

Reactions of metal ions in aqueous solution

Chemistry A-level (7405)

This resource (v1.4) represents colours of solutions and products (Specification reference 3.2.6 Reactions of ions in aqueous solution). Students are expected to describe:

Metal	Aqueous ion	Action of NaOH	Action of an excess of NaOH(aq)	Action of NH ₃ (aq)	Action of an excess of NH ₃ (aq)	Action of Na ₂ CO ₃ (aq)
Iron(II)	[Fe(H ₂ O) ₆] ²⁺ (aq) green solution	Fe(H ₂ O) ₄ (OH) ₂ (s) green ppt goes brown on standing in air	No further change	Fe(H ₂ O) ₄ (OH) ₂ (s) green ppt goes brown on standing in air	No further change	FeCO ₃ (s) green ppt
Copper(II)	[Cu(H ₂ O) ₆] ²⁺ (aq) blue solution	Cu(H ₂ O) ₄ (OH) ₂ (s) blue ppt	No further change	Cu(H ₂ O) ₄ (OH) ₂ (s) blue ppt	[Cu(H ₂ O) ₂ (NH ₃) ₄] ²⁺ (aq) deep blue solution	CuCO ₃ (s) blue-green ppt
Iron(III)	[Fe(H ₂ O) ₆] ³⁺ (aq) purple solution may look yellow-brown due to some [Fe(H ₂ O) ₅ (OH)] ²⁺ (aq)	Fe(H ₂ O) ₃ (OH) ₃ (s) brown ppt (ppt may look orange-brown)	No further change	Fe(H ₂ O) ₃ (OH) ₃ (s) brown ppt (ppt may look orange-brown)	No further change	Fe(H ₂ O) ₃ (OH) ₃ (s) brown ppt (ppt may look orange-brown) and CO ₂ gas evolved
Aluminium(III)	[Al(H ₂ O) ₆] ³⁺ (aq) colourless solution	Al(H ₂ O) ₃ (OH) ₃ (s) white ppt	[Al(OH) ₄] ⁻ (aq) colourless solution	Al(H ₂ O) ₃ (OH) ₃ (s) white ppt	No further change	Al(H ₂ O) ₃ (OH) ₃ (s) white ppt and CO ₂ gas evolved

Section 3.2.5.2: Substitution reactions

Substitution reactions involving Cobalt (II) were previously required knowledge under the old A-level Chemistry specification (2420). These reactions and the colours of the solutions and products are no longer required knowledge for the current A-level Chemistry specification (7405).

Section 3.2.5.5: Variable oxidation states

Students are also expected to know the colours of the vanadium ions produced when a solution of ammonium vanadate(V) (NH_4VO_3) is reduced by zinc metal under acidic conditions.

Oxidation state	V(V)	V(IV)	V(III)	V(II)
Species in acidic solution	$[\text{VO}_2(\text{H}_2\text{O})_4]^+$	$[\text{VO}(\text{H}_2\text{O})_5]^{2+}$	$[\text{V}(\text{H}_2\text{O})_6]^{3+}$	$[\text{V}(\text{H}_2\text{O})_6]^{2+}$
Colour of solution	yellow	blue	green	purple