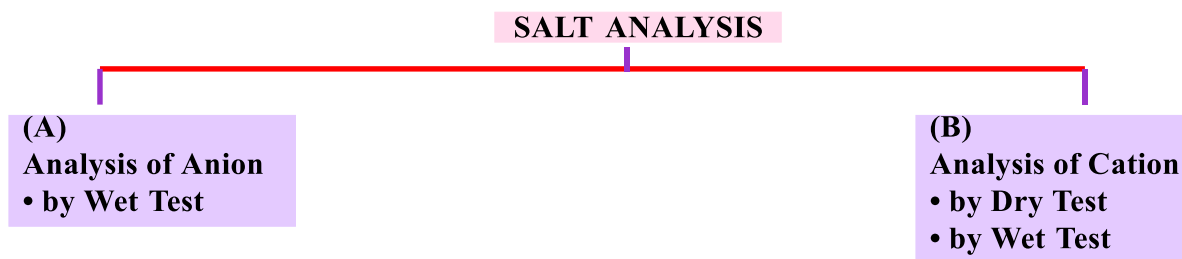


Salt Analysis

DEFINITION

The branch of chemical analysis which aims to find out the constituents of a mixture of compound is known as Qualitative Analysis.

The Identification of a substances usually involves its conversion into a new substance possessing characteristic properties with the help of one or more substance of known composition. The Substance which is used to bring about such change is called a Reagent.



ANALYSIS OF ACIDIC RADICAL

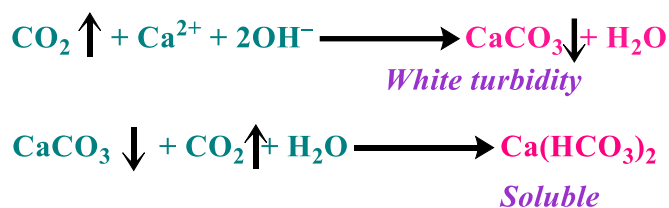
Classification of Acidic Radical

Class - A (Form volatile product with acid)	Class - B (Does not form volatile product with acid)
Sub group-I (Form volatile product with dil. HCl/ dil. H ₂ SO ₄) <i>CO₃²⁻, HCO₃⁻, SO₃²⁻, HSO₃⁻, S₂O₃²⁻, S₂⁻, CH₃COO⁻, NO₂²⁻</i>	Sub group-I (Detected by precipitation reaction) <i>SO₄²⁻, PO₄³⁻, AsO₃³⁻, AsO₄³⁻</i>
Sub group-II (Form volatile product with conc. H ₂ SO ₄) <i>F⁻, Cl⁻, Br⁻, I⁻, NO₃⁻, BO₃³⁻, C₂O₄²⁻</i> + sub group-I	Sub group-II (Detected by redox reaction) <i>CrO₄²⁻, Cr₂O₇²⁻, MnO₄⁻, MnO₄⁻²</i>

- CO₂ is colourless, odourless gas evolved with brisk effevescence, Detected by lime water test.
- SO₂ is colourless, Suffocating gas with burning sulphur odour. Detected by lime water test or by passing in Cr₂O₇²⁻/H⁺ solution.
- H₂ S is a colourless gas having rotten egg odour.
- CH₃COOH has colourless fumes having vinegar odour.
- NO₂/Br₂ is brown gas.
- I₂ is violet gas.

LIME WATER / BARYTA WATER TEST

When CO_2 is passed in lime water or baryta water then white turbidity (milky appearance) is formed due to the formation of insoluble carbonate but when excess of CO_2 is passed then white turbidity disappeared due to formation of soluble bicarbonate.



SO_2 also gives similar observation.

