

Lab (2)

Solubility

1st stage- college of Dentistry

By

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Solubility

Solubility is the ability of a solid, liquid, or gaseous chemical substance (referred to as the solute) to dissolve in solvent (usually a liquid) and form a solution. The solubility of a substance fundamentally depends on the solvent used, as well as temperature and pressure. The solubility of a substance in a particular solvent is measured by the concentration of the saturated solution. A solution is considered saturated when adding additional solute no longer increases the concentration of the solution.

The degree of solubility ranges widely depending on the substances, from infinitely soluble (fully miscible), such as ethanol in water, to poorly soluble, such as silver chloride in water. The term “insoluble” is often applied to poorly soluble compounds. Under certain conditions, the equilibrium solubility can be exceeded, yielding a supersaturated solution.

Solubility does not depend on particle size; given enough time, even large particles will eventually dissolve.

Factors Affecting Solubility

1- Temperature

The solubility of a given solute in a given solvent typically depends on temperature. For many solids dissolved in liquid water, solubility tends to correspond with increasing temperature. As water molecules heat up, they vibrate more quickly and are better able to interact with and break apart the solute.

The solubility of gases displays the opposite relationship with temperature; that is, as temperature increases, gas solubility tends to decrease. In a chart of solubility vs.

temperature, notice how solubility tends to increase with increasing temperature for the salts and decrease with increasing temperature for the gases.

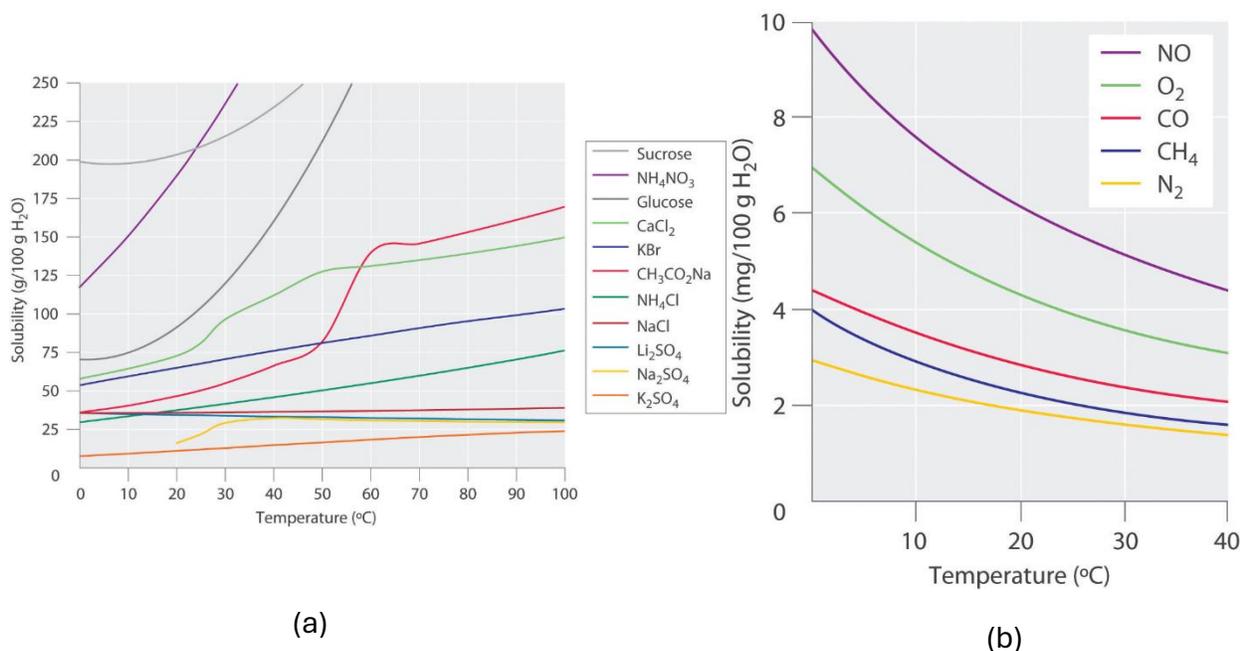


Figure (a) Solubilities of Several Inorganic and Organic Solids in Water as a Function of Temperature.

