How can you write a report for CATIONS?

شكرخاص للأستاذة ميمونة الرياني

1. Detection for ammonium

Experiment	Observation	Result
Solid salt + Na ₂ CO ₃	Colourless gas is evolved,	The gas is NH ₃
(solid)+ drops of water	recognized by its odour.	the cation is NH_4^+
Salt solution $+$ Nessler's	Brown ppt. is formed and with very	The ppt. is iodide of Millon's
reagent	dil. solution brown or yellow colour	base.
leagent	is appeared	the cation is NH_4^+
Salt solution +	Yellow ppt. is formed	The ppt, is $(NH_4)_3[Co(NO_2)_6]$
$Na_3[Co(NO_2)_6]$	rr	FF (4/3L (2/0)
	Colourless gas is evolved,	
Salt solution + NaOH	recognized by its odour, by formed	The gas is NH_2
	dense white fumes with conc. HCl,	The white fumes is NH.Cl
	and by turning red litmus paper	
	blue.	

Radical name: Ammonium **Chemical symbol of Radical:** NH₄⁺

2. <u>Detection for cations in Group I</u>

Radical name: Silver **Chemical symbol of Radical:** Ag^+

Experiment	Observation	Result
Solid salt + Na_2CO_3 (solid)	-ve	The cation is not NH_4^+
+ drops of water		
Salt solution + dil. HCl	White ppt. is formed, which	The ppt. is AgCl
	dissolves in NH ₄ OH and turns	the cation is Ag^+
	violet when exposed to light	
Salt solution + NaOH	Brown-black ppt. is formed	The ppt. is Ag ₂ O
Salt solution + KI	Yellow ppt. is formed	The ppt. is AgI
Salt solution + K_2CrO_4	Brick-red ppt. is formed	The ppt. is Ag ₂ CrO ₄

Radical name: Lead
Chemical symbol of Radical: Pb ²⁺

Experiment	Observation	Result
Solid salt + Na ₂ CO ₃ +	-ve	The cation is not NH ₄ ⁺
drops of water		
Salt solution + dil. HCl	White ppt. is formed, insoluble in	The ppt. is PbCl ₂
	NH ₄ OH but soluble in hot water	the cation is Pb ²⁺
	and reprecipitates on cooling	
Salt solution + NaOH	White ppt. is formed, soluble in	The ppt. is Pb(OH) ₂
	excess of NaOH	
Salt solution + KI	Yellow ppt. is formed, soluble in	The ppt. is PbI ₂
	excess of KI	
Salt solution + K_2CrO_4	Yellow ppt. is formed	The ppt. is PbCrO ₄

Radical name: Mercurous **Chemical symbol of Radical:** Hg_2^{2+}

Experiment	Observation	Result
Solid salt + Na_2CO_3 (solid)	-ve	The cation is not NH_4^+
+ drops of water		
Salt solution + dil. HCl	White ppt. is formed, turns to black	The ppt. is Hg ₂ Cl ₂
	when NH ₄ OH is added	the cation is Hg_2^{2+}
Salt solution + NaOH	Black ppt. is formed	The ppt. is Hg ₂ O
Salt solution + KI	Yellowish-green ppt. is formed,	The ppt. is Hg_2I_2
	soluble in excess of KI and the	
	solution turns grey	
Salt solution + K_2CrO_4	Brown ppt. is formed, converted to	The ppt. is Hg ₂ CrO ₄
	red crystalline form on boiling	

Detection for cations in Group III

the cation is not NH_4^+ the cation is not from Group
ne cation is not from Group
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he ppt. is $Al(OH)_3$
e cation is Al ³⁺
he ppt. is $Al(OH)_3$
ne ppt. is AlPO ₄

Radical name: Aluminum **Chemical symbol of Radical:** Al³⁺

Radical name: Chromium Chemical symbol of Radical: Cr³⁺

Experiment	Observation	Result
_		
Solid salt + Na_2CO_3 (solid)	-ve	The cation is not NH_4^+
+ drops of water		
Salt solution + dil. HCl	-ve	The cation is not from Group I
Salt solution + dil. HCl +	-ve	The cation is not from Group II
H_2S		
Salt solution + NH ₄ Cl +	Grayish-green gelatinous ppt. is	The ppt. is Cr(OH) ₃
NH4OH	formed	the cation is Cr ³⁺
Salt solution + NoOH	Crewish group coloting one rat is	The part is Cr(OII)
Salt solution + NaOH	Grayisn-green gelatinous ppt. is	The ppt. is $Cr(OH)_3$
	formed, soluble in excess of NaOH	
Salt solution + Na ₃ PO ₄	Greenish ppt. is formed	The ppt. is CrPO ₄

