بسم الله الرحمن الرحيم

Solutions colloidal system

- **Fluids in living system are complex mixtures of colloids, ions and molecules. The behavior of these fluids in the body is vital of life.**

- Solutions are homogeneous mixtures of two or more components.
- Solute = a substance dissolved in a solvent to form a solution; usually the smaller portion.
- Solvent = The dissolving medium of a solution; usually the greater portion.
- Solubility: Is an ability of a substance to dissolve. In the process of dissolving.
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- **Some substances, like water and alcohol, can be mixed together and create a homogenous phase in any proportion. A solubility measure cannot be applied to such two substances. Such substances are called *miscible*. On the other hand if two substances cannot be mixed together (like water and oil), they are called *immiscible*.**

Solutions

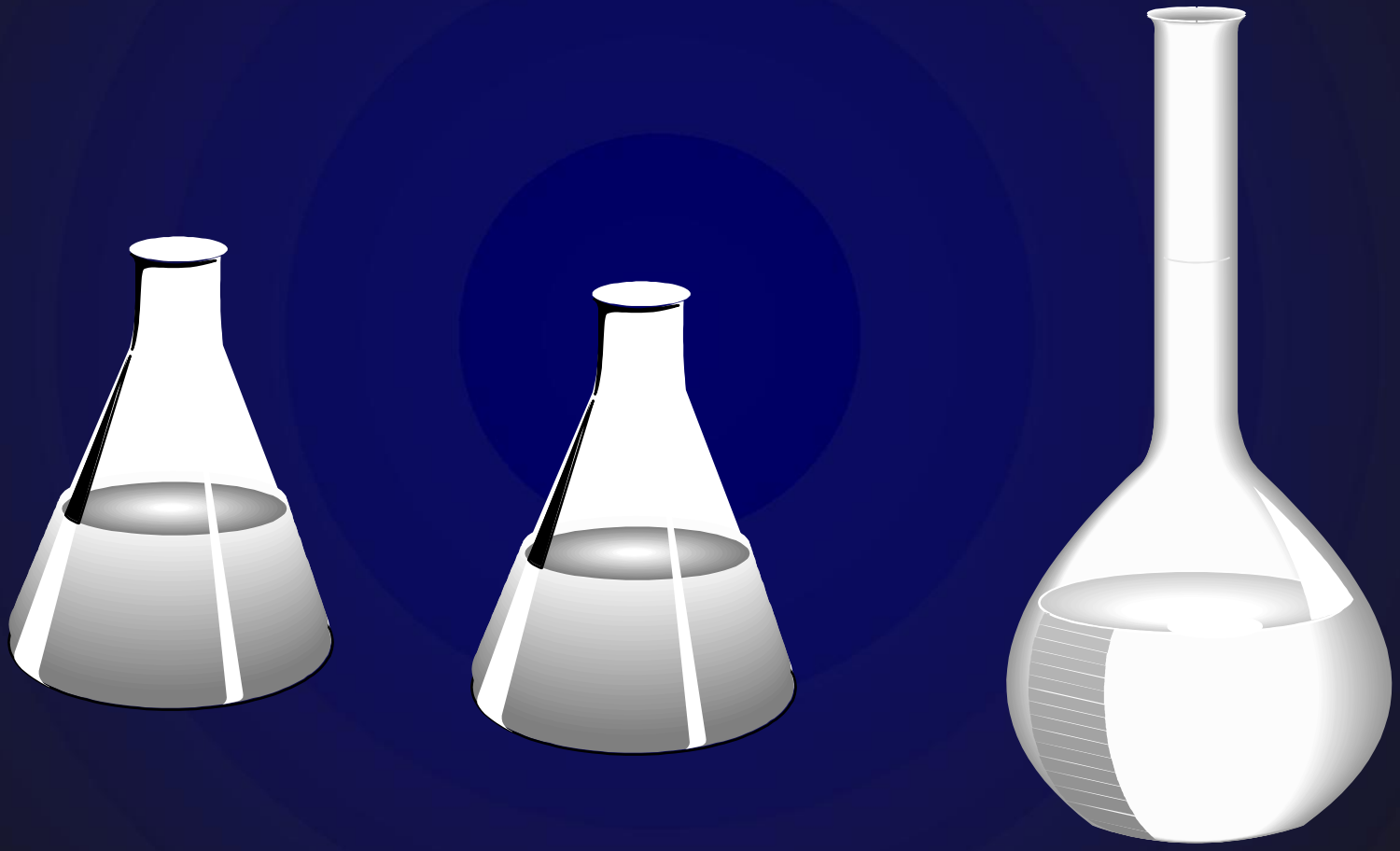
Heterogeneous

Heterogeneous: mixture are those which are not homogeneous.