Figure (b) Solubilities of Several Common Gases in Water as a Function of Temperature at Partial Pressure of 1 atm. The solubilities of gases decrease with increasing temperature.

Solubility of various substances vs. temperature change Solubility increases with temperature for most substances; for example, more sugar will dissolve in hot water than in cold water. The solubility of gases displays the opposite relationship with temperature; that is, as temperature increases.

Gas solubility tends to decrease. In a chart of solubility vs. temperature, notice how solubility tends to increase with increasing temperature for the salts and decrease with increasing temperature for the gases.

2- Pressure

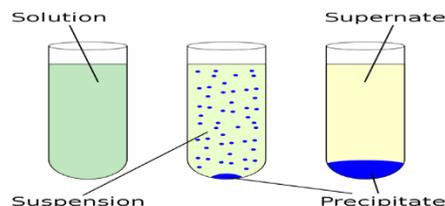
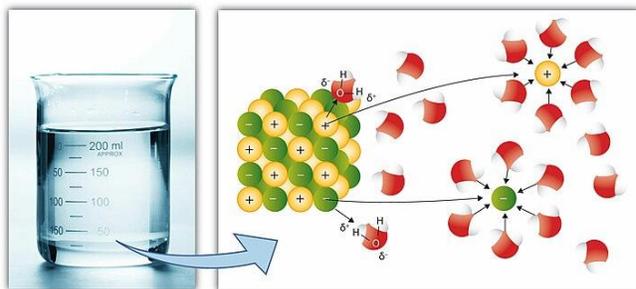
Effect of pressure on solubility the solubility of liquid and solid materials in a liquid solvent is not affected by pressure, but gaseous substances dissolved in liquids are affected by pressure. It was found that the solubility of any gas in a liquid is directly proportional to the partial pressure of the gas above the solution and this is a fact since there is a dynamic equilibrium by increasing the number of gas particles above the solution will increase the number of particles that dissolve in the solution, which in turn leads to an increase in the solubility.

3-Polarity

A popular saying used for predicting solubility is “Like dissolves like.” This statement indicates that a solute will dissolve best in a solvent that has a similar chemical structure; the ability for a solvent to dissolve various compounds depends primarily on its polarity. For example, a polar solute such as sugar is very soluble in polar water, less soluble in moderately polar methanol, and practically insoluble in non-polar solvents such as benzene. In contrast, a non-polar solute such as naphthalene is insoluble in water, moderately soluble in methanol, and highly soluble in benzene. Therefore, the solubility depends of kind if solute and solvent.

In general polar solvents dissolve polar solutes whereas nonpolar solvents will dissolve nonpolar solutes. Overall, the solution process depends on the strength of the attraction between the solute particles and the solvent particles. For example, water is a highly polar solvent that is capable of dissolving many ionic salts. Figure 7.2 shows the solution process, where water act as the solvent to dissolve the crystalline salt, sodium chloride (NaCl). Note that when ionic compounds dissolve in a solvent they break apart into free floating ions in solution. This enables the

compound to interact with the solvent. In the case of water dissolving sodium chloride, the sodium ion is attracted to the partial negative charge of the oxygen atom in the water molecule, whereas the chloride ion is attracted to the partial positive charge of the hydrogen atoms.



4-Stirring process

The stirring of the solution speeds up the removal of the solute particles from the contact surfaces, which increases the speed of the process of dissolving the solute particles in the solution.

5-Effect of acidic function PH

The H^+ ions concentration and OH^- influence the solubility of the compounds. As the solubility of compounds in acidic and basic media differs greatly from their solubility in pure water, meaning that the acidic and basic nature of the solvent has a remarkable effect on the solubility of the solute in the solution.

Experiment of Solubility

	Chemicals	Quantity	Equipment and Instruments
1	Distilled water	25 mL	Hot plate magnetic stirrer
2	NaCl	1 gm	Magnetic bar
3			Beaker
4			Glass rod

Procedure

- 1- Mix a certain amount of the solute in a solvent.
- 2- Stir well until the dissolution is complete and all solute dissolve in solvent.
- 3- There are some substances that will dissolve except by using some factors and conditions such as temperature, pressure, stirring ... etc.

Some type of substance dissolve direct and some type dissolved slightly.

- 4- When dissolve more amounts of solute, no more solute will dissolve in the solvent. because the solvent is saturated with solute and called saturated solution.