ACIDIC RADICAL TABLE

	dil. H_2SO_4	Conc. H_2SO_4	$CaCl_2$	$BaCl_2$	$HgCl_2$	$AgNO_3$	$Pb(OAc)_2$	MnO_2 / H^+
CO_3^{2-}	$CO_2 \uparrow$	$CO_2 \uparrow$	$CaCO_3 \downarrow$ white	$BaCO_3 \downarrow$ white	$HgCO_3 \cdot 3Hg$ Reddish brown	$Ag_2CO_3 \downarrow$	$PbCO_3 \cdot 2 Pb(OH)_2$	-
HCO_3^- + Δ	$CO_2 \uparrow$	$CO_2 \uparrow$	$CaCO_3 \downarrow$	$BaCO_3 \downarrow$	$HgCO_3 \cdot 3Hg$ Reddish brown	$Ag_2CO_3 \downarrow$	$PbCO_3 \cdot 2 Pb(OH)_2$	-
SO_3^{2-}	$SO_2 \uparrow$	$SO_2 \uparrow$	$CaSO_3 \downarrow$ white	$BaSO_3 \downarrow$ white	-	$Ag_2SO_3 \downarrow$ white	$PbSO_3 \downarrow$ white	SO_4^{2-}
$S_2O_3^{2-}$	$SO_2 \uparrow$ + $S \downarrow$	$SO_2 \uparrow$	-	$BaS_2O_3 \downarrow$ white	$HgS_2O_2 \downarrow$ white	$Ag_2 S_2O_3$ white	$PbS_2O_3 \downarrow$ white	SO_4^{2-} + $S \downarrow$
S^{2-}	$H_2 S \uparrow$	$S \downarrow$ + $SO_2 \uparrow$	-	$BaS \downarrow$ black	$HgS \downarrow$ black	$Ag_2 S \downarrow$ black	$PbS \downarrow$ black	$S \downarrow$
NO_2^-	$NO_2 \uparrow$	$NO_2 \uparrow$	-	-	-	$AgNO_2 \downarrow$	-	NO_3^-
CH_3COO^-	$CH_3COO \uparrow$	CH_3COO + $SO_2 \uparrow$	-	-	-	-	-	-
I^-		$I_2 \uparrow$ violet	-	-	$HgI_2 \downarrow$ scarlet red	$AgI \downarrow$ yellow	$PbCl_2 \downarrow$ dark yellow	$I_2 \uparrow$
Cl^-		$HCl \uparrow$	-	-	-	$AgCl \downarrow$ white	$PbCl_2 \downarrow$ white	$Cl_2 \uparrow$
Br^-		$Br_2 \uparrow$ brown	-	-	-	$AgBr \downarrow$ pale yellow	$PbBr_2 \downarrow$ white	$Br_2 \uparrow$
$C_2O_4^{2-}$	-	$CO_2 \uparrow$ + $CO \uparrow$	CaC_2O_4 white	BaC_2O_4 white	-	$Ag_2C_2O_4$ white	-	$CO_2 \uparrow$

BO_2^-	-	H_3BO_3 ↑	$\text{Ca}(\text{BO}_2)$ white	$\text{Ba}(\text{BO}_2)$ white	-	AgBO_2 ↓ white	-	-
NO_3^-	-	NO_2 ↑	-	-	-	-	-	-
SO_4^{2-}	-	-	CaSO_4 ↓ white	BaSO_4 ↓ curdy white ppt	$\text{HgSO}_4 \cdot$ 2HgO ↓ yellow	-	PbSO_4 ↓ white	-
PO_4^{3-}	-	-	CaHPO_4 white	BaHPO_4 white	-	Ag_3PO_4 ↓ yellow	-	-
CrO_4^{2-}	-	-	-	BaCrO_4 yellow	-	Ag_2CrO_4 brick red	PbCrO_4 ↓ yellow	-

