Solutions

soluble - capable of being dissolved

solution - homogeneous mixture of two or more substances in a single phase

solvent - dissolving medium of a solution

solute - what is being dissolved

Solutions are not always liquids.

Typically, the solute is the thing there is less of

Examples of Solutions

oxygen "dissolved" in nitrogen - gas solution

sugar in water - liquid solution

copper in nickel (alloy) - solid solution

Suspension

the particles in a solvent are so large that they settle out unless the mixture is constantly stirred or agitated

Colloid

aka colloidal dispersions, particles are larger than those in a solution, but smaller than a suspension. Typically the particles are between 1 nm and 1000 nm

Example

A muddy puddle. At the bottom of the puddle there will be larger particles that fell out of suspension, but the water remains cloudy. The cloudy part is the colloid.

The colloidal particles are known as the **dispersed phase**, the water as the **dispersing medium.**

Table 13.7 Types of Colloids

Colloid Type	Dispersed Substance	Dispersing Medium	Example(s)
Aerosol	Liquid	Gas	Fog
Aerosol	Solid	Gas	Smoke
Foam	Gas	Liquid	Whipped cream
Solid foam	Gas	Solid	Marshmallow
Emulsion	Liquid	Liquid	Milk
Solid emulsion	Liquid	Solid	Butter
Sol	Solid	Liquid	Paint; cell fluid
Solid sol	Solid	Solid	Opal

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Tyndall Effect

-when light is shined into a "clear" colloidal, the particles become visible

Comparison of Solutions, Colloids, and Suspensions

Type of Mixture	Type of Particle	Effect of Light	Settling	Separation
Solution	Small particles such as single atoms, ions, or molecules	Transparent	Particles do not settle	Particles cannot be separated by filters or semipermeable membranes
Colloid	Larger molecules or groups of molecules or ions	Tyndall effect	Particles do not settle	Particles can be separated by semipermeable membranes
Suspension	Very large particles that may be visible	Opaque	Particles settle rapidly	Particles can be separated by filters

Conducting Electricity....

an **electrolyte** is a substance that when dissolved in water, it creates a solution that DOES conduct electricity.

-ionic compounds disassociate into cations and anions and will thus conduct electricity

-some highly polar covalent compounds will **ionize** in water an conduct electricity

nonelectrolytes do not conduct electricity when dissolved into a solution

Factors that affect the rate of dissolution

- Surface area: the more surface area the solute has, the quicker it will dissolve

-Agitating a solution: the solution closer to the solute is at a higher concentration, by agitating the solution, you allow more solvent to interact with the solute

-Adding heat: with higher temperatures, the particles of the solvent have a higher KE and are thus moving faster. Faster moving particles can more quickly interact with and dissolve the solute

Solubility

-this refers to how much of a solute can be dissolved by a solvent

Solution Equilibrium is the physical state in which the opposing processes of dissolution and crystallization of a solute occur at equal rates.

Saturated Solution is one that contains the maximum amount of dissolved solute

Unsaturated Solution is one in which there is less than the maximum amount of dissolved solute

Supersaturated Solution is one in which more than the maximum of solute is dissolved in the solution.

This occurs when a solution is saturated at a higher temperature and then is allowed to cool undisturbed. The solute will remain dissolved until it is either agitated or a crystal known as a "seed" is added which causes a chain reaction that allows the solute to fall out of solution.

Solubility of a substance is the amount of that substance required to form a saturated solution with specific amount of solvent at a specified temperature

"Like Dissolves Like"

-this is a useful rule to help determine what solutes will dissolve in what solvents

factors involved are the type of bonding, polarity or non-polarity of molecules, and intermolecular forces

Dissolving Ionic Compounds in Water

Since water is such a polar molecule, ionic compounds separate in solution and the cations are attracted to the O and the anions to the H.

This process is often referred to as **hydration**.

The ions are said to be **hydrated.**

They are then referred to as **hydrates** which have specific ratios of water molecules in their formulas, such as $CuSO_4 \cdot 5H_2O$ which has the name of copper (ii) sulfate pentahydrate.

Nonpolar Solvents

Ionic compounds will not typically dissolve in nonpolar solvents such as carbon tetrachloride. Essentially, there is not enough attraction between the solvent and solute molecules to overcome the attractions between the ionic compounds themselves