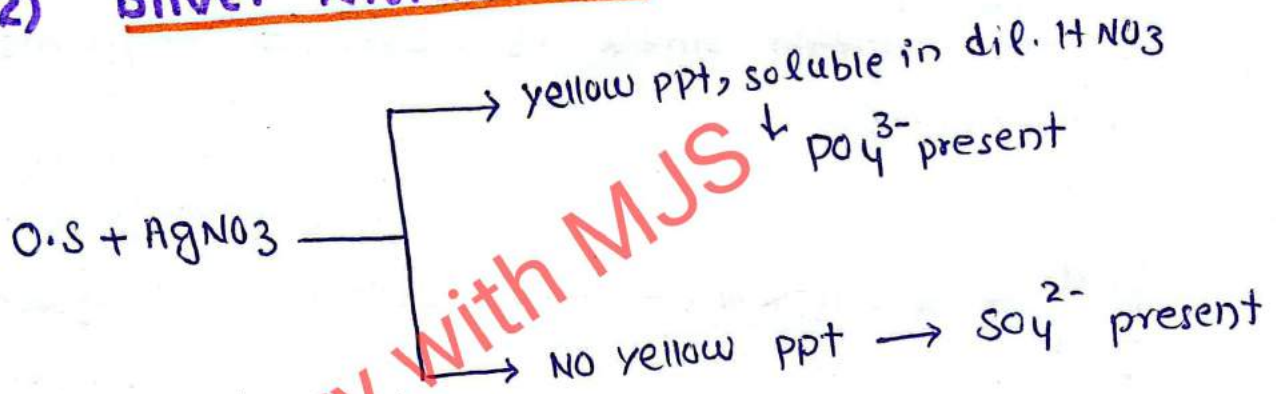
• No gas is evolved with dil. or concentrated H_2SO_4 even on heating

Q: How to distinguish B/W SO_4^{2-} & PO_4^{3-} ?

1) Barium chloride test:



2) Silver nitrate test:



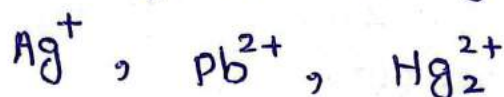
Chemistry with MJS

BASIC RADICALS → Total (26) Basic Radicals

↳ Six-Groups

↳ depends upon the formation of insoluble precipitates using the different group reagents.

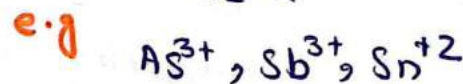
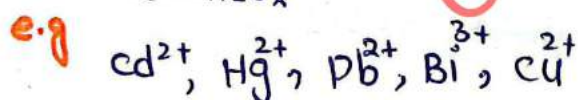
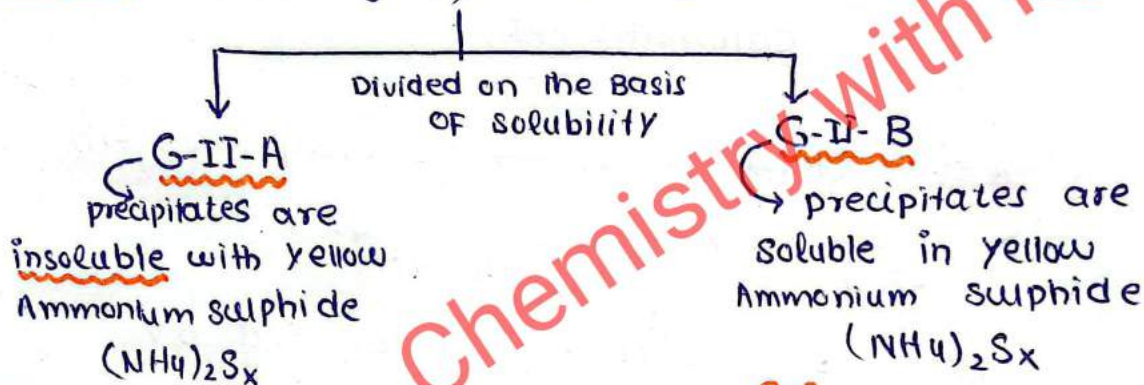
* Group-1: (Silver group) → G-Reagent → Dil. HCl



