 Dr. Arno Papazyan

Solubilities of common ions

- A compound is soluble if it dissolves in water to give a solution with a concentration of at least 0.1 moles per liter at room temperature.
- A compound is insoluble if the concentration of an aqueous solution is less than 0.001 M at room temperature.
- Slightly soluble compounds give solutions that fall between these extremes.
- There are alternative definitions in use as well (e.g. if more than 1g dissolves in 100g of water it's soluble)
- The following tables assume a solution temperature of 25°C.

Compounds with these ions are <u>soluble</u>		**except when combined with:**
Group IA metals	Li^+, Na^+, K^+, Rb^+, Cs^+	*
Ammonium	NH_4^+	
Nitrate	NO_3^-	
Acetate	$C_2H_3O_2^-$	
Perchlorate	ClO_4^-	
Chlorate	ClO_3^-	
Halides except fluoride	Cl^-, Br^-,I^-	Ag^+, Pb^{2+}, Hg_2^{2+}
Sulfate	SO_4^{2-}	Ag^+ **, Pb^{2+}, Hg_2^{2+}, Ca^{2+}, Ba^{2+}, Sr^{2+}

* Li_3PO_4 is only very slightly soluble (very close to the "insoluble" limit)

** Ag_2SO_4 is slightly soluble

Compounds with these ions are <u>insoluble</u>		**except when combined with:**
Carbonate	CO_3^{2-}	Group IA metals and NH_4^+
Phosphate	PO_4^{3-}	Group IA metals (except Li^+)* and NH_4^+
Chromate	CrO_4^{2-}	Group IA metals and NH_4^+
Sulfide	S^{2-}	Group IA metals and NH_4^+; Group IIA metals***
Hydroxide	OH^-	Group IA, NH_4^+ **, Ba^{2+} soluble; Ca^{2+} and Sr^{2+} slightly soluble

** NH_4OH does not exist as a compound. However, NH_4^+ and OH^- can exist in solution together, such as when NH_3 (ammonia, a weak base) dissolves in water and some NH_3 molecules grab an H^+ from water to produce NH_4^+ and OH^-. Aqueous ammonia solutions are often labeled as NH_4OH even though most of the ammonia would be in NH_3 form.

*** Sulfides of Group IIA metals react with water. CaS, BaS, and SrS are soluble to varying degrees, but they are ultimately not stable in water.