SPECIFIC REACTION OF ACIDIC RADICAL

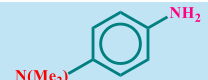
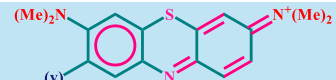
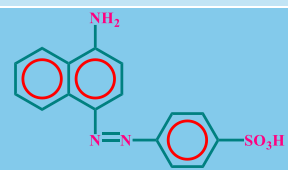
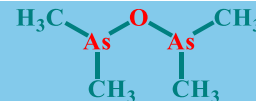
Anion	Reaction Name/with	Reagent	Product	Observation
S^{2-}	Sodium Nitro Prusside	$\text{Na}_2[\text{Fe}(\text{CN})_5\text{NO}]$	$\text{Na}_4[\text{Fe}(\text{CN})_5\text{NOS}]$	Purple Complex
S^{2-}	Methylene blue Test	+ FeCl_3 + Conc HCl		Methylene Blue
NO_2^-	Gries Illosavay Test	(i) Sulphanilic acid (ii) 1, Methyl Amine		Red Azo dye
NO_2^-	Brown Ring Test	FeSO_4 + dil. H_2SO_4	$[\text{Fe}(\text{H}_2\text{O})_5\text{NO}_3\text{SO}_4]$	Brown Ring
CH_3COO^-	Cacodyl Test	As_2O_3	$\text{H}_3\text{C}^{\text{AS}}\text{AS} \searrow_{\text{CH}_3}$	Nauseating odour
CH_3COO^-	$\text{FeCl}_3\text{Sol}^{\text{n}}$	$\text{FeCl}_3 + \text{H}_2\text{O} \xrightarrow{\text{boil}}$	$[\text{Fe}_3(\text{HO})_2(\text{CH}_3\text{OO})_6]^+$	Blood Red solution ↓ Boiling Reddish Brown ppt.
NO_3^-	Brown Ring test	FeSO_4 + Conc. H_2SO_4	$[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]\text{SO}_4$	Brown Ring
$\text{C}_2\text{O}_4^{2-}$	Mn^{+2} + NaOH	$\text{NaOH} + \text{Mn}^{+2} \xrightarrow{\Delta}$	$[\text{Mn}(\text{C}_2\text{O}_4)_3]^{3-}$	Red Complex
Br^-	Layer Test	Cl_2 Water + CCl_4	$\text{Br}_2 + \text{CCl}_4$	Red layer
I	Layer Test	Cl_2 Water + CCl_4	$\text{I}_2 + \text{CCl}_4$	Violet Layer
I^-	HgCl_2	HgCl_2	HgI_2	Red/yellow
Cl^-	Chromyl Chloride Test	(i) $\text{K}_2\text{Cr}_2\text{O}_7$ (s) + conc. H_2SO_4 (ii) NaOH (iii) $\text{Pb}(\text{CH}_3\text{COO})_2 + \text{CH}_3\text{COOH}$	CrO_2Cl_2 CrO_4^{2-} ↓ PbCrO_4	Reddish brown Vapour ↓ Yellow Solution ↓ Yellow PPT.

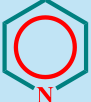
BO_3^{3-}	Green Flame Test	Conc. H_2SO_4 + ROH + Δ (Flame)	B(OR)_3	Green edge flame
BO_3^{3-}	Modified Green Flame Test	CaF_2 + Conc. H_2SO_4	$\text{BF}_3 \uparrow + \text{Ca(HSO}_4)_2 + \Delta$	Green flame
PO_4^{3-}	Ammonium molybdate	$(\text{NH}_4)_2\text{MoO}_4$ + dil HNO_3 + 30 – 40°C	$\text{Na}_3\text{MoO}_4 \cdot 12\text{MoO}_3$	Canary yellow ppt.
$\text{CrO}_4^{2-} / \text{Cr}_2\text{O}_7$	Acidic Solution of H_2O_2 + pyridine	$\text{H}_2\text{O}_2 + \text{H}^+$	CrO_5	Blue Solution