∴ chlorides → ppt

↳ we can not use conc. HCl b/c PbCl_2 is soluble in conc. HCl

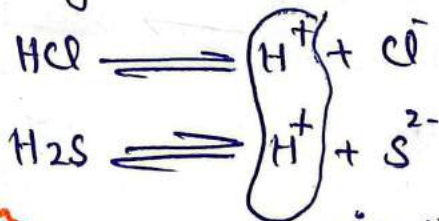
* Group-2: (Copper group) → G-Reagent → Dil. HCl + H_2S



precipitate in the form of sulphides

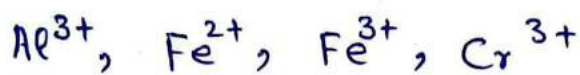
∴ Dil. HCl is added before passing H_2S gas
imp For the detection of G-II Radicals b/c of suppressing the ionization of H_2S (common-ion effect)

Q: Why Lead is placed in both G-I & G-II?
b/c PbCl_2 is slightly soluble in water & therefore lead is never completely precipitated by adding dil. HCl to a sample, the rest of the lead ions are precipitated with H_2S in acidic medium.



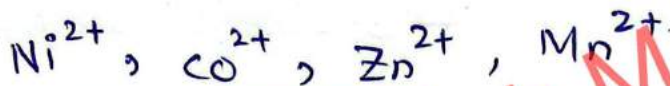
∴ in this way sulphides of G-IV are not formed

* Group-3: (Iron Group) \rightarrow G. Reagent \rightarrow $\text{NH}_4\text{Cl} + \text{NH}_4\text{OH}$



\therefore Hydroxides (ppt)

* Group-4: (Zinc Group) \rightarrow G. Reagent \rightarrow $\text{NH}_4\text{Cl} + \text{NH}_4\text{OH} + \text{H}_2\text{S} + (\text{NH}_4)_2\text{CO}_3$



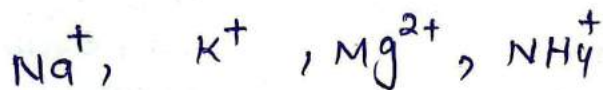
Sulphides ppt

* Group-5: (Calcium Group) \rightarrow G. Reagent \rightarrow $\text{NH}_4\text{Cl} + \text{NH}_4\text{OH} + (\text{NH}_4)_2\text{CO}_3$