Radical name: Ferrous Chemical symbol of Radical: Fe²⁺

Experiment	Observation	Result
Solid salt + Na ₂ CO ₃ (solid)	-ve	The cation is not NH ₄ ⁺
+ drops of water		
Salt solution + dil. HCl	-ve	The cation is not from Group I
Salt solution + dil. HCl +	-ve	The cation is not from Group II
H_2S		
Salt solution + NH ₄ Cl +	Dirty green ppt. is formed, turns to	The green ppt. is $Fe(OH)_2$
NH ₄ OH	brown ppt. when left in air	The brown ppt. is $Fe(OH)_3$
		the cation is Fe^{2+}
Salt solution + NaOH	Dirty green ppt. is formed, turns to	The green ppt. is $Fe(OH)_2$
	brown ppt. when left in air	The brown ppt. is $Fe(OH)_3$
Salt solution + K_4 Fe(CN) ₆	Pale blue ppt. is formed	The ppt. is $K_2Fe[Fe(CN)_6]$
Salt solution + $K_3Fe(CN)_6$	Dark blue ppt. is formed	The ppt. is KFe[Fe(CN) ₆]

Radical name: Ferric **Chemical symbol of Radical:** Fe³⁺

Experiment	Observation	Result
Solid salt + Na_2CO_3 (solid)	-ve	The cation is not NH ₄ ⁺
+ drops of water		
Salt solution + dil. HCl	-ve	The cation is not from Group I
Salt solution + dil. HCl +	-ve	The cation is not from Group II
H_2S		
Salt solution + NH ₄ Cl +	Reddish-brown gelatinous ppt. is	The ppt. is Fe(OH) ₃
NH ₄ OH	formed	the cation is Fe ³⁺
Salt solution + NaOH	Reddish-brown ppt. is formed	The ppt. is Fe(OH) ₃
Salt solution + K_4 Fe(CN) ₆	Dark blue ppt. is formed, soluble in	The ppt. is Fe ₄ [Fe(CN) ₆] ₃
	excess of K ₄ Fe(CN) ₆	
Salt solution + $K_3Fe(CN)_6$	Brown colour is appeared	The colour is Fe[Fe(CN) ₆]

Detection for cations in Group IV

Experiment	Observation	Result
Solid salt + Na ₂ CO ₃ (solid)	-ve	The cation is not NH_4^+
+ drops of water		
Salt solution + dil. HCl	-ve	The cation is not from Group I
Salt solution + dil. HCl +	-ve	The cation is not from Group II
H_2S		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group III
NH ₄ OH		
Salt solution + NH ₄ Cl +	White ppt. is formed	The ppt. is ZnS
$NH_4OH + H_2S$		the cation is Zn^{2+}
Salt solution + NaOH	White gelatinous ppt. is formed,	The ppt. is $Zn(OH)_2$
	soluble in excess of NaOH	
Salt solution + NH ₄ OH	White ppt. is formed, soluble in	The ppt. is $Zn(OH)_2$
	excess of NH ₄ OH	

Radical name: Zinc **Chemical symbol of Radical:** Zn²⁺

Radical name: Manganese **Chemical symbol of Radical:** Mn²⁺

Experiment	Observation	Result
Solid salt + Na ₂ CO ₃ (solid)	-ve	The cation is not NH_4^+
+ drops of water		
Salt solution + dil. HCl	-ve	The cation is not from Group I
Salt solution + dil. HCl +	-ve	The cation is not from Group II
H_2S		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group III
NH ₄ OH		
Salt solution + NH ₄ Cl +	Buff ppt. is formed	The ppt. is MnS
$NH_4OH + H_2S$		the cation is Mn ²⁺
Salt solution + NaOH	White gelatinous ppt. is formed,	The white ppt. is $Mn(OH)_2$
	becomes brown in air	The brown ppt. is Mn(OH) ₃
Salt solution + NH ₄ OH	White gelatinous ppt. is formed,	The white ppt. is $Mn(OH)_2$
	becomes brown in air	The brown ppt. is Mn(OH) ₃