	dil. H_2SO_4	Conc. H_2SO_4	CaCl_2	BaCl_2	HgCl_2	AgNO_3	Pb(OAc)_2	$\text{MnO}_2 / \text{H}^+$
CO_3^{2-}	$\text{CO}_2 \uparrow$	$\text{CO}_2 \uparrow$	$\text{CaCO}_3 \downarrow$ white	$\text{BaCO}_3 \downarrow$ white	$\text{HgCO}_3 \cdot 3\text{Hg}$ Reddish brown	$\text{Ag}_2\text{CO}_3 \downarrow$	$\text{PbCO}_3 \cdot 2 \text{Pb(OH)}_2$	-
$\text{HCO}_3^- + \Delta$	$\text{CO}_2 \uparrow$	$\text{CO}_2 \uparrow$	$\text{CaCO}_3 \downarrow$	$\text{BaCO}_3 \downarrow$	$\text{HgCO}_3 \cdot 3\text{Hg}$ Reddish brown	$\text{Ag}_2\text{CO}_3 \downarrow$	$\text{PbCO}_3 \cdot 2 \text{Pb(OH)}_2$	-
SO_3^{2-}	$\text{SO}_2 \uparrow$	$\text{SO}_2 \uparrow$	$\text{CaSO}_3 \downarrow$ white	$\text{BaSO}_3 \downarrow$ white	-	$\text{Ag}_2\text{SO}_3 \downarrow$ white	$\text{PbSO}_3 \downarrow$ white	SO_4^{2-}
$\text{S}_2\text{O}_3^{2-}$	$\text{SO}_2 \uparrow + \text{S} \downarrow$	$\text{SO}_2 \uparrow$	-	$\text{BaS}_2\text{O}_3 \downarrow$ white	$\text{HgS}_2\text{O}_2 \downarrow$ white	$\text{Ag}_2 \text{S}_2\text{O}_3$ white	$\text{PbS}_2\text{O}_3 \downarrow$ white	$\text{SO}_4^{2-} + \text{S} \downarrow$
S^{2-}	$\text{H}_2 \text{S} \uparrow$	$\text{S} \downarrow + \text{SO}_2 \uparrow$	-	$\text{BaS} \downarrow$ black	$\text{HgS} \downarrow$ black	$\text{Ag}_2 \text{S} \downarrow$ black	$\text{PbS} \downarrow$ black	$\text{S} \downarrow$
NO_2^-	$\text{NO}_2 \uparrow$	$\text{NO}_2 \uparrow$	-	-	-	$\text{AgNO}_2 \downarrow$	-	NO_3^-
CH_3COO^-	$\text{CH}_3\text{COO}^- \uparrow$	$\text{CH}_3\text{COO}^- + \text{SO}_2 \uparrow$	-	-	-	-	-	-
I^-		$\text{I}_2 \uparrow$ violet	-	-	$\text{HgI}_2 \downarrow$ scarlet red	$\text{AgI} \downarrow$ yellow	$\text{PbCl}_2 \downarrow$ dark yellow	$\text{I}_2 \uparrow$
Cl^-		$\text{HCl} \uparrow$	-	-	-	$\text{AgCl} \downarrow$ white	$\text{PbCl}_2 \downarrow$ white	$\text{Cl}_2 \uparrow$
Br^-		$\text{Br}_2 \uparrow$ brown	-	-	-	$\text{AgBr} \downarrow$ pale yellow	$\text{PbBr}_2 \downarrow$ white	$\text{Br}_2 \uparrow$
$\text{C}_2\text{O}_4^{2-}$	-	$\text{CO}_2 \uparrow + \text{CO} \uparrow$	CaC_2O_4 white	BaC_2O_4 white	-	$\text{Ag}_2\text{C}_2\text{O}_4$ white	-	$\text{CO}_2 \uparrow$
BO_2^-	-	$\text{H}_3\text{BO}_3 \uparrow$	$\text{Ca(BO}_2)_2$ white	$\text{Ba(BO}_2)_2$ white	-	$\text{AgBO}_2 \downarrow$ white	-	-
NO_3^-	-	$\text{NO}_2 \uparrow$	-	-	-	-	-	-

SO_4^{2-}	-	-	$\text{CaSO}_4 \downarrow$ white	$\text{BaSO}_4 \downarrow$ curdy white ppt	$\text{HgSO}_4 \cdot$ $2\text{HgO} \downarrow$ yellow	-	$\text{PbSO}_4 \downarrow$ white	-
PO_4^{3-}	-	-	CaHPO_4 white	BaHPO_4 white	-	$\text{Ag}_3\text{PO}_4 \downarrow$ yellow	-	-
CrO_4^{2-}	-	-	-	BaCrO_4 yellow	-	Ag_2CrO_4 brick red	$\text{PbCrO}_4 \downarrow$ yellow	-

