

Aqueous Solubility Rules for Ionic Compounds

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General Chemistry I & II

1. Soluble compounds:
 - a. All compounds of the Group 1A ions.
 - b. All ammonium ion compounds.
 - c. All compounds that contain nitrate, perchlorate, chlorate, or acetate ion.
 - d. All compounds that contain chloride, bromide, or iodide ion except
 - i. mercury(I) ion, Hg_2^{2+}
 - ii. lead(II) ion, Pb^{2+}
 - iii. silver ion, Ag^{1+}
 - e. All compounds that contain sulfate ion except
 - i. barium ion, Ba^{2+}
 - ii. lead(II) ion, Pb^{2+}
 - iii. mercury(I) ion, Hg_2^{2+}
 - iv. strontium ion, Sr^{2+}

2. Insoluble compounds:
 - a. All compounds of most other negative ions including
 - i. carbonate ion, CO_3^{2-}
 - ii. hydroxide ion, OH^{1-}
 - iii. oxalate ion, $\text{C}_2\text{O}_4^{2-}$
 - iv. oxide ion, O^{2-}
 - v. phosphate ion, PO_4^{3-}
 - vi. sulfide ion, S^{2-}
 - vii. sulfite ion, SO_3^{2-}

Note that we are making some very broad generalities for solubility and we've broken the concept into two categories- soluble and insoluble. Some texts also make another category for compounds that are slightly soluble. A common rule-of-thumb is if an aqueous 0.1 M solution can be made of the substance, it's considered to be soluble.

Textbooks also disagree on some ions. These are the rules I've established for my classes based not only on examination of numerous solubility rules but my own empirical results. For example, strontium sulfate is commonly listed as soluble in many lists although I list it as insoluble.