Radical name: Cobalt Chemical symbol of Radical: Co²⁺

Experiment	Observation	Result
Solid salt + Na ₂ CO ₃ (solid)	-ve	The cation is not NH ₄ ⁺
+ drops of water		
Salt solution + dil. HCl	-ve	The cation is not from Group I
Salt solution + dil. HCl +	-ve	The cation is not from Group II
H_2S		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group III
NH ₄ OH		
Salt solution + NH ₄ Cl +	Black ppt. is formed	The ppt. may be CoS or NiS
$NH_4OH + H_2S$		the cation may be Co^{2+} or Ni^{2+}
Salt solution +	-ve	the cation is Co^{2+}
Dimethylglyoxime		
Salt solution + NaOH	Blue ppt. is formed, turns to pink	The ppt. is Co(OH)NO ₃
	with heating in excess of NaOH	
Salt solution + NH ₄ OH	Blue ppt. is formed, soluble in	The ppt. is Co(OH)NO ₃
	excess of NH ₄ OH	

Radical name: Nickel **Chemical symbol of Radical:** Ni²⁺

Experiment	Observation	Result
Solid salt + Na ₂ CO ₃ (solid)	-ve	The cation is not NH_4^+
+ drops of water		
Salt solution + dil. HCl	-ve	The cation is not from Group I
Salt solution + dil. HCl +	-ve	The cation is not from Group II
H_2S		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group III
NH4OH		
Salt solution + NH ₄ Cl +	Black ppt. is formed	The ppt. may be CoS or NiS
$NH_4OH + H_2S \\$		the cation may be Co^{2+} or Ni^{2+}
Salt solution +	Red ppt. is formed	The ppt. is nickel
Dimethylglyoxime		dimethylglyoxime
		the cation is Ni ²⁺

Salt solution + NaOH	Greenish ppt. is formed	The ppt. is Ni(OH) ₂
Salt solution + NH ₄ OH	Greenish ppt. is formed, soluble in excess of NH ₄ OH	The ppt. is Ni(OH) ₂

3. <u>Detection for cations in Group V</u>

Experiment	Observation	Result
Solid salt + Na ₂ CO ₃ (solid)	-ve	The cation is not NH_4^+
+ drops of water		
Salt solution + dil. HCl	-ve	The cation is not from Group I
Salt solution + dil. HCl +	-ve	The cation is not from Group II
H_2S		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group III
NH ₄ OH		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group IV
$NH_4OH + H_2S \\$		
Salt solution + NH ₄ Cl +	White ppt. is formed	The ppt. may be CaCo ₃ , SrCo ₃
$NH_4OH + (NH_4)_2CO_3$		or BaCO ₃
		the cation may be Ca^{2+} , Sr^{2+} or
		Ba ²⁺
Salt solution + CaSO ₄	No ppt. is formed	the cation is Ca ²⁺
Salt solution + K_2CrO_4	From dil. solution: No ppt. is	The ppt. is CaCrO ₄
	formed	
	From conc. solution: yellow ppt. is	
	formed, soluble in acetic acid	
Flame test	Brick red colour is appeared	the cation is Ca ²⁺

Radical name: Calcium Chemical symbol of Radical: Ca²⁺

Radical name: Strontium **Chemical symbol of Radical:** Sr²⁺

Experiment	Observation	Result
Solid salt + Na ₂ CO ₃ (solid)	-ve	The cation is not NH ₄ ⁺
+ drops of water		
Salt solution + dil. HCl	-ve	The cation is not from Group I
Salt solution + dil. HCl +	-ve	The cation is not from Group II
H_2S		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group III
NH ₄ OH		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group IV
$NH_4OH + H_2S$		
Salt solution + NH ₄ Cl +	White ppt. is formed	The ppt. may be CaCo ₃ , SrCo ₃
$NH_4OH + (NH_4)_2CO_3$		or BaCO ₃
		the cation may be Ca^{2+} , Sr^{2+} or
		Ba ²⁺
Salt solution + CaSO ₄	White ppt. is formed on heating or	The ppt. is SrSO ₄
	after some time	the cation is Sr^{2+}
Salt solution + K_2CrO_4	Yellow ppt. is formed, soluble in	The ppt. is SrCrO ₄
	acetic acid	
Flame test	Crimson red colour is appeared	the cation is Sr ²⁺

