CSUSM
STEM Success Center

SOLUBILITY

Solubility: Solubility is a chemical property referring to the ability for a given substance, the solute, to dissolve in a solvent.

Upon dissolution…

- ionic compounds dissociate into ions
- ionic compounds conduct electrical currents and are called electrolytes

Non-electrolytes: substances that do not conduct electrical currents. These substances…

- do not dissociate into ions when dissolved
- do not conduct electricity in water

weak electrolytes: a covalent compound that only dissociates into ions to a small extent when dissolved in water

- associated with weak acids and weak bases
- ex) Acetic acid (CH_3COOH) = weak acid
- ex) Ammonia (NH_3) = weak base
- Hydrocarbons DO NOT dissolve in water

Polyatomic ions:

OH^-	CO_3^{2-}	PO_4^{3-}
NO_3^-	SO_4^{2-}	NH_4^+

Examples of ionic compounds dissolving in water they dissociate into ions

- $MgCl_2$ (s) → Mg^{2+} (aq) + $2Cl^-$ (aq)
- KOH (s) → K^+(aq) + OH^- (aq)
- NaNO3 (s) → Na^+ (aq) + $NO3^-$ (aq)

*Notice that polyatomic ions stay intact upon dissociation

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General Solubility rules:

- The soluble column shows the ions that are soluble in any compound, except when in a compound with ions in the same row on the right. They are then considered: insoluble.
- The Insoluble column shows the ions that do not separate upon dissolution when in a compound with the ions in the same row as the ions on the rate. when in a compound with the ions on the right they are considered: soluble.
- When two monatomic or polyatomic ions, that are considered insoluble when combined, are submerged in a solution, they form a precipitate (solid).

Example) $2\mathbf{Ag}NO3(aq) + Na_2\mathbf{CO}_3(aq) \rightarrow \mathbf{Ag_2CO_3}(s) + 2NaNO_3(aq)$

-The precipitate is the solid on the products side (right). It is formed when the soluble compounds on the reactants side (left). Silver Carbonate (Ag_2CO_3) is the only insoluble combination of ions and will therefore precipitate and form a solid. You can use the following table to predict the product of a precipitation reaction

Soluble compounds	**Exceptions**
Li^+ Na^+ K^+	none
NH_4^+	none
Cl^- Br^- I^-	halides of Ag^+, Hg_2^{2+}, Pb^{2+}
NO_3^- ClO_4^- $CH_3CO_2^-$	none
SO_4^{2-}	sulfates of SR^{2+}, Ba^{2+}, Hg_2^{2+}, Pb^{2+}
Insoluble compounds	**Exceptions**
CO_3^2	carbonates of group 1A, NH_4^+
OH^-	Hydroxides of Group 1A cations, NH_4^+, Ca^{2+}, Sr^{2+}, Ba^{2+}