Homogenous

Homogeneous mixtures are those in which the smallest samples are everywhere identical in composition and properties.

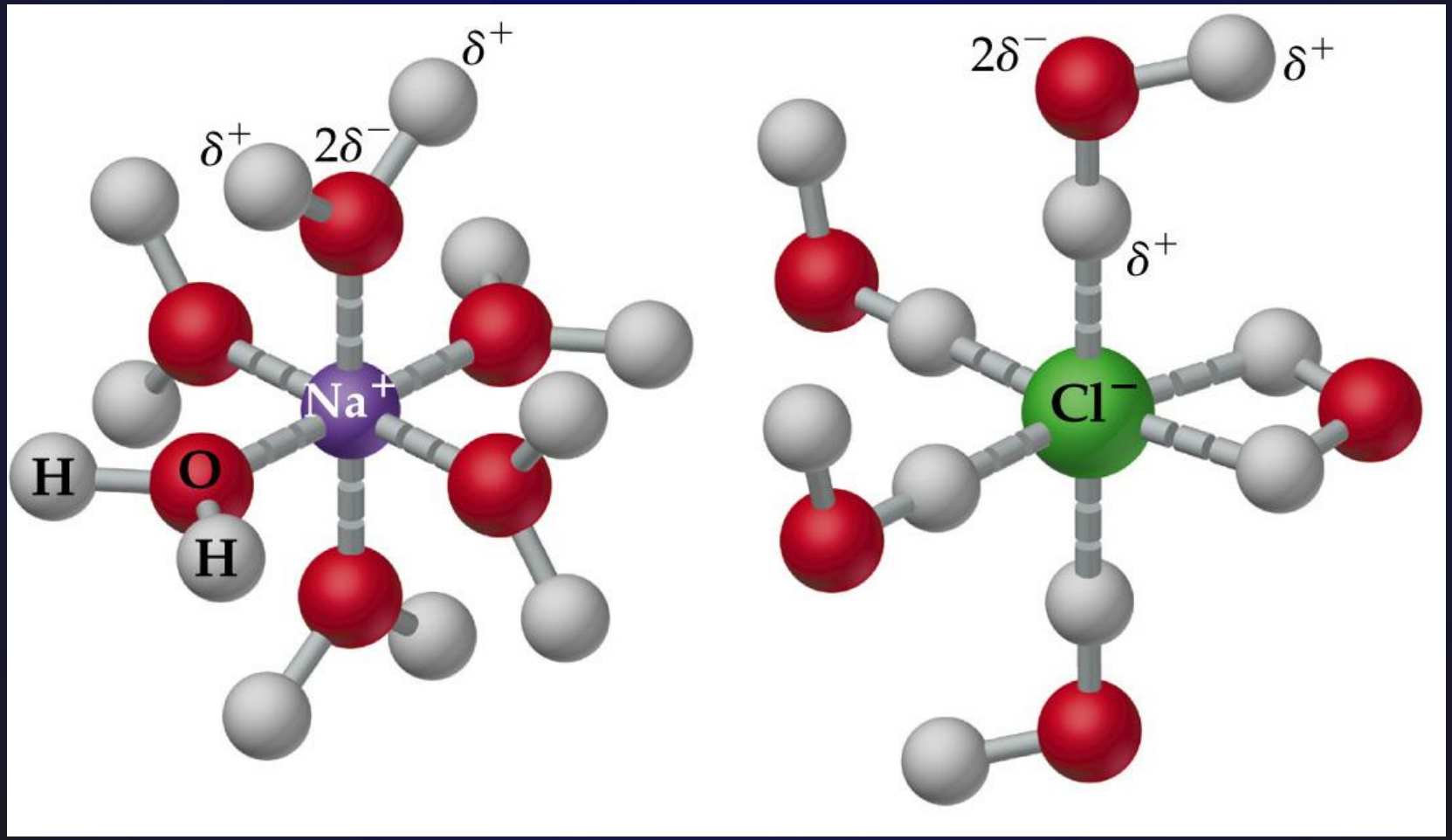
Types of Solutions



There are five main types of solution as shown in the table below:

