

Solubility is typically a limit to how much solute can dissolve in a given amount of solvent. Solubility is the property of a solid, liquid or gaseous form of a chemical solute to dissolve in a solid, liquid or gaseous solvent to form a solution. The solubility depends on the physical and chemical properties of both solute and solvent. The solubility of a substance is effected by temperature, pressure and PH of the solution. The level of the solubility of a substance in a specific solvent is measured as the saturation concentration, that means adding more solute does not increase the concentration of the solution but the extra amount of solute will begin to percipitate.

Factors That Affect Solubility

Based on the solubility any solvents can be categorized into three types. They are

- **Highly soluble** - If 0.1 g of solute is capable of dissolving in a 100g of solvent, then it falls into the highly soluble category.
- **Sparingly soluble** - If less than 0.1 g of solute is capable of dissolving in a 100g of solvent, then it falls into the sparingly soluble category.
- **Insoluble** - cannot be dissolved into a solvent.

The nature of solute and solvent

Let's remember polar solvents and non polar solvents. Polar solvents are liquid made up of polar molecules. Non polar solvents are liquid made up of non polar molecules. When two substances are similar they can dissolve in each other. So here polar solutes dissolves in polar solvents and non polar solutes dissolves in non polar solvents. The generalized statement is "Like dissolves Like"- two liquids dissolves in each other because their molecules are alike in priority. Ionic compounds are more soluble in polar solvent than non polar solvent. Inorganic acids, bases and salt which are ionic tends to be much more soluble in water. Solvents such as carbon tetrachloride, Hexane and Benzene which are non polars does not soluble in polar solvents.

Solute	Polar solvent	Non polar solvent
Polar	Soluble	Insoluble
Non polar	Insoluble	Soluble

Ionic

Soluble

Insoluble

Temperature

Most of the solutes have a limited solubility in a given amount of solvent at a fixed temperature. The temperature of a solvent generally has a marked effect on the amount of solute that will dissolve.

In case of solids dissolve in liquids the dissolving process is endothermic

- As the temperature increases, the solubility of solids in liquids increases.(there are few exceptions)

In case of gases dissolve in liquids the dissolving process is exothermic

- As the temperature increases, the solubility of gases in liquids decreases.

How temperature affects solubility as the solution is formed ?

If temperature is decreased while mixing the solute and solvent, raising the temperature will increase the solubility.

If temperature kept neutral it does not affect the solubility.

If temperature is increased when the solute and solvent are mixed, raising the temperature will decrease the solubility.

Pressure

Pressure does not affect for majority of solid and liquid solutes.

The solubility of gases increases with increase in the pressure of a gas above the solution.

Henry's Law gives a quantitative relation between pressure and gas solubility in a liquid. It states that :

“The solubility of a gas in a liquid is directly proportional to the partial pressure of the gas present above the surface of liquid or solution”.

$$P=K_{HX}$$

where, p = partial pressure of the gas
 x = mole fraction of the gas in solution
 K_H = Henry's law constant

Stirring increases the speed of dissolving

Stirring does not have an effect on solubility of a substance, but everyone knows that if he puts sugar in the tea and does not stir, it will not dissolve. If we leave the tea to stand for a long enough time, the sugar would dissolve. Stirring only increases the speed of the process - it increases movement of the solvent what exposes solute to fresh portions of it, thus enabling solubility. As molecules in liquid substances are in constant move, the process would take place anyway, but it would take more time.