

The solubility of a substance is the amount of that substance that will dissolve in a given amount of solvent.

Solute – The substance that dissolves to form a solution

Solvent – The substance in which a solute dissolves

Solution – A mixture of one or more solutes dissolved in a solvent

Note:

A substance is said to be soluble if more than 0.1 g of that substance dissolves in 100 mL solvent.

Factors Affecting Solubility:

- I. The nature of the intermolecular forces or interionic forces in both the solute and the solvent.
- II. Temperature

Interparticles Bonds & Solubility					
Kinds of Bonds	Example		Solubility in different solvents		
	Chemical	Formula	Water	Alcohol	Benzene
ionic	Potassium chloride	KCl	Very soluble	Slightly soluble	insoluble
Polar covalent	Sugar	C ₁₂ H ₂₂ O ₁₁	Very soluble	soluble	insoluble
Nonpolar covalent	Naphthalene	C ₁₀ H ₈	insoluble	soluble	Very soluble

Solubility Rules

a)

Nitrates: NO ₃ ⁻			
All nitrates are soluble.		Except: Oxynitrates : Antimony & Bismuth	
Example	K NO ₃	SbONO ₃	BiONO ₃
Note:			

b)

Acetates: CH ₃ COO ⁻			
All acetates are soluble.		Except: Silver acetate (with concentrated solution may precipitate):	
Example	Ca(CH ₃ COO) ₂	Ag (CH ₃ COO)	
Note:			

c)

Chlorates: ClO_3^-		
All chlorates are soluble.		
Example	$\text{Mg}(\text{ClO}_3)_2$	
Note:		

d)

Chlorides: Cl^-		
All chlorides, bromides and iodides are soluble.		Except: Ag, Hg(I) · Pb
Example	CaCl_2	AgCl
Note: Sb & Bi chlorides hydrolyze in water. $\text{SbCl}_3 + \text{H}_2\text{O} \rightarrow \text{SbOCl}(\text{s}) + 2\text{HCl}$		

e)

Sulfates: SO_4^{2-}		
All sulfates are soluble.		Except: Ba, Sr, Pb
Example	$\text{Mg}(\text{SO}_4)$	$\text{Ba}(\text{SO}_4)(\text{s})$
Note: Ca (SO_4) Ag ₂ (SO_4), Hg ₂ (SO_4) are slightly soluble in water.		

f)

Salts of: Na^+ , K^+ , NH_4^+		
All salts of sodium, potassium and ammonium are soluble		Except: such compounds as $\text{K}_2\text{NaCo}(\text{NO}_2)_6$, K_2PtCl_6 , ...
Example	NH_4Br	
Note:		

g)

Carbonates: CO_3^{2-}		
All carbonates are insoluble.		Except: Na^+ , K^+ , NH_4^+
Example	$\text{CaCO}_3(\text{s})$	Na_2CO_3
Note: Magnesium carbonate is slightly soluble. Many hydrogen carbonates, such as $\text{Ca}(\text{HCO}_3)_2$ and $\text{Mg}(\text{HCO}_3)_2$, are soluble.		

h)

Phosphates: PO_4^{3-}		
All phosphates are insoluble.		Except: Na^+ , K^+ , NH_4^+
Example	$\text{Ca}_3(\text{PO}_4)_3(\text{s})$	$(\text{NH}_4)_3(\text{PO}_4)$
Note: hydrogen phosphates, such as $\text{Ca}(\text{H}_2\text{PO}_4)_2$, are soluble.		

l)

Sulfides: S^{2-}		
All sulfides are insoluble.		Except: Li^+ , Na^+ , K^+ , NH_4^+ , Ca^{2+} , Mg^{2+} , Ba^{2+} , Sr^{2+}
Example	$PbS_{(s)}$	Li_2S
Note: hydrogen phosphates, such as $Ca (H_2PO_4)_2$, are soluble.		

j)

Hydroxides: OH^-		
All hydroxides are insoluble.		Except: Na^+ , K^+ , NH_4^+ , Ba^{2+}
Example	$Ca(OH)_2 (s)$	$NaOH$
Note: Calcium and strontium hydroxides are slightly soluble. Magnesium hydroxide is only very slightly soluble		

k)

Arsenates: AsO_4^{3-}		
All arsenates are insoluble.		Except: Na^+ , K^+ , NH_4^+
Example	$Zn_3 (AsO_4)_2 (s)$	K_3AsO_4
Note:		