

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
Li^+ , Na^+ , K^+ , NH_4^+	None
NO_3^- , $\text{C}_2\text{H}_3\text{O}_2^-$	None
Cl^- , Br^- , I^-	When any of these ions pairs With Ag^+ , Hg_2^{+2} , Pb^{+2} , or Cu^+ , it is <i>insoluble</i>
SO_4^{-2}	When SO_4^{-2} pairs with Sr^{+2} , Ba^{+2} , Pb^{+2} , or Ca^{+2} , it is <i>insoluble</i>
Compounds Containing the Following Ions Are Mostly Insoluble*	Exceptions
OH^- , S^{-2}	When either of these ions pairs with Li^+ , Na^+ , 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> **
CO_3^{-2} , PO_4^{-3}	When either of these ions pairs with Li^+ , Na^+ , 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*