

General scheme for identification of acidic radicals

First group of acidic radical

EXP.	$(\text{CO}_3)^{2-}$	$(\text{HCO}_3)^-$	$(\text{S}_2\text{O}_3)^{2-}$
Principle test Solid salt + dil. HCl	Strong eff. With evolution of colorless gas (CO_2)		Yellowish-white ppt. after shaking with evolution of colorless gas with pungent odor (SO_2)
Confirmatory tests Salt soln + MgSO_4	White ppt. on cold soluble in dil. Mineral acids	White ppt. on hot soluble in dil. Mineral acids	
Salt soln + BaCl_2	White ppt. on cold soluble in dil. Mineral acids	White ppt. on hot soluble in dil. Mineral acids	
Salt soln + AgNO_3	White ppt. turns to brown ppt. by heating ملحوظة: يظهر اللون البنى مباشرة اذا كان محلول المحلول مخفف	White ppt. on hot	White ppt. turns into yellow, orange, brown and finally to black ppt. توضع نقطة واحدة من محلول الملح مع زيادة كبره من نترات الفضة
Salt soln + I_2 (one drop)			Disappearance of I_2 color
Salt soln + FeCl_3 (one drop)			Gives dark violet color disappears on standing or by addition of FeCl_3 excess
Salt soln + $(\text{CH}_3\text{COO})_2\text{Pb}$ (few drops)			White ppt. is formed after shaking turns to black by heating
Salt soln + dil. H_2SO_4 + KMnO_4 (few drops)			Disappearance of KMnO_4 color

Second group of acidic radical

Exp.	Cl ⁻	Br ⁻	I ⁻	NO ₃ ⁻
Principle test Solid salt + conc. H ₂ SO ₄ (in dry test tube)	Strong eff. With evolution of colorless gas that gives white clouds with HCl-NH ₄ OH moistened paper	Reddish-brown fumes with irritating odor evolved and the soln becomes Reddish-brown	Violet fumes are evolved after warming and the soln turns dark blue or black	Faint brown fumes with evolution of pungent odor after heating, fumes are intensified by addition of Cu metal pieces
Confirmatory tests Salt soln + AgNO ₃	White ppt. soluble in NH ₄ OH and turns into violet ppt. in direct sun light	Pale yellow ppt. sparingly soluble in NH ₄ OH	yellow ppt. insoluble in NH ₄ OH	
Salt soln + (CH ₃ COO) ₂ Pb (few drops)	White ppt. after shaking dissolves in boiling water and reppted on cooling	White ppt. after shaking dissolves in boiling water and reppted on cooling	Yellow ppt. dissolves in boiling water and reppted on cooling	
Brown ring test: Salt soln + FeSO ₄ freshly prepared (3ml) + conc. H ₂ SO ₄ (on the wall of test tube)				Brown ring appears and disappears on shaking

Third group of acidic radical

Exp.	$(\text{SO}_4)^{2-}$	$(\text{PO}_4)^{3-}$	$(\text{B}_4\text{O}_7)^{2-}$
Principle test Conc. Salt soln + BaCl_2	White ppt. insoluble in dil. HCl	White ppt. soluble in dil. HCl	
Confirmatory tests Salt soln + AgNO_3	Pale white ppt. or turbidity increases by heating	yellow ppt. soluble in dil. HNO_3 and NH_4OH	white ppt. changes into brown by heating يظهر اللون بني مباشرة اذا كان محلول الملح مخفف
Salt soln + $(\text{CH}_3\text{COO})_2\text{Pb}$ (few drops)	White ppt. soluble in hot conc. H_2SO_4		
Salt soln + FeCl_3 (one drop)		Yellowish-White ppt. soluble in dil. HCl	

First group of basic radical

Exp.	Pb ²⁺
Principle test Salt soln + dil. HCl	White ppt. soluble in hot water and precipitated by cooling
Confirmatory tests Salt soln + H ₂ SO ₄	White ppt. soluble in hot NaOH
Salt soln + NaOH (few)	White ppt. soluble in excess of NaOH
Salt soln + NH ₄ OH (few)	White ppt. soluble in excess of NH ₄ OH
Salt soln + KI (few)	Yellow ppt. soluble in excess of KI ملحوظة: الراسب يذوب اذا كان محلول KI مركز
Salt soln + K ₂ CrO ₄	Yellow ppt. soluble in hot NaOH and also in hot dil. HNO ₃
Salt soln + H ₂ S	Black ppt. soluble in hot dil. HNO ₃

Second group of basic radical

Exp.	Bi^{3+}	Cu^{2+}	Cd^{2+}
Principle tests Salt soln + dil. HCl (xxs) + H_2S (few)	Brown ppt. soluble in hot dil. HNO_3	Black ppt. soluble in hot dil. HNO_3	Canary yellow ppt. soluble in hot dil. HNO_3
Confirmatory tests Salt soln + NaOH (few)	White ppt. insoluble in excess of NaOH	Bluish ppt.	white ppt. insoluble in excess of NaOH
Salt soln + NH_4OH (few)	White ppt. insoluble in excess of NH_4OH	Greenish ppt soluble in excess of NH_4OH forming intense blue soln	white ppt. soluble in excess of NH_4OH
Salt soln + $\text{K}_4[\text{Fe}(\text{CN})_6]$ (few)		Reddish-brown ppt.	White ppt. ملحوظة: الكاشف لا بد ان يكون مخفف جدا حتى يعطى الراسب الابيض
Salt soln + dil. KI	Black ppt. soluble in excess of KI forming yellow solution		
Salt soln + H_2O	White ppt.		
Salt soln + dil. $\text{K}_2\text{Cr}_2\text{O}_7$ (few)	Yellow ppt. soluble in excess of reagent forming yellow soln.		
Salt soln + NH_4SCN (solid)		Black ppt. soluble in excess of NH_4SCN محلول الكاشف يعطى محلول اخضر فاتح	

