COLLOIDS

① ∴ colloidal solution :-

colloidal solution is a binary systems in which the particle size of the dispersed phase is of the order of 1mμ – 0.1μ.

colloidal solution is a ∴ heterogeneous binary system.

Example: Starch paste, gelatin when added to hot water and the mixture is shaked well, colloidal solutions of the substance are formed.

② True solutions :-

The size of the particles in true solution is less than 1mμ

$(1 m\mu = 10^{-9} m)$

True solutions are as clear as water and transparent to light.

The particles of solute in a true solution are either single molecules (or) ions.

These cannot be separated by filtration.

Examples: ① Nacl solution.
② sugar solution.

③ Suspensions

If the particle size of the solute (dispersed phase) in the binary system is greater than 1 μ, a suspension is formed.

Differences between colloidal, true and supension solutions

S.NO	property	True solution	colloidal solution	Suspensions.
1.	particle size	< 1 mμ	1 mμ - 0.1 μ	> 1 μ
2.	Nature of the system	Homogeneous	Heterogeneous	Heterogeneous.
3.	stability	Highly stable	less stable	stable.
4.	separation of solute by ultrafiltration.	not possible	possible	possible.

Q ① What are colloids? How are colloids classified? Give examples?

Ans: colloidal solution is a binary systems in which the particle size of the dispersed phase is of the order of 1 mμ - 1 μ.

colloidal solution is a heterogeneous binary system.

Example: starch, gelatin when added to water and the mixture is shaken well, colloidal solutions of the substance are formed.

A colloidal solution is a heterogeneous system, consisting of a dispersed phase and the dispersion medium.

The substance distributed in a dispersion medium as colloidal particles in a heterogeneous system of colloidal solution is called as dispersed phase.

The continuous medium of the heterogeneous colloidal solution, in which the colloidal particles are dispersed is called as dispersion medium.

colloidal solutions are generally abbreviated as "sols"

① Gold sol :

Dispersed phase = gold particles.

Dispersion medium = Water.

② Smoke :

carbon particles are dispersed in air to give the colloidal solution "smoke".

Dispersed phase = carbon particles.

Dispersion medium = Air.

Classification of colloids

colloidal solutions are classified into two types. They are

① Lyophilic colloids (solvent loving)
② Lyophobic colloids (solvent hating)

① Lyophilic colloids

The colloidal solution in which the dispersed phase has great affinity to the dispersion medium is called as Lyophilic colloid.

Example: starch solution.

The starch paste when dissolved in hot water, with stirring, then the starch solution is formed. The starch particles (dispersed phase) has great affinity to water molecules (dispersion medium). So starch solution is a lyophilic solution (or) lyophilic colloid.

② Lyophobic colloid:

The colloidal solution in which particles of the dispersed phase have no affinity for the dispersion medium.

Example: colloidal solution of gold.

These solutions are relatively less stable.

Differences between Lyophilic and Lyophobic colloids (sols)

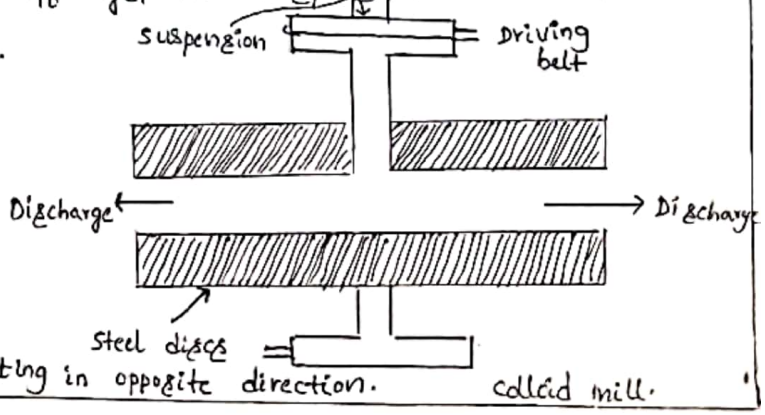
S.NO.	property	Lyophilic colloids	Lyophobic colloids
1.	preparation	These can be easily prepared by direct mixing	prepared only by special methods.
2.	Nature	Reversible	Irreversible.
3.	stability	self stabilised.	Less stable
4.	Action of electrolyte.	For coagulation of sol, large amount of electrolytes are required.	For coagulation, small amounts of electrolytes are required.
5.	Tyndall effect	It does not exhibit Tyndall effect.	It exhibits Tyndall effect.

② Discuss the various methods of preparation of colloids?

Dispersion methods

① By mechanical disintegration:

It is done with the help of a colloid mill. The mill consists of two steel discs with a small gap between them. The discs rotate in opposite direction at high speed. The substance whose sol is to be prepared is first grind as finely as possible and then shaken with the dispersion medium to get a suspension. The suspension is added to the colloid mill. The speed of the rotating discs is adjusted and the particles of the suspension are broken to produce the particles of colloidal size.