carbonates ppt

* Group-6 (Alkali Group) \rightarrow NO Group Reagent



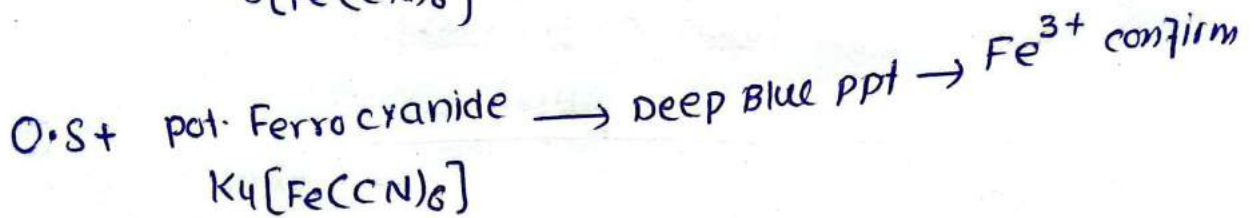
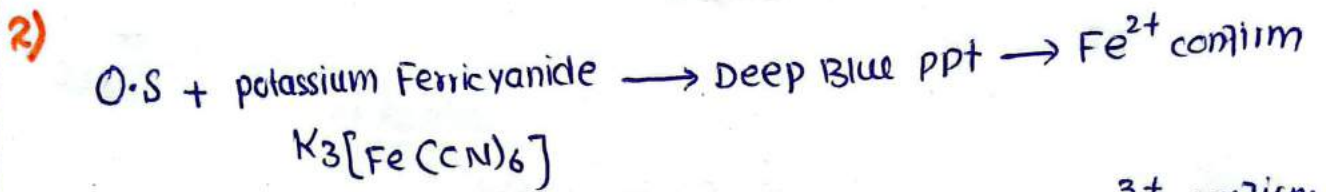
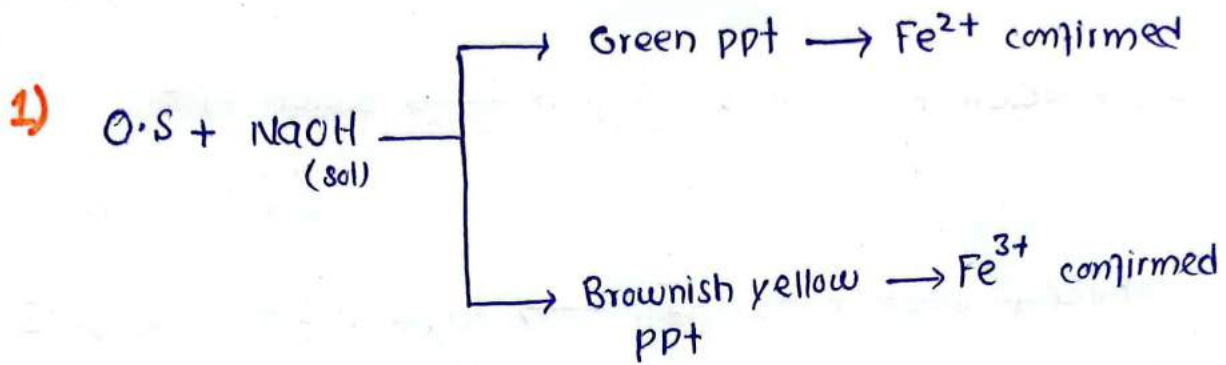
\therefore Radicals of G-VI are detected by applying the individual tests.

\therefore Imp. TESTS FOR BASIC RADICALS:

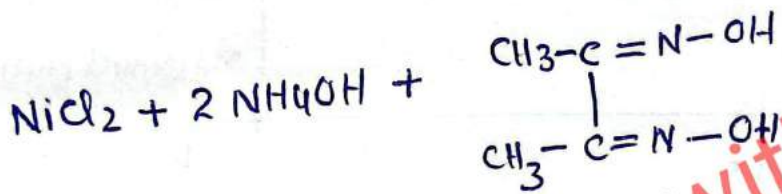
Lake Test: Used for the confirmation of Al^{3+}

O.S + Few drops of Litmus solution + dil. $\text{HCl} + \text{NH}_4\text{OH}$ \rightarrow Blue ppt float over colourless solution
 \downarrow
confirm the Al^{3+} Radical

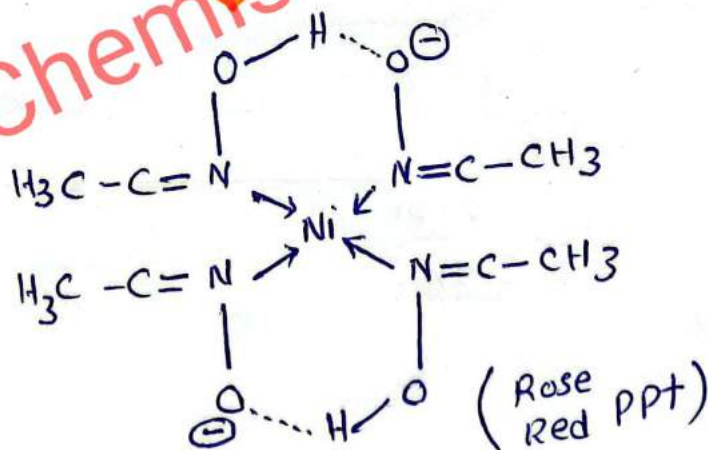
Distinguish test for Fe^{2+} & Fe^{3+} \rightarrow (G-III Radical)