State of Solution	Original State of Solute	State of Solvent	Examples
Gas	Gas	Gas	Air, natural gas;
Liquid	Liquid	Liquid	alcoholic beverages, antifreeze
Liquid	Solid	Liquid	seawater, sugar solution, etc.
	Gas	Liquid	carbonated (soda) water
Solid	Solid	Solid	metal alloy, e.g., steel, brass, bronze, etc;

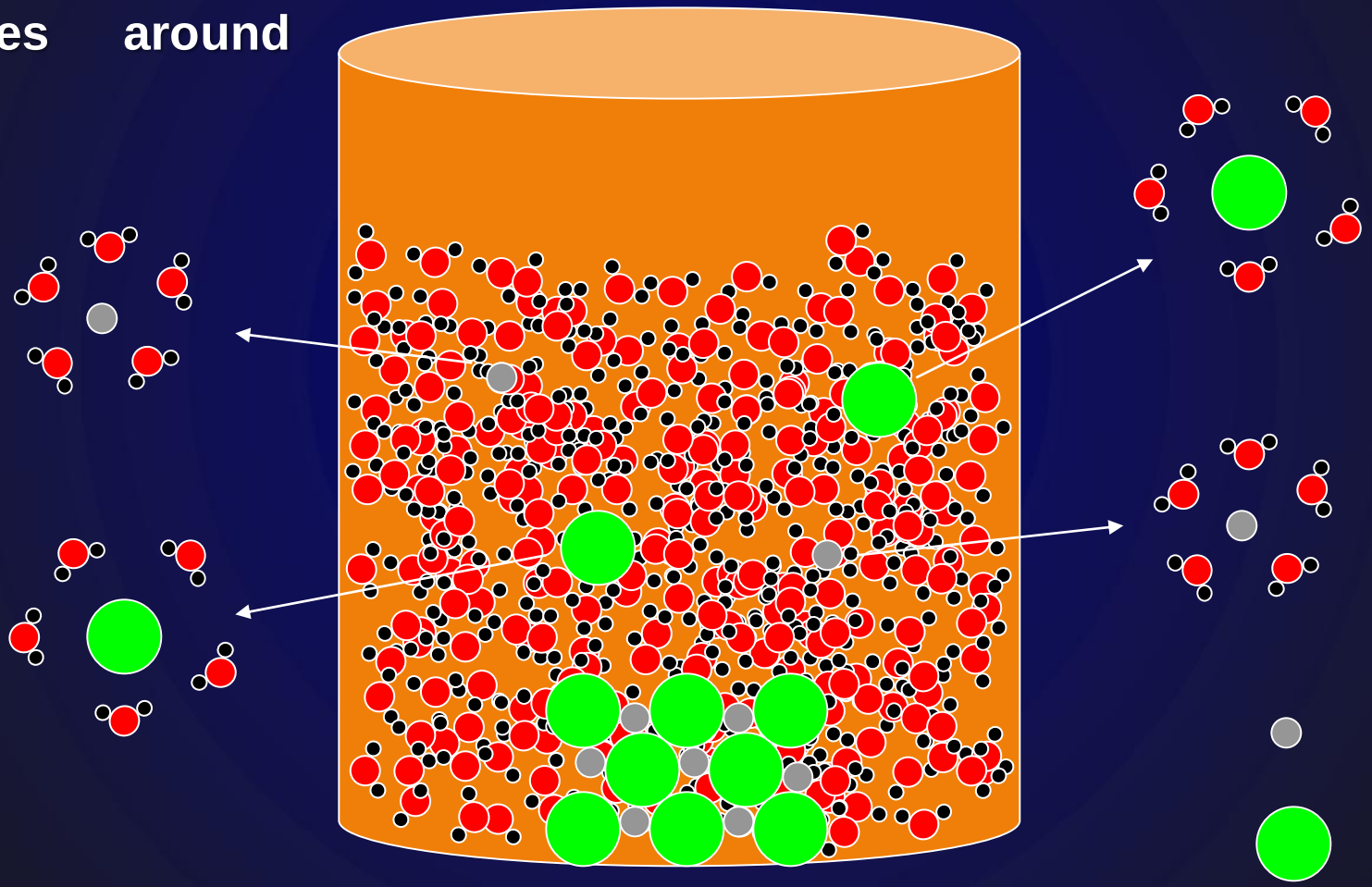
The Solution Process Hydration or Solvation



