
Solubility Rules

A compound is *soluble* in a particular liquid if it dissolves in that liquid. A compound is *insoluble* if it does NOT dissolve in the liquid. There is no easy way to tell whether a particular compound will be soluble or insoluble in water. For ionic compounds, however, there are empirical rules that have been deduced from observations of many compounds. Consider the following:

Compounds Containing the Following Ions Are Mostly Soluble*

	Exceptions
$\text{Li}^+, \text{Na}^+, \text{K}^+, \text{NH}_4^+$	None
$\text{NO}_3^-, \text{C}_2\text{H}_3\text{O}_2^-$	None
$\text{Cl}^-, \text{Br}^-, \text{I}^-$	When any of these ions pairs With $\text{Ag}^+, \text{Hg}_2^{+2}, \text{Pb}^{+2}$, or Cu^+ , it is <i>insoluble</i>
SO_4^{-2}	When SO_4^{-2} pairs with Sr^{+2} , $\text{Ba}^{+2}, \text{Pb}^{+2}$, or Ca^{+2} , it is <i>insoluble</i>

Compounds Containing the Following Ions Are Mostly Insoluble*

	Exceptions
$\text{OH}^-, \text{S}^{-2}$	When either of these ions pairs with $\text{Li}^+, \text{Na}^+, \text{K}^+$, or NH_4^+ , it is <i>soluble</i>
S^{-2}	When S^{-2} pairs with Sr^{+2} , Ba^{+2} , or Ca^{+2} , the compound is <i>soluble</i>
OH^-	When OH^- pairs with Sr^{+2} , Ba^{+2} , or Ca^{+2} , it is <i>slightly soluble</i> **
$\text{CO}_3^{-2}, \text{PO}_4^{-3}$	When either of these ions pairs with $\text{Li}^+, \text{Na}^+, \text{K}^+$, or NH_4^+ , it is <i>soluble</i>

*adapted from Tro, Nivaldo J. Introductory Chemistry, 2nd ed. Upper Saddle River: Prentice Hall, 2006.

** For our purposes, these can be considered *insoluble*