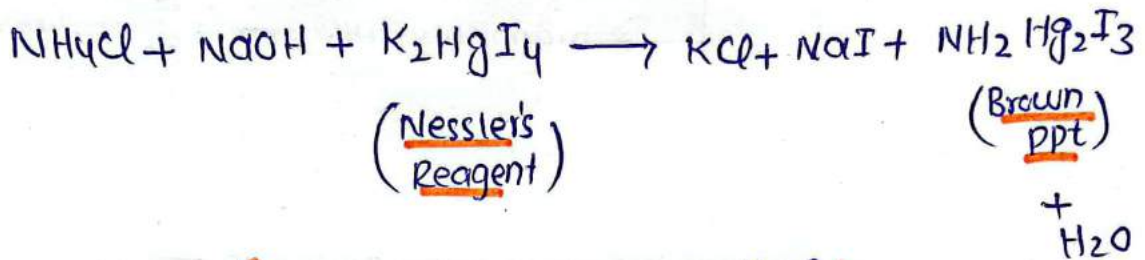
DMG Test: (For Ni^{2+}) \rightarrow G-IV Radical



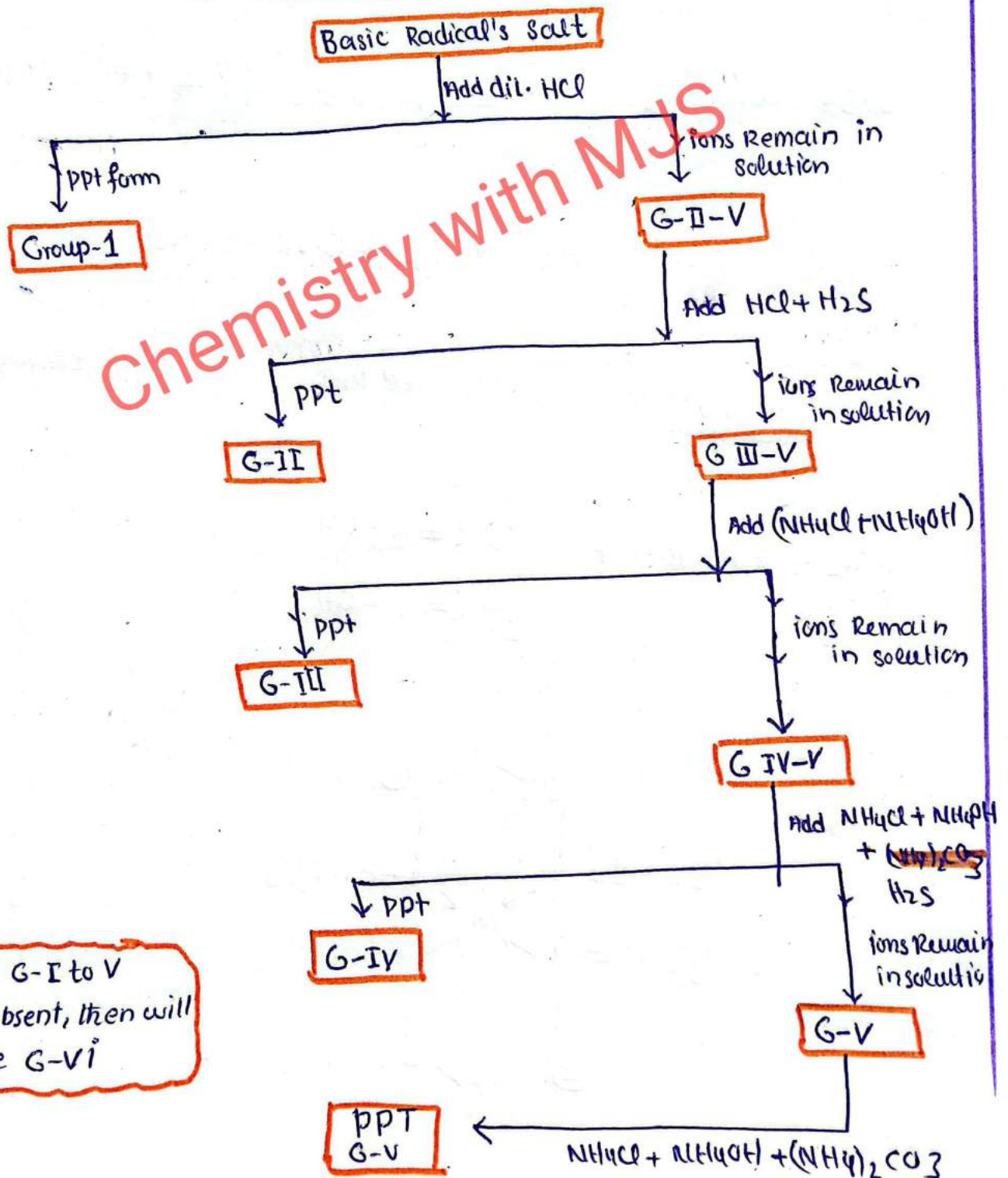
Chemistry with MJS



Test For NH_4^+ \rightarrow Group-VI



