

5.3.1 Transition elements

Ion	Sodium hydroxide	Ammonia
Cu^{2+} (aq)	<p><i>Pale blue solution</i> $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ (aq) + 2OH^- (aq) \rightarrow <i>Blue precipitate</i> $\text{Cu}(\text{OH})_2$ (s) + $6\text{H}_2\text{O}$ (l)</p> <p><i>(No further reaction with excess)</i></p>	<p><i>Pale blue solution</i> $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ (aq) + 2NH_3 (aq) \rightarrow <i>Blue precipitate</i> $\text{Cu}(\text{OH})_2$ (s) + 2NH_4^+ (aq) + $4\text{H}_2\text{O}$ (l)</p> <p><i>EXCESS:</i></p> <p><i>Pale blue solution</i> $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ + 4NH_3 \rightleftharpoons <i>Dark blue solution</i> $[\text{Cu}(\text{NH}_3)_4(\text{H}_2\text{O})_2]^{2+}$ + $4\text{H}_2\text{O}$</p> <p><i>Blue precipitate</i> $\text{Cu}(\text{OH})_2$ (s) + 4NH_3 (aq) + $2\text{H}_2\text{O}$ (l) \rightarrow <i>Dark blue solution</i> $[\text{Cu}(\text{NH}_3)_4(\text{H}_2\text{O})_2]^{2+}$ (aq) + 2OH^- (aq)</p>
Fe^{2+} (aq)	<p><i>Green solution</i> $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ (aq) + 2OH^- (aq) \rightarrow <i>Green precipitate</i> $\text{Fe}(\text{OH})_2$ (s) + $6\text{H}_2\text{O}$ (l)</p> <p><i>(No further reaction with excess)</i></p>	<p><i>Green solution</i> $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ (aq) + 2NH_3 (aq) \rightarrow <i>Green precipitate</i> $\text{Fe}(\text{OH})_2$ (s) + 2NH_4^+ (aq) + $4\text{H}_2\text{O}$ (l)</p> <p><i>(No further reaction with excess)</i></p>
Fe^{3+} (aq)	<p><i>Pale yellow solution</i> $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ (aq) + 3OH^- (aq) \rightarrow <i>Orange-brown precipitate</i> $\text{Fe}(\text{OH})_3$ (s) + $6\text{H}_2\text{O}$ (l)</p> <p><i>(No further reaction with excess)</i></p>	<p><i>Pale yellow solution</i> $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ (aq) + 3NH_3 (aq) \rightarrow <i>Orange-brown precipitate</i> $\text{Fe}(\text{OH})_3$ (s) + 3NH_4^+ (aq) + $3\text{H}_2\text{O}$ (l)</p> <p><i>(No further reaction with excess)</i></p>
Mn^{2+} (aq)	<p><i>Pale pink solution</i> $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ (aq) + 2OH^- (aq) \rightarrow <i>Purple precipitate</i> $\text{Mn}(\text{OH})_2$ (s) + $6\text{H}_2\text{O}$ (l)</p> <p><i>(No further reaction with excess)</i></p>	<p><i>Pale pink solution</i> $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ (aq) + 2NH_3 (aq) \rightarrow <i>Purple precipitate</i> $\text{Mn}(\text{OH})_2$ (s) + 2NH_4^+ (aq) + $4\text{H}_2\text{O}$ (l)</p> <p><i>(No further reaction with excess)</i></p>
Cr^{3+} (aq)	<p><i>Violet solution</i> $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ (aq) + 3OH^- (aq) \rightarrow <i>Green precipitate</i> $\text{Cr}(\text{OH})_3$ (s) + $6\text{H}_2\text{O}$ (l)</p> <p><i>EXCESS:</i></p> <p><i>Green precipitate</i> $\text{Cr}(\text{OH})_3$ (s) + 3OH^- (aq) \rightarrow <i>Dark green solution</i> $[\text{Cr}(\text{OH})_6]^{3-}$ (aq)</p>	<p><i>Violet solution</i> $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ (aq) + 3NH_3 (aq) \rightarrow <i>Green precipitate</i> $\text{Cr}(\text{OH})_3$ (s) + 3NH_4^+ (aq) + $3\text{H}_2\text{O}$ (l)</p> <p><i>EXCESS:</i></p> <p><i>Violet solution</i> $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ + 6NH_3 \rightleftharpoons <i>Purple solution</i> $[\text{Cr}(\text{NH}_3)_6]^{3+}$ + $6\text{H}_2\text{O}$</p> <p><i>Green precipitate</i> $\text{Cr}(\text{OH})_3$ (s) + 6NH_3 (aq) \rightarrow <i>Purple solution</i> $[\text{Cr}(\text{NH}_3)_6]^{3+}$ (aq) + 3OH^- (aq)</p>