Dissolving process in water

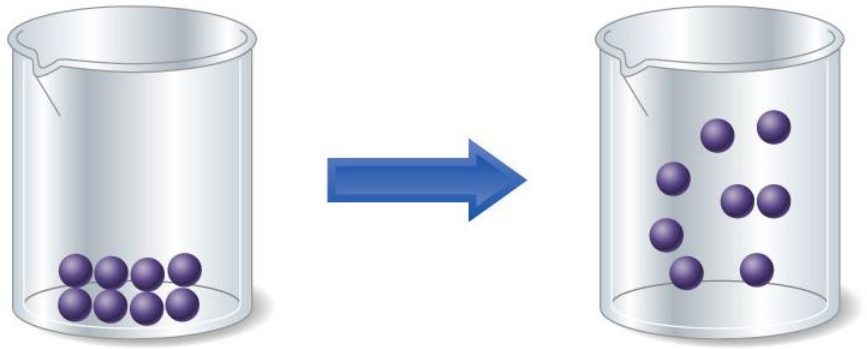
2. Hydration of solute

Orientation of water molecules around solute

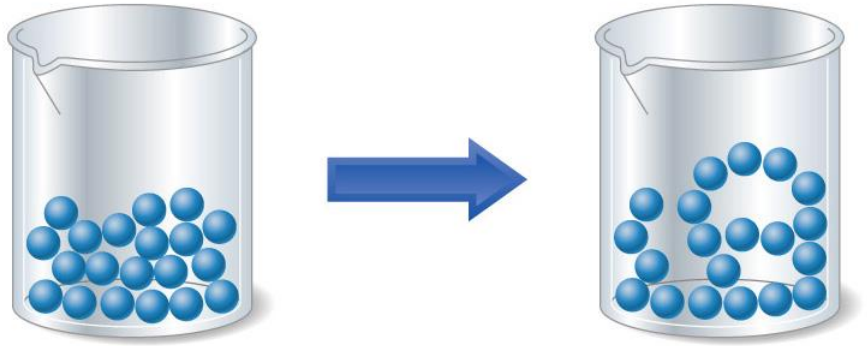


1. Overcome attractive forces in solid

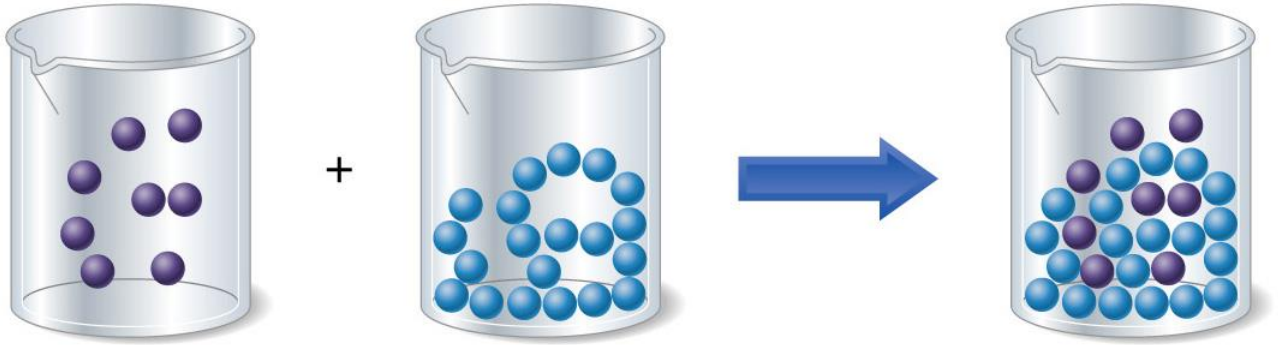
Three Steps of Solution Formation



ΔH_1: Separation of solute molecules



ΔH_2: Separation of solvent molecules



ΔH_3: Formation of solute-solvent interactions

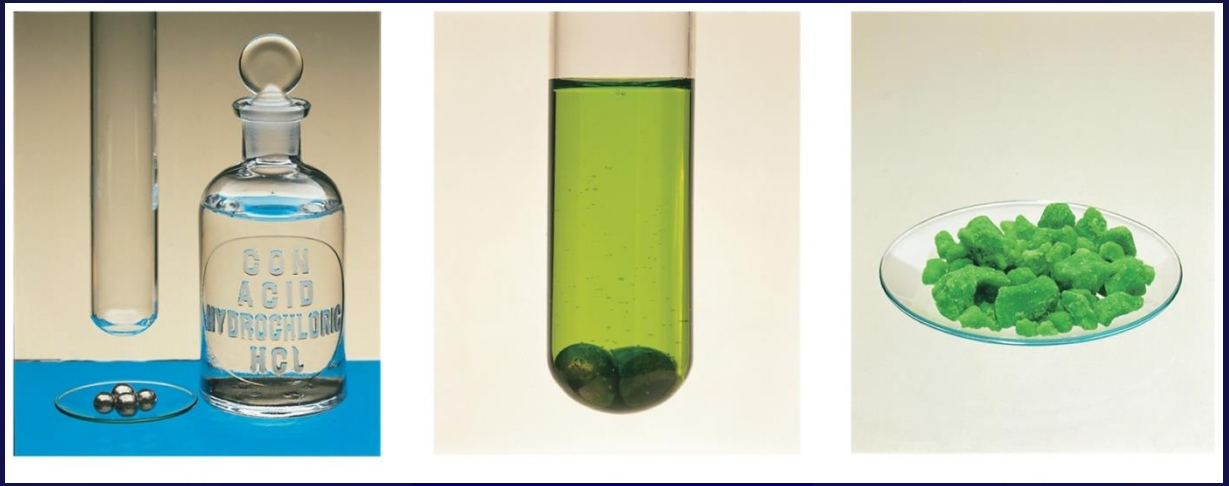
Factors Affecting Solubility

- Intermolecular Forces