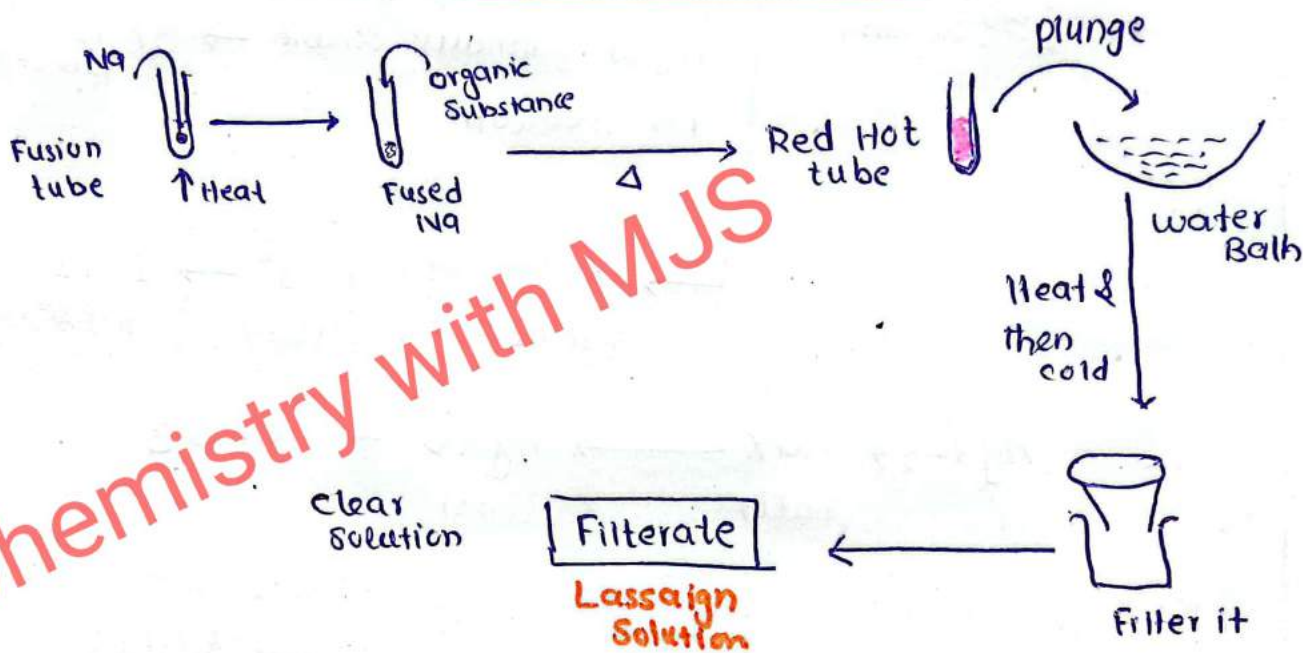
Scheme For Basic Radical



If G-I to V Absent, then will be G-VI

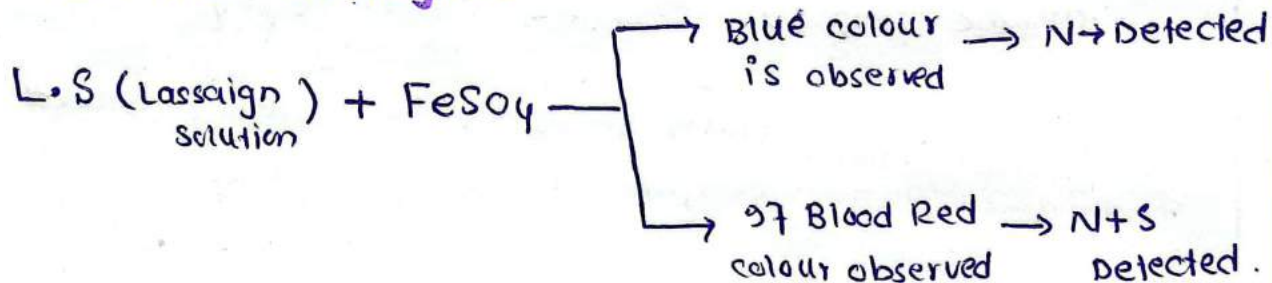
Compounds Identification

How to make Lassaigne solution?