SPECIFIC REACTION OF ACIDIC RADICAL

Anion	Reaction Name/with	Reagent	Product	Observation
S^{2-}	Sodium Nitro Prusside	$\text{Na}_2[\text{Fe}(\text{CN})_5\text{NO}]$	$\text{Na}_4[\text{Fe}(\text{CN})_5\text{NOS}]$	Purple Complex
S^{2-}	Methylene blue Test	 $+\text{FeCl}_3 + \text{Conc HCl}$	 $+\text{Fe} + \text{Cl}$	Methylene Blue
NO_2^-	Gries Illosavay Test	(i) Sulphanilic acid (ii) 1, Methyl Amine		Red Azo dye
NO_2^-	Brown Ring Test	$\text{FeSO}_4 + \text{dil. H}_2\text{SO}_4$	$[\text{Fe}(\text{H}_2\text{O})_5\text{NO}_3\text{SO}_4]$	Brown Ring
CH_3COO^-	Cacodyl Test	As_2O_3		Nauseating odour
CH_3COO^-	$\text{FeCl}_3\text{Sol}^n$	$\text{FeCl}_3 + \text{H}_2\text{O} \xrightarrow{\text{boil}}$	$[\text{Fe}_3(\text{HO})_2(\text{CH}_3\text{OO})_6]^+$	Blood Red solution \downarrow Boiling Reddish Brown ppt.
NO_3^-	Brown Ring test	$\text{FeSO}_4 + \text{Conc. H}_2\text{SO}_4$	$[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]\text{SO}_4$	Brown Ring
$\text{C}_2\text{O}_4^{2-}$	$\text{Mn}^{+2} + \text{NaOH}$	$\text{NaOH} + \text{Mn}^{+2} \xrightarrow{\Delta}$	$[\text{Mn}(\text{C}_2\text{O}_4)_3]^{3-}$	Red Complex
Br^-	Layer Test	Cl_2 Water + CCl_4	$\text{Br}_2 + \text{CCl}_4$	Red layer
I^-	Layer Test	Cl_2 Water + CCl_4	$\text{I}_2 + \text{CCl}_4$	Violet Layer
I^-	HgCl_2	HgCl_2	HgI_2	Red/yellow
Cl^-	Chromyl Chloride Test	(i) $\text{K}_2\text{Cr}_2\text{O}_7(\text{s}) + \text{conc. H}_2\text{SO}_4$ (ii) NaOH (iii) $\text{Pb}(\text{CH}_3\text{COO})_2 + \text{CH}_3\text{COOH}$	CrO_2Cl_2 $\text{CrO}_4^{2-} \rightarrow \text{PbCrO}_4$	Reddish brown Vapour \downarrow Yellow Solution \downarrow Yellow PPT.

BO_3^{3-}	Green Flame Test	Conc. H_2SO_4 + ROH + Δ (Flame)	B(OR)_3	Green edge flame
BO_3^{3-}	Modified Green Flame Test	CaF_2 + Conc. H_2SO_4	$\text{BF}_3 \uparrow + \text{Ca(HSO}_4)_2 + \Delta$	Green flame
PO_4^{3-}	Ammonium molybdate	$(\text{NH}_4)_2\text{MoO}_4$ + dil HNO_3 + 30 – 40°C	$\text{Na}_3\text{MoO}_4 \cdot 12\text{MoO}_3$	Canary yellow ppt.
$\text{CrO}_4^{2-} / \text{Cr}_2\text{O}_7$	Acidic Solution of H_2O_2 + pyridine	$\text{H}_2\text{O}_2 + \text{H}^+$ + 	CrO_5	Blue Solution