Radical name: Barium **Chemical symbol of Radical:** Ba²⁺

Experiment	Observation	Result
Solid salt + Na_2CO_3 (solid)	-ve	The cation is not NH ₄ ⁺
+ drops of water		
Salt solution + dil. HCl	-ve	The cation is not from Group I
Salt solution + dil. HCl +	-ve	The cation is not from Group II
H_2S		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group III
NH ₄ OH		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group IV
$NH_4OH + H_2S$		
Salt solution + NH ₄ Cl +	White ppt. is formed	The ppt. may be CaCo ₃ , SrCo ₃
$NH_4OH + (NH_4)_2CO_3$		or BaCO ₃
		the cation may be Ca^{2+} , Sr^{2+} or
		Ba ²⁺
Salt solution + CaSO ₄	White ppt. is formed	The ppt. is BaSO ₄
		the cation is Ba ²⁺
Salt solution + K_2CrO_4	Yellow ppt. is formed, insoluble in	The ppt. is BaCrO ₄
	acetic acid	
Flame test	Pale apple green colour is appeared	the cation is Ba ²⁺

Detection for Magnesium

Experiment	Observation	Result
Solid salt + Na_2CO_3 (solid)	-ve	The cation is not NH_4^+
+ drops of water		
Salt solution + dil. HCl	-ve	The cation is not from Group I
Salt solution + dil. HCl +	-ve	The cation is not from Group II
H_2S		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group III
NH ₄ OH		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group IV
$NH_4OH + H_2S$		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group V
$NH_4OH + (NH_4)_2CO_3$		
Salt solution + NaOH	White ppt. is formed	The ppt. is Mg(OH) ₂
		the cation is Mg ²⁺
Salt solution + $(NH_4)_2CO_3$	White ppt. is formed	The ppt. is MgCO ₃
Salt solution + Na ₃ PO ₄ +	White ppt. is formed	The ppt. is Mg(NH ₄)PO ₄
$NH_4Cl + NH_4OH$		

Radical name: Magnesium **Chemical symbol of Radical:** Mg²⁺

Detection for Potassium & Sodium

Experiment	Observation	Result
Solid salt + Na ₂ CO ₃ (solid)	-ve	The cation is not NH_4^+
+ drops of water		
Salt solution + dil. HCl	-ve	The cation is not from Group I
Salt solution + dil. HCl +	-ve	The cation is not from Group II
H_2S		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group III
NH ₄ OH		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group IV
$NH_4OH + H_2S$		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group V
$NH_4OH + (NH_4)_2CO_3$		
Salt solution + NaOH	-ve	The cation is not Mg ²⁺
Salt solution +	Yellow ppt. is formed	The ppt. is K ₃ [Co(NO ₂) ₆]
$Na_3[Co(NO_2)_6]$		the cation is K ⁺
Salt solution + Tartaric	White ppt. is formed from conc.	The ppt. is potassium hydrogen
acid solution	solution	tartarate
Flame test	Violet colour is appeared	the cation is K ⁺

Radical name: Potassium **Chemical symbol of Radical:** K⁺

Experiment	Observation	Result
Solid salt + Na ₂ CO ₃ (solid)	-ve	The cation is not NH_4^+
+ drops of water		
Salt solution + dil. HCl	-ve	The cation is not from Group I
Salt solution + dil. HCl +	-ve	The cation is not from Group II
H_2S		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group III
NH ₄ OH		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group IV
$NH_4OH + H_2S$		
Salt solution + NH ₄ Cl +	-ve	The cation is not from Group V
$NH_4OH + (NH_4)_2CO_3$		
Salt solution + NaOH	-ve	The cation is not Mg ²⁺
Salt solution +	-ve	The cation is Na ⁺
Na ₃ [Co(NO ₂) ₆]		
Flame test	Golden yellow colour is appeared	the cation is Na ⁺

Radical name: Sodium **Chemical symbol of Radical:** Na⁺

