

Will the salt be soluble or insoluble?

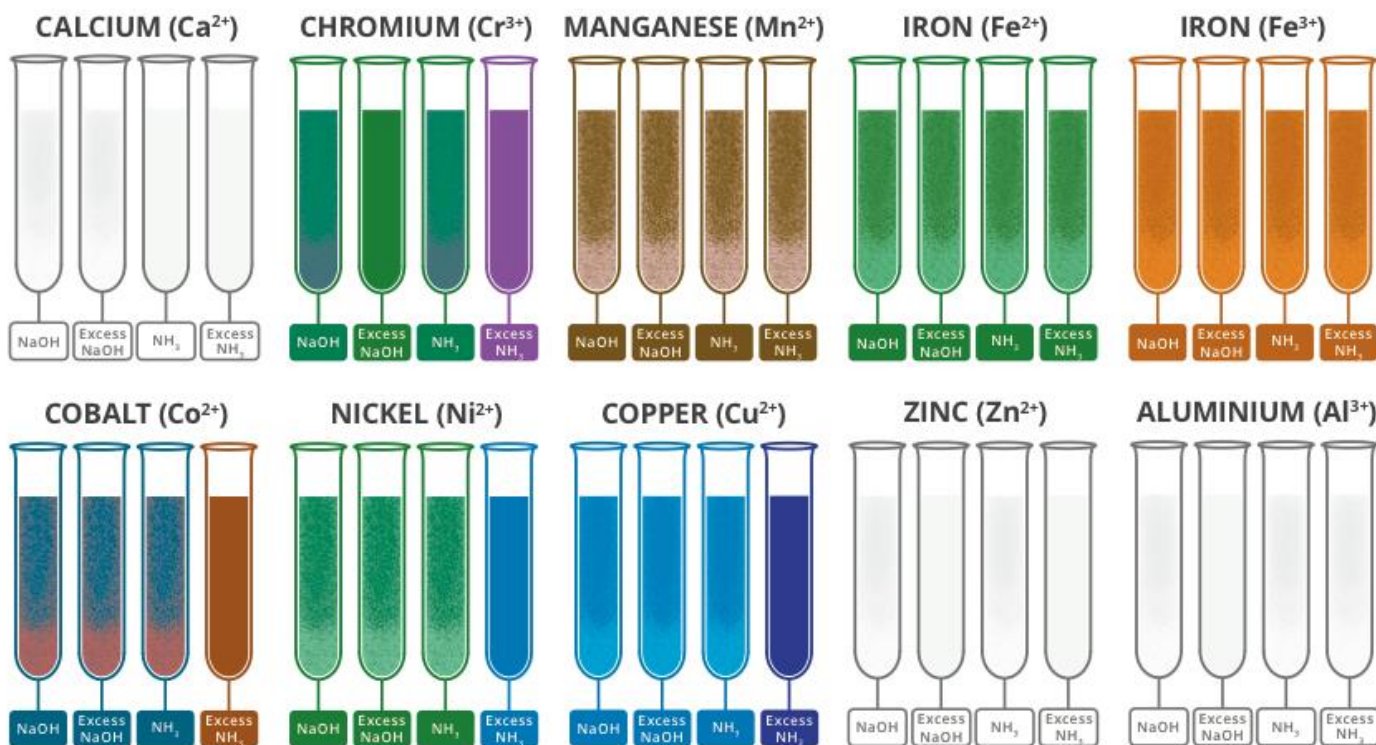
Salt	Insoluble	Exceptions
Sulfates	Lead, barium, silver and calcium sulfate are insoluble	Iron sulfate is sparingly soluble
Hydroxides	Metal hydroxides	Except group 1, ammonium. Ca/Sr/Ba hydroxides are sparingly soluble Ag reacts with hydroxide to make a precipitate of silver oxide (brown) Zinc forms a precipitate but excess hydroxide dissolves it.
Carbonates	All metal carbonates	Ones at the top of group 2 are sparingly soluble
Halides (I, Cl, Br)	Silver and lead halides	
Nitrates		All are soluble
Ammonium		All are soluble
Oxides	Group 1 react with water so are not really considered insoluble or soluble	
Chlorates, ClO_3^-		All are soluble

