

Chemical Tests for identifying cations

Cation	Test	Result if the cation is present	Addition of excess
Ammonium NH_4^+	Add dilute NaOH(aq) to the solid/ salt solution. Heat gently.	Ammonia gas is given off	
Aluminium Al^{3+}	Add dilute NaOH(aq)	White ppt forms	Dissolves again to give a colourless solution
	Add NH_4OH (aq)	White ppt forms	No effect
Zinc Zn^{2+}	Add dilute NaOH(aq)	White ppt forms	Dissolves again to give a colourless solution
	Add NH_4OH (aq)	White ppt forms	Dissolves again to give a colourless solution
Calcium Ca^{2+}	Add dilute NaOH(aq)	White ppt forms	No effect
	Add NH_4OH (aq)	No white/slight white ppt forms	
Copper(II) Cu^{2+}	Add dilute NaOH(aq)	Pale blue ppt	No effect
	Add NH_4OH (aq)	Pale blue ppt	Dissolves again to give a deep blue solution
Chromium Cr^{3+}	Add dilute NaOH(aq)	Grey-green ppt	Dissolves again to give a green solution
	Add NH_4OH (aq)	Grey-green ppt	Dissolves again to give a purple solution
Iron(II) Fe^{2+}	Add dilute NaOH(aq)	Pale green ppt	No effect
	Add NH_4OH (aq)	Pale green ppt	No effect
Iron(III) Fe^{3+}	Add dilute NaOH(aq)	Red-brown ppt	
	Add NH_4OH (aq)	Red-brown ppt	

Cation	Ionic Equation for the reaction
Ammonium NH_4^+	$\text{NH}_4^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{NH}_3(\text{g}) + \text{H}_2\text{O}(\text{l})$
Aluminium Al^{3+}	$\text{Al}^{3+}(\text{aq}) + 3\text{OH}^-(\text{aq}) \rightarrow \text{Al}(\text{OH})_3(\text{s})$ $\text{Al}(\text{OH})_3$ is amphoteric, so the ppt dissolves in excess NaOH
Zinc Zn^{2+}	$\text{Zn}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Zn}(\text{OH})_2(\text{s})$ $\text{Zn}(\text{OH})_2$ is amphoteric, so the ppt dissolves in excess NaOH A soluble complex ion forms, so it dissolves in excess NH_4OH
Calcium Ca^{2+}	$\text{Ca}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Ca}(\text{OH})_2(\text{s})$
Copper(II) Cu^{2+}	$\text{Cu}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Cu}(\text{OH})_2(\text{s})$ A soluble complex ion forms, so the ppt dissolves in excess NH_4OH
Chromium Cr^{3+}	$\text{Cr}^{3+}(\text{aq}) + 3\text{OH}^-(\text{aq}) \rightarrow \text{Cr}(\text{OH})_3(\text{s})$ $\text{Cr}(\text{OH})_3$ is amphoteric, so the ppt dissolves in excess NaOH A soluble complex ion forms, so the ppt dissolves in excess NH_4OH
Iron(II) Fe^{2+}	$\text{Fe}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Fe}(\text{OH})_2(\text{s})$
Iron(III) Fe^{3+}	$\text{Fe}^{3+}(\text{aq}) + 3\text{OH}^-(\text{aq}) \rightarrow \text{Fe}(\text{OH})_3(\text{s})$