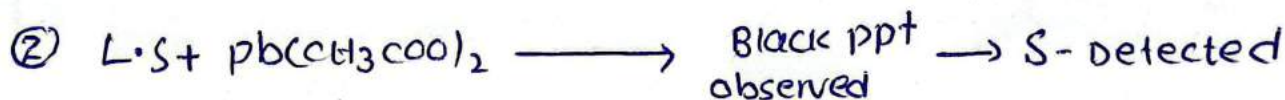


∴ Detection of N, S & Halogens in organic compounds

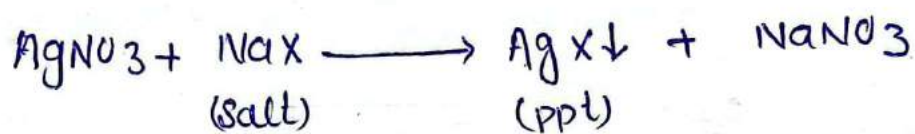
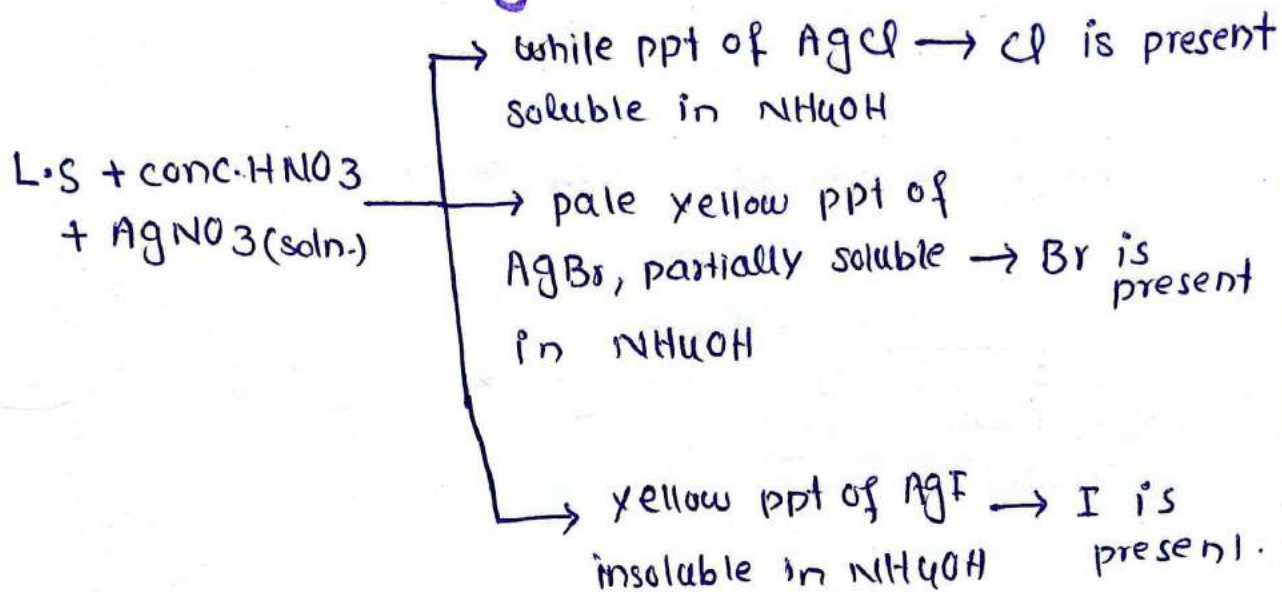
Test For Nitrogen:



Test For Sulphur:



Test For Halogens:



Tests FOR Functional Group identification:

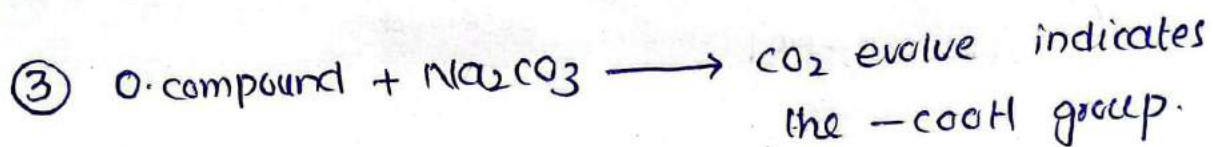
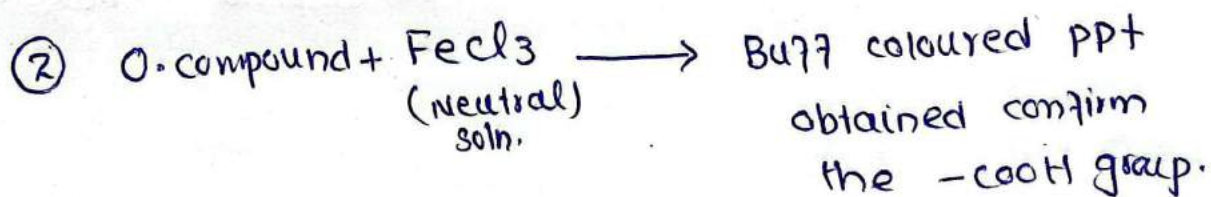
COOH Group:

(confirmatory tests)

① Esterification test:



↓
Fruity smell of an ester produced
confirm the $-\text{COOH}$ group.

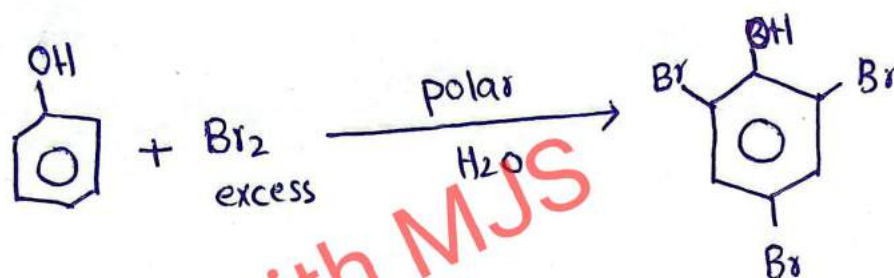


Phenols & phenolic Group:

- ① Organic compound + Freshly prepared FeCl_3 solution
↓
violet colour produced confirm
the phenolic group.

② Bromine water test:

O. compound + Br_2 $\xrightarrow[\text{polar solvent}]{\text{H}_2\text{O}}$ Decolourization with the
Blackening of reactant
occured.



(2,4,6-tribromophenol)

Chemistry with MJS


Aldehyde Group: (-CHO)

① Fehling Test:

O. compound + Fehling Reagent \longrightarrow Red ppt of Cu_2O
obtained.
-CHO confirm

② Tollen's test:

O. compound + Tollen's Reagent \longrightarrow Silver mirror
is formed
-CHO confirm

 Good Luck
MJS 