Colloid mill.

② By Bredig's arc method :-

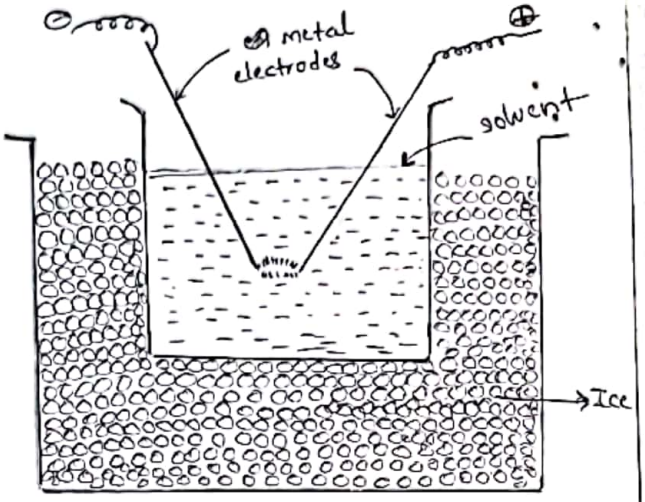
metals like pt, Ag, cu, etc. are converted into their colloidal solution by this method.

metal electrodes are immersed in the dispersion medium.

The dispersion medium is further placed in the freezing mixture.

When an electric arc is struck, an intense heat of the arc turns the metal into the vapours.

The vapours get condensed by the ice cold water to give particles of colloidal size. A little "KOH" is added to water (dispersion medium) in order to stabilise the sol.



Bredig's arc method

condensation methods:

① When hydrogen sulphide gas is passed through dilute nitric acid to form a milky colloidal solution of sulphur.

$$H_2S + (O) \xrightarrow{HNO_3} H_2O + S \text{ (colloidal)}$$

② Reduction :-

When an auric chloride solution is treated with stannous chloride solution to form gold colloidal solution.

$$2AuCl_3 + 3SnCl_2 \longrightarrow 3SnCl_4 + 2Au \text{ (colloidal)}$$

③ Hydrolysis :-

This method is used to prepare sol of hydroxide of metals.

Take 500ml of boiling water and add 2-3ml of $FeCl_3$ solution and the reaction mixture is shaking to form sol of ferric hydroxide.

$$FeCl_3 + 3H_2O \longrightarrow Fe(OH)_3 + 3HCl.$$

③ Explain the properties of colloids?

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April-2006.

(OR)

Explain kinetic, optical and electrical properties of colloids?

Ans: ① optical properties:-

① colour:-

colloids are coloured. The colour of a sol depends upon its nature of particles and the wavelength of the light. its

Example: Finest gold sol is red in colour and as the size of particles increases it becomes purple, then blue and finally golden spangles.

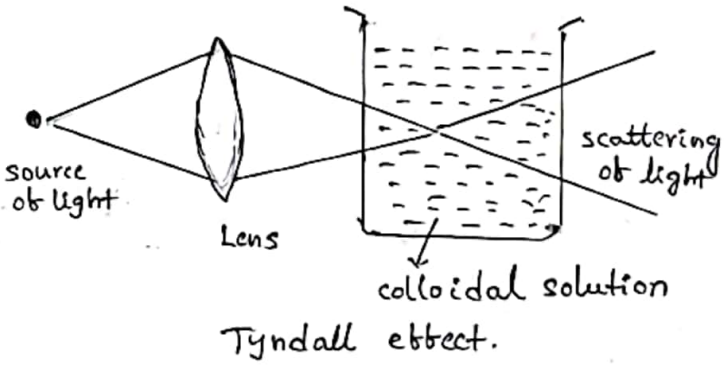
② Tyndall effect:-

When light enters a colloidal solution, it is scattered by the large sized colloidal particles.

The phenomenon of scattering of light by colloidal (sol) particles is called Tyndall effect.

The diameter of the particles of the dispersed phase must not be much smaller than wavelength of the light used then the show the Tyndall effect.

Blue colour of sky and sea water are due to scattering of light. (Tyndall effect).



Tyndall effect.

(II) Kinetic properties of colloids:-

① Diffusion:-

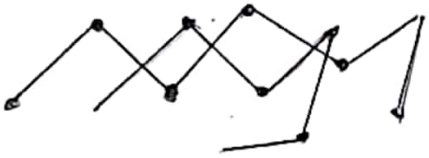
colloid particles diffuse from a region of higher concentration towards a lower concentration region. The diffusion is slow due to large size of particles as compared to true solution.

② Brownian movement :-

When a colloidal solution is examined by ultramicroscopic, the colloidal particles are found to be moving in a rapid zig-zag motion. This rapid motion of colloidal particles is called Brownian movement.

This motion is due to unequal bombardment of colloidal particles by molecules of dispersion medium.

Smaller the colloidal particles, the more rapid is the Brownian movement.



Brownian motion.