- Pressure
- Temperature

General Rule: "*Like dissolves Like*"

- **Polar solvents tend to dissolve polar or ionic solutes.**
- **Non-polar solvents tend to dissolve non-polar solutes.**

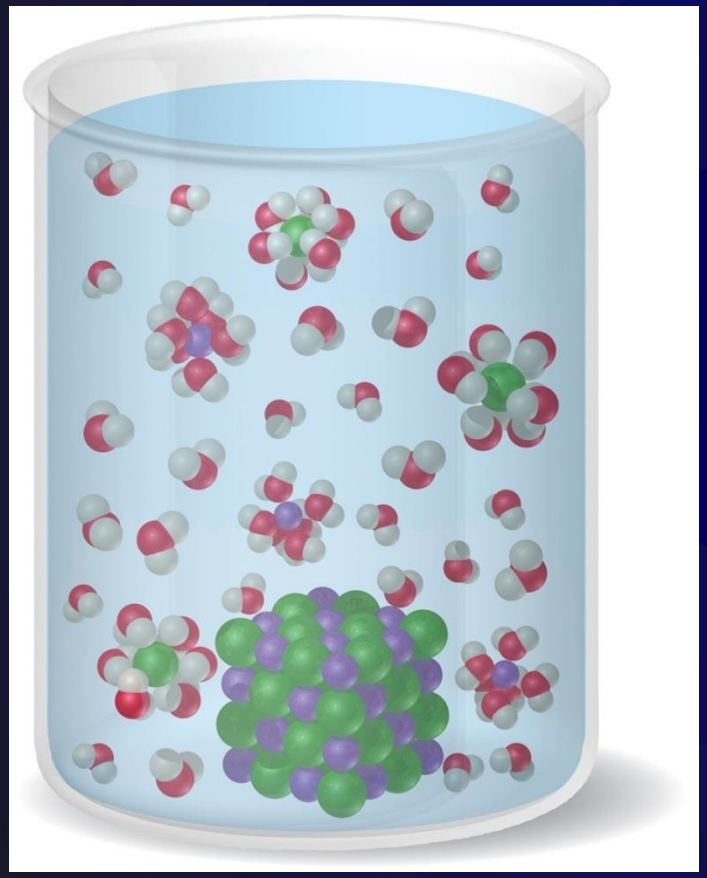
Dissolution vs reaction



$Ni(s) + HCl(aq) \longrightarrow NiCl_2(aq) + H_2(g)$ $\xrightarrow{dry}$ $NiCl_2(s)$

- Dissolution is a physical change—you can get back the original solute by evaporating the solvent.
- If you can't, the substance didn't dissolve, it reacted.