Anion	Reaction Nmae/with	Reagent	Product	Observation
S^{2-}	Sodium Nitro Prusside	$\text{Na}_2[\text{Fe(CN)}_5\text{NO}]$	$\text{Na}_4[\text{Fe(CN)}_5\text{NOS}]$	Purple Complex
S^{2-}	Methylene blue Test	+ FeCl_3 + Conc HCl		Methylene Blue
NO_2^-	Gries Illosavay Test	(i) Sulphanilic acid (ii) 1, Methyl Amine		Red Azo dye
NO_2^-	Brown Ring Test	FeSO_4 + dil. H_2SO_4	$[\text{Fe(H}_2\text{O)}_5\text{NO}_3\text{SO}_4]$	Brown Ring
CH_3COO^-	Cacodyl Test	As_2O_3	$\text{H}_3\text{C}^{\text{AS}} \searrow_{\text{CH}_3}$	Nauseating odour
CH_3COO^-	$\text{FeCl}_3\text{Sol}^{\text{n}}$	$\text{FeCl}_3 + \text{H}_2\text{O} \xrightarrow{\text{boil}}$	$[\text{Fe}_3(\text{HO})_2(\text{CH}_3\text{OO})_6]^+$	Blood Red solution ↓ Boiling Reddish Brown ppt.
NO_3^-	Brown Ring test	FeSO_4 + Conc. H_2SO_4	$[\text{Fe(H}_2\text{O)}_5\text{NO}]\text{SO}_4$	Brown Ring
$\text{C}_2\text{O}_4^{2-}$	Mn^{+2} + NaOH	$\text{NaOH} + \text{Mn}^{+2} \xrightarrow{\Delta}$	$[\text{Mn(C}_2\text{O}_4)_3]^{3-}$	Red Complex
Br^-	Layer Test	Cl_2 Water + CCl_4	$\text{Br}_2 + \text{CCl}_4$	Red layer
I	Layer Test	Cl_2 Water + CCl_4	$\text{I}_2 + \text{CCl}_4$	Violet Layer
I^-	HgCl_2	HgCl_2	HgI_2	Red/yellow
Cl^-	Chromyl Chloride Test	(i) $\text{K}_2\text{Cr}_2\text{O}_7$ (s) + conc. H_2SO_4 (ii) NaOH (iii) $\text{Pb(CH}_3\text{COO)}_2$ + CH_3COOH	CrO_2Cl_2 $\text{CrO}_4^{2-} \downarrow$ PbCrO_4	Reddish brown Vapour ↓ Yellow Solution ↓ Yellow PPT.
BO_3^{3-}	Green Flame Test	Conc. H_2SO_4 + ROH + Δ (Flame)	B(OR)_3	Green edge flame

BO_3^{3-}	Modified Green Flame Test	$\text{CaF}_2 + \text{Conc. H}_2\text{SO}_4$	$\text{BF}_3 \uparrow + \text{Ca}(\text{HSO}_4)_2 + \Delta$	Green flame
PO_4^{3-}	Ammonium molybdate	$(\text{NH}_4)_2\text{MoO}_4 + \text{dil HNO}_3 + 30 - 40^\circ\text{C}$	$\text{Na}_3\text{MoO}_4 \cdot 12\text{MoO}_3$	Canary yellow ppt.
$\text{CrO}_4^{2-} / \text{Cr}_2\text{O}_7$	Acidic Solution of $\text{H}_2\text{O}_2 + \text{pyridine}$	$\text{H}_2\text{O}_2 + \text{H}^+ +$	CrO_5	Blue Solution

BASIC RADICAL ANALYSIS

Dry Text of Cation

Flame test : used for s-block cation (except $\text{Be}^{+2}, \text{Mg}^{+2}$)

Cation:	Li^+	Na^+	K^+	Ca^{+2}	Sr^{+2}	Ba^{+2}	$\text{Cu} + 2$
Observation:	Caramine	Golden	Lilac	Brick	Crimosn	Apple	Green
(Naked eye)	red	yellow		Red	Red	green	flame
Cobalt glass:		flame	crimson	Green	Purple	Bluish	Green
		disappear	red			green	flame

Borax Bead Test

- Used for cloured cation (d-block cation)
- Given salt heated on borax bead than metal metaborate are form.
- Metal metaborate on heating show characteristic bead colour.

	Oxidizing flame		Reducing flame	
	Hot	Cold	Hot	Cold
Mn	Violet	Amethyst	Colourless	Colourless
Cr	Yellow	Yellow	Green	Green
Fe	Yellowish brown	Green	Green	Green
Co	Blue	Blue	Blue	Blue
Ni	Violet	Brown	Grey	Grey
Cu	Green	Blue	Colourless	Opaque red

Charcol Cavity Text

- Heat salt with Na_2CO_3 in charcoal cavity
- Zn^{+2} In hot yellow and in cold white residue.
- Pb^{+2} Yellow residue in hot and grey metal in cold.
- As^{+3} White residue with garlic odour.
- Cd^{+2} Brown residue.