Third group of basic radical

Exp.	Al^{3+}	Fe^{3+}
Principle tests Salt soln + NH_4Cl (solid, xxs) + NH_4OH (few)	White gelatinous ppt. soluble in NaOH or dil. HCl	Reddish-brown gelatinous ppt. soluble in dil. HCl
Confirmatory tests Salt soln + NaOH (few)	White gelatinous ppt. soluble in excess of NaOH or dil. HCl	Reddish-brown gelatinous ppt. soluble in dil. HCl
Salt soln + [NH_4OH (few) + H_2S (xxs)]	White gelatinous ppt. soluble in NaOH or dil. HCl	Black ppt. soluble in dil. HCl
Salt soln + $K_4[Fe(CN)_6]$ (few)		Dark blue ppt. insoluble in dil. HCl
Salt soln + NH_4SCN (few)		Deep red (blood red) color
Salt soln + NH_4OH (few) + Na_2HPO_4 (xxs)	White gelatinous ppt. soluble in dil. HCl	Pale-yellow (yellowish-white) ppt. soluble in dil. HCl

Fourth group of basic radical

Exp.	Zn ²⁺	Mn ²⁺	Co ²⁺	Ni ²⁺
Principle test Salt soln + NH ₄ Cl (solid, excess) + NH ₄ OH (few) + H ₂ S (xss)	White gelatinous ppt. soluble in NaOH or dil. HCl	Buff ppt. (faint brown) soluble in dil. HCl	Black ppt. soluble in hot conc. HNO ₃ or aqua regia.	
Confirmatory test Salt soln + NaOH (few)	White gel. ppt. soluble in excess of NaOH	White ppt. readily turns into buff ppt. soluble in hot conc. HCl	Blue ppt. turns into pink by excess of NaOH and heating	Greenish ppt. insoluble in NaOH but soluble in NH ₄ OH forming blue soln.
Salt soln + NH ₄ OH (few)	White gel. ppt. soluble in excess of NH ₄ OH	White ppt. readily turns to buff ppt.	Blue ppt. soluble in excess of conc. NH ₄ OH forming yellow soln.	Greenish ppt. soluble in excess of NH ₄ OH forming blue soln.
Salt soln + NH ₄ OH (few) + Na ₂ HPO ₄ (xss)	White ppt. soluble in dil. HCl	White ppt. readily turns to buff ppt.	Violet ppt. soluble in dil. acids	Greenish ppt. soluble in excess of NH ₄ OH or dil. acids
Salt soln + K ₄ [Fe(CN) ₆] (few)	White ppt. soluble in NaOH			
Salt soln + K ₃ [Fe(CN) ₆] (few)	Brownish-yellow ppt. soluble in dil. HCl or NH ₄ OH			Yellow ppt.
Salt soln (one drop) + NH ₄ SCN (solid)			Blue soln turns into pink color by addition of water	
Salt solution + DMG + NH ₄ OH (few drops)				Red ppt.

Fifth group of basic radical

Exp.	Ca ²⁺	Sr ²⁺	Ba ²⁺
Principle test Conc. Salt soln + NH ₄ Cl (x xs) + NH ₄ OH (few) + (NH ₄) ₂ CO ₃ (x xs)	White ppt. soluble in dil. Acids		
Confirmatory tests Conc. Salt soln + CaSO ₄	-ve	White ppt. soluble in acids	Heavy white ppt. soluble in acids
Conc. Salt soln + K ₂ CrO ₄	Yellow color	Yellow ppt. <u>soluble in acetic acid</u>	Yellow ppt. <u>insoluble in acetic acid</u>
Conc. Salt soln + NH ₄ OH (few) + Na ₂ HPO ₄ (x xs)	White ppt. soluble in dil. HCl		
Conc. Salt soln + NH ₄ Cl (solid) K ₄ [Fe(CN) ₆]	White ppt. soluble in dil. acids		
Conc. Salt soln + NH ₄ OH (few) + (NH ₄) ₂ C ₂ O ₄ and warming	White ppt. soluble in dil. HCl		
Conc. Salt soln + K ₂ Cr ₂ O ₇			Yellow ppt.
Flame test	Brick red colored flame	Crimson red colored flame	Apple green colored flame

Sixth group of basic radical

Exp.	$(\text{NH}_4)^+$	Mg^{2+}	Na^+	K^+
Salt soln + NaOH and heating	Odor of NH_3 is evolved which gives white clouds with HCl-moistened paper	White gel. ppt. on cold soluble in dil. HCl	-ve	
Salt soln + Na_2CO_3 and heating	Odor of NH_3 is evolved	White ppt. soluble in dil HCl		
Salt soln + NH_4OH (few)		White gel. ppt. on cold soluble in dil HCl		
Salt soln + NH_4OH (few) + Na_2HPO_4 (xss)		White crystalline ppt. after scratching the test tube or shaking		
Salt soln + $\text{Na}_3[\text{Co}(\text{NO}_2)_6]$	Yellow ppt.		Yellow soln	Yellow ppt.
Salt soln + Tartaric acid			-ve	White crystalline ppt. after scratching the test tube or shaking
Flame test			Golden yellow colored flame	Violet colored flame