

Solubility Rules for Ionic Compounds

The rules are meant as a guide only. There are exceptions to these rules.

- Salts of the alkali metals are soluble.** (Note: The alkali metals are in group 1.)
e.g. If $M = \text{Li, Na or K}$, then $\text{MX, M}_2\text{X, M}_3\text{X}$, etc. are soluble regardless of what X is.
- Ammonium (NH_4^+) salts are soluble.**
e.g. $\text{NH}_4\text{X, (NH}_4)_2\text{X, (NH}_4)_3\text{X}$, etc. are soluble regardless of what X is.
- Nitrates NO_3^- are soluble.**
e.g. $\text{MNO}_3, \text{M(NO}_3)_2, \text{M(NO}_3)_3$, etc. are soluble regardless of what M is.
- Halides i.e. chlorides (Cl^-), bromides (Br^-) and iodides (I^-) are soluble except for the halides of lead (Pb^{2+}), mercury (Hg^+ and Hg_2^{2+}) and silver (Ag^+).**
e.g. If $X = \text{Cl, Br or I}$, then $\text{MX, MX}_2, \text{MX}_3$, etc. are soluble unless $M = \text{Pb, Hg or Ag}$.
- Sulfates (SO_4^{2-}) are soluble except for the sulfates of calcium, strontium, barium, silver mercury and lead.**
e.g. $\text{M}_2\text{SO}_4, \text{MSO}_4, \text{M}_2(\text{SO}_4)_3$, etc. are soluble unless M is from group 2 (the alkaline earths) or $M = \text{Pb, Hg or Ag}$.
- Carbonates (CO_3^{2-}), phosphates (PO_4^{3-}) and sulfides (S^{2-}) are insoluble except for
(i) the carbonates/phosphates/sulfides of the alkalis (because of Rule 1), and
(ii) ammonium carbonate/phosphate/sulfide (because of Rule 2).**
- Hydroxides (OH^-) are insoluble or slightly soluble except for the hydroxides of the alkalis (because of Rule 1).**

Note: The hydroxides of group 2 (the alkaline earth metals) are slightly soluble. Virtually all other hydroxides are insoluble.