If white residue is obtain then add. $\text{Co}(\text{NO}_3)_2$ and heat.

Zn^{+2}	ZnO. CoO	Rinmann's Green
Al^{+3}	Al_2O_3	Thenard Blue
Mg^{+2}	MgO. CoO	Pink residue
Sn^{+2}	SnO.CoO	Bluish residue

CLASSIFICATION OF BASIC RADICAL

Group	Basic Radical	Reagent used	Precipitate form
Group -I	$\text{Pb}^{+2}, \text{Hg}_2^{+2}$	dil HCl	AgCl PbCl_2 Hg_2Cl_2 white ppt.
Group -II	$\text{Cu}^{+2}, \text{Pb}^{+2}, \text{Hg}^{+2}$ $\text{Cd}^{+2}, \text{Bi}^{+3}$	H_2S + dil. HCl	$\text{Cu}_2\text{S}, \text{PbS}, \text{HgS}$ $\text{CdS}, \text{Bi}_2\text{S}_3$ Black yellow black
	$\text{Sn}^{+2}, \text{Sn}^{+4}, \text{As}^{+3}$ $\text{As}^{+5}, \text{Sb}^{+3}, \text{Sb}^{+5}$		SnS SnS ₂ As_2S_3 As_2S_5 Sb_2S_3 Sb_2S_5 Brown Brown yellow Gray
Group -III	$\text{Cr}^{+3}, \text{Al}^{+3}, \text{Fe}^{+3}$	NH_4OH + NH_4Cl	$\text{Al}(\text{OH})_3$ $\text{Fe}(\text{OH})_3, \text{Cr}(\text{OH})_3$ gelatinous reddish green white brown
Group -IV	$\text{Zn}^{+2}, \text{Mn}^{+2}, \text{Ni}^{+2}$	H_2S + NH_4OH	ZnS MnS NiS CoS white buff black
Group -V	$\text{Ca}^{+2}, \text{Sr}^{+2}, \text{Ba}^{+2}$	$(\text{NH}_4)_2\text{CO}_3$ + NH_4OH	$\text{CaCO}_3, \text{SrCO}_3, \text{BaCO}_3$ white

TEST OF BASIC RADICAL

	Ag^+	Hg_2^{+2}	Pb^{+2}	Cu^{+2}	Hg^{+2}	Cd^{+2}	Al^{+3}
KI	AgI Yellow	Hg_2I_2 Green	PbI_2 Yellow	$\text{CuI} + \text{I}_3^-$ White solution	HgI_2 Scarlet Red	—	-
ex KI	-	Hg + $[\text{HgI}_4]^{2-}$ Black	$[\text{PbI}_4]^{2-}$ soluble complex	—	$[\text{HgI}_4]^{2-}$ Red solution	-	-
KCN	AgCN White	Hg + $\text{Hg}(\text{CN})_2$	$\text{Pb}(\text{CN})_2$ White	$\text{CuCN} + [\text{CN}]_2$ ↑	-	$\text{Cd}(\text{CN})_2$ White	-
ex KCN	$[\text{Ag}(\text{CN})_2]^-$	-	-	$\text{K}_3[\text{Cu}(\text{CN})_4]$	-	$[\text{Cd}(\text{CN})_4]^{2-}$	-