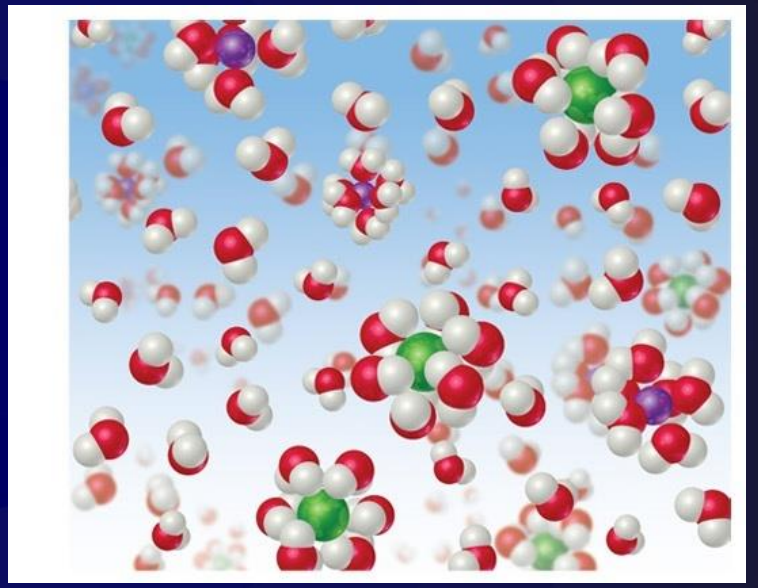
Degree of saturation



- Saturated solution
  - Solvent holds as much solute as is possible at that temperature.
  - Undissolved solid remains in flask.
  - Dissolved solute is in dynamic equilibrium with solid solute particles.

Degree of saturation

- **Unsaturated Solution**
  - Less than the maximum amount of solute for that temperature is dissolved in the solvent.
  - No solid remains in flask.



Degree of saturation

- **Supersaturated**
  - **Solvent holds *more* solute than is normally possible at that temperature.**
  - **These solutions are unstable; crystallization can often be stimulated by adding a “seed crystal” or scratching the side of the flask.**

- **Generally it is useful to know what substances dissolved in water and what factors affected the solubility especially in clinical work in order to specify exactly the amount of solute in solution, the method diverse from substance to other and from solvent to other.**

Colloids and colloidal dispersions

Colloids

Colloid-- A mixture of two phases of matter

emulsions	*aerosols*
smoke	*fog*
foams	*gels*
milk	*clouds*

Gel & Foam

Clouds

Milk

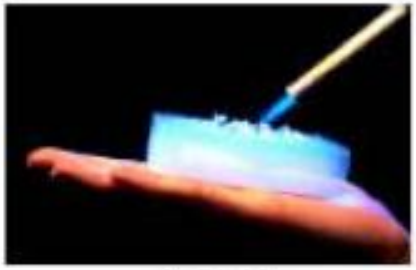
Examples of colloidal systems from daily life

Foams

Milk

Fog, smoke

Detergents



Aerogel

Blood

Paints

Cosmetics

Tyndall Effect

- Colloidal suspensions can scatter rays of light.
- This phenomenon is known as the Tyndall effect.

Why the particles in colloidal solution do not settled down?

- The reason is that all the particles have the same electrical charges which caused by the adsorption of ions to the surface of the particles or the large particles themselves can be charged. As a result the particles repel from each other and cannot form large enough to settle down.

- **Suspension:** is a heterogeneous mixture of two or more substances. In a suspension, very small pieces of solid are spread through a liquid but do not dissolve. If left, the solid pieces will separate from the liquid and either fall to the bottom or rise to the top. Sand in water is a suspension. Suspensions may separate quickly or stay suspended for a long time, depending on what they contain.
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Suspensions

- Have very large particles
- Settle out
- Can be filtered
- Must stir to stay suspended (Examples; Blood platelets, Muddy water).

What are the differences between solution and colloidal solutions?

Solutions

- Have small particles (ions or molecules)
- Are transparent
- Do not separate
- Cannot be filtered
- Do not scatter light

Colloids

- Have medium size particles
- Cannot be filtered
- Separated with semipermeable membranes
- Scatter light (Tyndall effect)

Thank you