Common precipitates for qualitative analysis

Salt	Colour of precipitate
Lead iodide	Bright yellow
Lead chloride or lead bromide	white
Silver iodide	Pale yellow
Silver bromide	Cream
Silver chloride	White
Carbonate	Most are white. Iron (II) is off-white
Silver oxide	Brown (Ag_2O)
Calcium or lead(II) hydroxide	White
Iron(II) hydroxide	Dark green gelatinous
Iron(III) hydroxide	Gelatinous orange/brown
Copper(II) hydroxide	Gelatinous blue. On addition of ammonia, it re-dissolves (no precipitate) but the solution goes deep blue-purple due to the ammonia complex.
Zinc hydroxide	Forms a white precipitate that re-dissolves in excess NaOH. $\text{Zn}^{2+}_{(\text{aq})} + 2\text{OH}^{-}_{(\text{aq})} \rightarrow \text{Zn}(\text{OH})_{2(\text{s})}$ Then... $\text{Zn}(\text{OH})_{2(\text{s})} + \text{OH}^{-}_{(\text{aq})} \rightarrow \text{Zn}(\text{OH})_{3}^{-}_{(\text{aq})}$

TESTING FOR CATIONS: SODIUM HYDROXIDE & AMMONIA PRECIPITATES

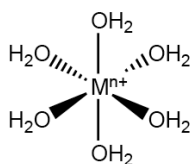
SODIUM HYDROXIDE SOLUTION OR AQUEOUS AMMONIA SOLUTION CAN BE ADDED TO SOLUTIONS CONTAINING METAL IONS IN ORDER TO DISCERN THEIR IDENTITY. THE COLOUR PRECIPITATE FORMED BY THE REACTION CAN BE USED TO DETERMINE THE METAL IDENTITY. IN SOME CASES, THE PRECIPITATE DISSOLVES IN EXCESS NaOH or NH_3 .



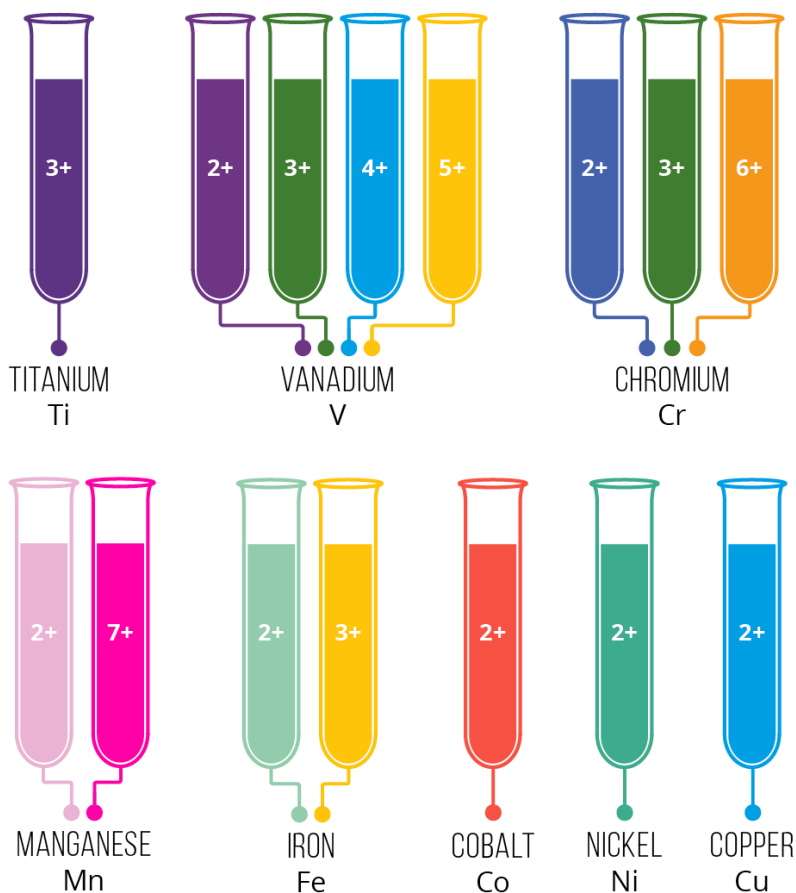
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TRANSITION METAL ION COLOURS

Transition metals form coloured compounds and complexes. These colours can vary depending on the charge on the metal ion, and the number and type of groups of atoms (called ligands) attached to the metal ion. In aqueous solutions, the ions form complexes with the colours shown to the right.



Electrons are arranged around the nucleus of the metal atom in orbitals. Transition metals, unlike other metals, have partially filled d orbitals, which can hold up to 10 electrons. When ligands are present, some d orbitals become higher in energy than before, and some become lower. Electrons can then move between these higher and lower d orbitals by absorbing a photon of light. This absorption of light affects the perceived colour of the compound or complex. The wavelength of the light absorbed is affected by the size of the energy gap between the d orbitals, which is in turn affected by the type of ligand and the charge on the metal ion.



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