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# Solubility chart

A **solubility chart** is a chart describing whether the ionic compounds formed from different combinations of cations and anions dissolve in or precipitate from solution.

The following chart shows the solubility of various ionic compounds in water at 1 atm pressure and room temperature (approx. 25 °C (298.15 K)). "Soluble" means the ionic compound doesn't precipitate, while "slightly soluble" and "insoluble" mean that a solid will precipitate; "slightly soluble" compounds like calcium sulfate may require heat to precipitate. For detailed information on exact solubility of compounds, see **solubility table**.

For compounds with multiple hydrates, the solubility of the most soluble hydrate is shown.

Some compounds like nickel oxalate will not precipitate immediately even though they are insoluble, requiring a few minutes to precipitate out.[1]

| Ions names and symbols | Halogens | | | | | Chalcogens | | | | Pnictogens | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fluoride $F^-$ | Chloride $Cl^-$ | Bromide $Br^-$ | Iodide $I^-$ | Perchlorate $ClO_4^-$ | Oxide $O^{2-}$ | Hydroxide $OH^-$ | Sulfide $S^{2-}$ | Sulfate $SO_4^{2-}$ | Nitrate $NO_3^-$[a] | Phosphate $PO_4^{3-}$ | Carbonate $CO_3^{2-}$[a] | Cyanide $CN^-$ |
| Hydrogen $H^+$ | S | S | S | S | S | S | S | sS | S | S | S | S | S |
| Ammonium $NH_4^+$[a] | S | S | S | S | S | S[b] | S | R | S | S | S | S | S |
| Lithium $Li^+$ | sS | S | S | S | S | R | S | R | S | S | sS | sS | S |
| Sodium $Na^+$ | S | S | S | S | S | R | S | R | S | S | S | S | S |
| Potassium $K^+$ | S | S | S | S | sS | R | S | R | S | S | S | S | S |
| Rubidium $Rb^+$ | S | S | S | S | sS | R | S | R | S | S | S | S | S |
| Caesium $Cs^+$ | S | S | S | S | sS | R | S | R | S | S | S | S | S |
| Beryllium $Be^{2+}$ | S | S | S | R | S[3] | I | I | R | S | S | S | sS | R |
| Magnesium $Mg^{2+}$ | sS | S | S | S | S | R | I | R | S | S | I | sS | R |
| Calcium $Ca^{2+}$ | I | S | S | S | S | R | sS | R | sS | S | I | I | R |
| Strontium $Sr^{2+}$ | sS | S | S | S | S | R | sS | R | sS | S | sS | I | S |
| Barium $Ba^{2+}$ | sS | S | S | S | S | R | S | R | I | S | I[4] | sS | S |
| Aluminium $Al^{3+}$ | sS | S | S | S[c] | S[5] | I | I | R | S | S | I | R | R |
| Gallium $Ga^{3+}$ | I | S | S | R | S[5] | I | I | R | sS | S | I | R | R |
| Manganese(II) $Mn^{2+}$ | sS | S | S | S | S[6] | I | I | I | S | S | I | I | S |
| Iron(II) $Fe^{2+}$ | sS | S | S | S | S | I | I | I | S | S | I | I | S |
| Cobalt(II) $Co^{2+}$ | sS | S | S | S | S[7] | I | I | I | S | S | I | I | I |
| Nickel(II) $Ni^{2+}$ | S | S | S | S | S | I | I | I | S | S | I | I | I |
| Copper(II) $Cu^{2+}$ | sS | S | S | ? | S | I | I | I | S | S | I | R[d] | I |
| Zinc $Zn^{2+}$ | sS | S | S | S | S[8] | I | I | I | S | S | I | I | I |
| Cadmium $Cd^{2+}$ | S | S | S | S | S | I | I | I | S | S | I | I | sS |
| Mercury(II) $Hg^{2+}$ | R | S | S | I | S[9] | I | I | I | R | S | I | I | S |
| Vanadium(III) $V^{3+}$ | I | S | S | S | S[11] | I | I | I | sS | S | I | ? | ? |
| Chromium(III) $Cr^{3+}$ | sS | S | S | S | S | I | I | I | S | S | I | I | S |
| Iron(III) $Fe^{3+}$ | S[e] | S | S | R | S | I | I | I | S | S | sS | R[12] | S |
| Gold(III) $Au^{3+}$ | R | S | sS | ? | ? | I | I | I | ? | ? | I | I | S |
| Tin(II) $Sn^{2+}$ | S | S | S | S | S[14] | I | I | I | S | ? | I | I | ? |
| Lead(II) $Pb^{2+}$ | sS | sS | sS | sS | S | I | sS | I | I | S | I | I | sS |
| Silver $Ag^+$ | S | I | I | I | S | I | I | I | sS | S | I | I | I |
| Mercury(I) $Hg_2^{2+}$ | R | I | I | I | S | I | ? | ? | sS | S[g] | ? | I | I |
| | Fluoride $F^-$ | Chloride $Cl^-$ | Bromide $Br^-$ | Iodide $I^-$ | Perchlorate $ClO_4^-$ | Oxide $O^{2-}$ | Hydroxide $OH^-$ | Sulfide $S^{2-}$ | Sulfate $SO_4^{2-}$ | Nitrate $NO_3^-$[a] | Phosphate $PO_4^{3-}$ | Carbonate $CO_3^{2-}$[a] | Cyanide $CN^-$ |

Key

| | | |
|---|---|---|
| S | soluble | 20~100000 g/L |
| sS | slightly soluble | 0.1~20 g/L |
| I | insoluble | <0.1 g/L |
| R | reacts with or in water | — |
| ? | unavailable | — |

## See also

- Solubility rules

## Notes

a. Compounds that include ammonium ($NH_4^+$), chlorate ($ClO_3^-$), or nitrate ($NO_3^-$) are soluble without exceptions. Compounds that include carbonate ($CO_3^{2-}$) are insoluble, unless the compound includes group 1 elements or ammonium.[2]

b. "Ammonium oxide" does not exist. However, its theoretical molecular formula $(NH_4^+)_2O^{2-}$ represents that of aqueous ammonia.

c. Partial electrolysis.

d. The commonly encountered basic copper carbonate ($CuCO_3(OH)_2$) is insoluble in water. True copper(II) carbonate ($CuCO_3$) is rare and reacts with water to form basic copper carbonate.

e. Anhydrous $FeF_3$ is slightly soluble in water; $FeF_3{\cdot}3H_2O$ is much more soluble in water.

f. The commonly encountered basic iron(III) acetate ($[Fe_3O(OAc)_6(H_2O)_3]OAc$) is insoluble in water. True iron(III) acetate ($Fe(OAc)_3$) is rare and is soluble in water.

g. Slowly decomposes in water.

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