

Solutions

Solutions are of Three types.

(A) True Solutions

(B) Suspension

(C) Colloids

(A) True Solutions :

? A solution is a homogeneous mixture of two or more pure substances. A solution is made up of two parts i.e., a solute and a solvent. Usually the component which is present in larger amount is called solvent and the other is called solute.

Ex. In case of solution of sugar and water, sugar is the solute and water is the solvent.

? **Aqueous solutions**

The solutions made by dissolving various solutes in water are called aqueous solutions.

Properties of solutions

- ? A solution is homogeneous in nature.
- ? The solute particles in a solution easily pass through a filter paper. Thus, a true solution passes through a filter paper.
- ? The solute particles in a solution cannot be seen by naked eyes.
- ? The properties of solute are retained in the true solution. Thus a sugar solution is sweet in taste and a solution of salt in water is saline in taste.
- ? A true solution does not scatter light and hence does not show tyndall effect. In other words, solutions are transparent to light.
- ? The solute particles in a solution do not settle on keeping.
- ? The diameter of solute particles in a solution is about 10^{-9} m.

Types of solutions

? **Solution of solid in a solid** : Metal alloys are the solutions of solids in solids.

Ex. Brass is a solution of zinc in copper. Brass is prepared by mixing molten zinc with molten copper and cooling their mixture.

? **Solution of solid in a liquid** : This is the most common type of solutions. Sugar solution and salt solution are the solutions of solids in liquids. A solution of iodine in alcohol called 'tincture of iodine' is also a 'solid in a liquid' type of solution. This is because it contains a solid (iodine) dissolved in a liquid (alcohol) solution.

- ❓ **Solution of liquid in a liquid** : Vinegar is a solution of acetic acid (ethanoic acid) in water
- ❓ **Solution of gas in a liquid** : Soda-water is a solution of carbon dioxide gas in water
- ❓ **Solution of gas in a gas** : Air is a solution of gases like oxygen, argon, carbon dioxide and water vapour, etc., in nitrogen gas. Nitrogen is the solvent in air and all other gases are solutes.

(B) Suspensions:

A suspension is a heterogeneous mixture in which the small particles of a solid are spread throughout a liquid without dissolving in it.

Ex. Chalk-water mixture, Muddy water, Milk of magnesia, Sand particles suspended in water, and Flour in water.

Properties of suspensions

- ❓ A suspension is a heterogeneous mixture.
- ❓ The particles of a suspension do not pass through a filter paper. Hence, it is possible to separate them by ordinary filtration.
- ❓ The particles of suspension can be seen with naked eyes or with the help of a simple microscope.
- ❓ The particles of suspension settle down when a suspension is left undisturbed. Thus, a suspension is unstable.
- ❓ The size of particles in a suspension is greater than 100 nm in diameter.
- ❓ A suspension is not transparent to light.

(C) Colloids:

- ❓ A colloid is a kind of solution in which the size of solute particles is intermediate between those in true solutions and those in suspensions. The size of solute particles in a colloids is bigger than that of a true solution but smaller than those of a suspension.

Dispersed particles

The solute particles are also called 'dispersed particles'

Dispersion medium

- ❓ Solvents are also known as dispersion medium.
- ❓ Solution, suspensions and colloids differ in the size of solute particles, the size of particles being minimum in solutions and maximum in suspensions.

Properties of colloidal solutions

- ❓ **Heterogeneous Nature** : A colloidal solution is heterogeneous in nature. It consists of two phases : dispersed phase and dispersion medium.
- ❓ **Filtrability** : The size of the colloidal particles is less than the pores of a filter paper, and, therefore, they easily pass through a filter paper. Colloidal particles however, cannot pass through the parchment paper or an animal membrane or ultra-filter.
- ❓ **Tyndall Effect** : When a strong beam of light is passed through a colloidal solution placed in dark place, the path of the beam gets illuminated by a bluish light . This phenomenon is called **Tyndall effect**. The phenomenon is due to the scattering of light by the colloidal particles.
- ❓ The same phenomenon is noticed when a beam of sunlight enters a dark room through a small slit, due to scattering of light by dust particles in the air.
- ❓ **Visibility** : Colloidal particles are too small to be seen by the naked eye. They however, scatter light and become visible when viewed through an **ultra microscope**.
- ❓ **Brownian movement** : When colloidal particles are seen under an ultra microscope, the particles are found to be in constant motion in zig-zag path in all possible directions. This zig-zag motion of colloidal particles is called Brownian movement. The movement of the particles is due to the collisions with the molecules of the dispersion medium.
- ❓ **Diffusion** : Colloidal particles diffuse from a region of higher concentration to that of lower concentration. However, because of their bigger sizes colloidal particles move slowly and hence diffuse at slower rate.
- ❓ **Sedimentation or settling** : Under the influence of gravity, the solute particles tend to settle down very slowly. This rate of settling down or sedimentation can be accelerated by the use of high speed centrifuge called ultra-centrifuge.

Classification of colloids

Colloids are classified according to the physical state of dispersed phase (solute) and the dispersion medium (solvent). Most of the colloids can be classified into the following seven groups.

- ❓ **Sol** : Sol is a colloid in which tiny solid particles are dispersed in a liquid medium.
Ex. Ink, Soap solution, starch solution and most paints.
- ❓ **Solid sol** : Solid sol is a colloid in which solid particles are dispersed in a solid medium.
Ex. Coloured gemstones (like ruby glass).
- ❓ **Aerosol** : An aerosol is a colloid in which a solid or liquid is dispersed in a gas (including air).
Ex. The examples of aerosols in which a solid is dispersed in a gas are : Smoke (which is soot in air) and Automobile exhausts. The examples of aerosols in which a liquid is dispersed in a gas are : Hairspray, Fog, Mist and clouds.

❓ **Emulsion** : An emulsion is a colloid in which minute droplets of one liquid are dispersed in another liquid which is not miscible with it.

Ex. Milk, butter and Face cream.

❓ **Foam** : The foam is a colloid in which a gas is dispersed in a liquid medium.

Ex. Fire-extinguisher foam ; Soap bubbles, shaving cream and Beer foam.

❓ **Solid foam** : The solid foam is a colloid in which a gas is dispersed in a solid medium.

Ex. Insulating foam, foam rubber and Sponge.

❓ **Gel** : The gel is a semi-solid colloid in which there is a continuous network of solid particles dispersed in a liquid.

Ex. Jellies and Gelatin.