				soluble complex			
ex NaOH	-	-	Na ₂ [Pb(OH) ₄] soluble complex	-	-	-	Na[Al(OH) ₄] soluble complex
NH ₄ OH	Ag ₂ O Brown	Hg + HgO. HgNH ₂ ⁺ N	Pb(OH) ₂ White	Cu(OH) ₂ Pale Blue	HgO. HgNH ₂ White	Cd(OH) ₂ White	Al(OH) ₃ Gelatinous white
ex NH ₄ OH	[Ag(NH ₃) ₂] ⁺	-	-	[Cu(NH ₃) ₄] ²⁺ Deep blue	-	[Cd(NH ₃) ₄] ²⁺	-
H ₂ S / * (NH ₄) ₂ S	Ag ₂ S Black	<u>Hg + HgS</u> black	PbS Black	CuS Black	HgS Black	CdS Yellow	Al(OH) ₃ Gelatinous white
K ₂ CrO ₄	Ag ₂ CrO ₄ Red	Hg ₂ CrO ₄ Red	PbCrO ₄ Yellow	-	—	—	—
Na ₂ S ₂ O ₃	Ag ₂ S ₂ O ₃ White	—	PbS ₂ O ₃ White	Cu ₂ S ₂ O ₃ White	HgS ₂ O ₃ White	-	-
K ₄ [Fe(CN) ₆]	Ag ₄ [Fe(CN) ₆] White	—	-	Cu ₂ [Fe(CN) ₆] Brown	—	—	—
K ₃ [Fe(CN) ₆]	-	-	-	Cu ₃ [Fe(CN) ₆] Green	-	-	-

TEST OF BASIC RADICAL

	Cr ⁺³	Fe ⁺³	Fe ⁺²	Zn ⁺²	Mn ⁺²	Ni ⁺²	Co ⁺²
KI	-	FeI ₂ + I ₃ ⁻ yellowish brown sol.	-	-	—	-	-
ex KI	-	-	-	Zn(CN) ₂ White	—	-	-

KCN	-	Fe(CN) ₃ Brown	Fe(CN) ₂ yellowish brown	-	Mn(CN) ₂ Mn(OH) ₂ Pink	Ni(CN) ₂ green	Co(CN) ₂ Reddish Brown
ex KCN	-	K ₃ [Fe(CN)] Yellow	K ₄ [Fe(CN)] Pale yellow	-	-	K ₂ [Ni(CN)] Soluble Complex	[Co(CN) ₆] Brown Solution
NaOH	Cr(OH) ₃ Green	Fe(OH) ₃ Reddish Brown ppt	Fe(OH) ₂ Dirty Green	Zn(OH) ₂ White	Mn(OH) ₂ Pink	Ni(OH) ₂ Green	Co(OH)Cl Blue
ex NaOH	Na[(AlOH)] Yellow	-	—	Na ₂ [Zn(OH)]	-	-	(CoOH) ₂ pink
NH₄OH	Cr(OH) ₃ Green	Fe(OH) ₃ Reddish Brown ppt	Fe(OH) ₂ Dirty Green	Zn(OH) ₂	—	Ni(OH) ₂ Green	Co(OH)Cl

	Cr ⁺³	Fe ⁺³	Fe ⁺²	Zn ⁺²	Mn ⁺²	Ni ⁺²	Co ⁺²
ex NH₄OH	[Cr(NH ₃) Pink/vol let	—	-	[Zn(NH ₃) ₄]	-	Ni[(NH ₃) Deep blue	[Co(NH ₃) Yellow
H₂ S/ * (NH₄)₂	Cr(OH) ₃ Green	FeS + S Black yellow	FeS Black	ZnS White	MnS Pink	NiS Black	CoS Black
K₂CrO₄	—	-	-	-	-	-	-
Na₂ S₂ O₃	-	Fe ⁺² Green solution					
K₄[Fe(CN)]	-	Fe ₄ [Fe(CN)] Prussian blue	K ₂ Fe[Fe(CN)]	K ₂ Zn ₃ [Fe(CN)] White	Mn ₂ [Fe(CN)] White	Ni ₂ [Fe(CN)] Light green	Co ₂ [Fe(CN)] Green
K₃[Fe(CN)]	-	Fe[Fe(CN)] Brown	Fe ₃ [Fe(CN)] Turnbull's blue	—	—	-	-

OTHER IMPORTANT REACTION OF BASIC RADICAL

Basic radical	Reagent	Product	Observation
Fe ⁺³	SCN ⁻	Fe(SCN) ₃	Blood red colouration
Ni ⁺²	dmg/NH ⁺	[Ni(dm _g) ₂]	Rosy red complex
Co ⁺²	KNO ₂	K ₃ [Co(NO ₂) ₆]	Yellow ppt
Hg ⁺²	SnCl ₂ (ex)	Hg	Grey / black
K ⁺	HClO ₄	KClO ₄	White ppt