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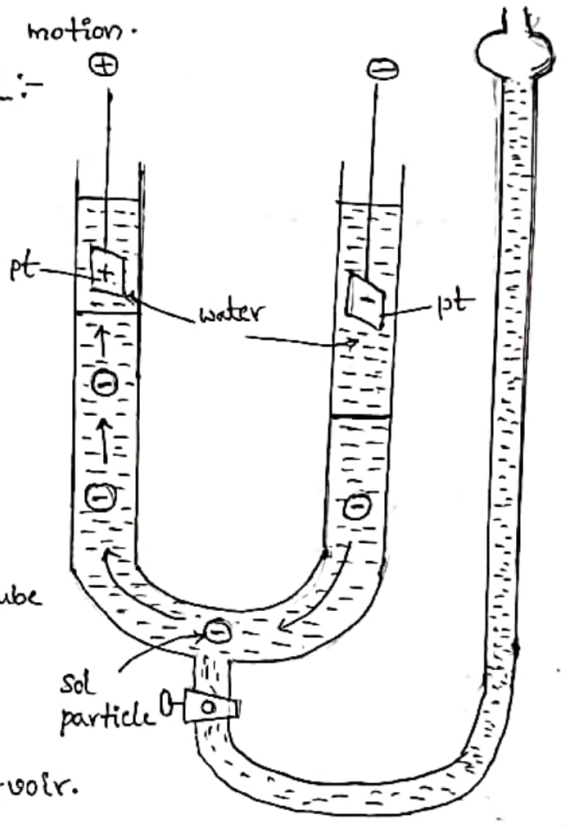
(III) Electrical properties of colloids :-

The migration of colloidal particles under the influence of an electric field towards an electrode is called electrophoresis.

If the movement of colloidal particles under the influence of an electric field towards cathode, it is called as cataphoresis



The apparatus consists of a U-tube provided with two "pt" electrodes and a stop cock, which it is connected to a funnel shaped reservoir.

A small amount of water is placed in the "U" tube and a quantity of the sol is taken in the reservoir. The stopcock is opened and introduce the sol in the U-tube. When an electric current is passed through the electrodes, the colloidal particles move towards the electrodes.

Example: When the particles are negatively charged (As_2S_3 sol) move towards anode electrode.

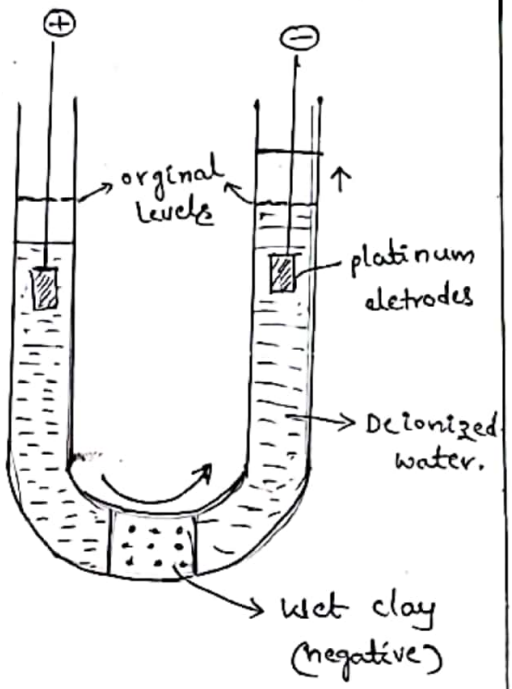
(iv) Electro-osmosis:-

The movement of the dispersion medium under the influence of an electric field is called "electro-osmosis".

The apparatus consists of a "U"-tube fitted with a plug of wet clay (a negative sol). The two limbs of the tube are filled with water to the same level.

The "pt" electrodes are immersed in water. When an electric current is passed by connecting the electrodes to the battery, then the dispersion medium is move towards the negative electrode.

This shows that the charge on the medium is positive.



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Q(4) What is a coagulation of colloid? How can it be prevented?
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Ans: coagulation:- (OR) (flocculation) :-

The phenomenon of colloidal substance loosing charge and coming down as a precipitate on addition of an electrolyte to the colloidal solution is called coagulation.

Example: Arsenous sulphide (As_2S_3) colloid is negatively charged. It can be precipitated by adding NaCl, $BaCl_2$ (or) $AlCl_3$.

prevention of coagulation:-

Lyophilic colloids are stable. A lyophobic colloid (sol) is presented coagulated by the addition of an electrolyte. This can be prevented by the previous addition of a lyophilic sol like gelatine. This is known as protection of a colloid.

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2, 1M. (5) What is Gold Number?

***Imp. Ans:

Gold Number:-

Gold number is defined as the weight (in mg) of a protective colloid which prevents the coagulation of 10ml of a given gold sol on adding 1ml. of 10% solution of sodium chloride.

Example:

Gelatin having gold number 0.005 – 0.01

capacity of Lyophilic colloid in protecting lyophobic colloid is measured in terms of gold number.

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Q. (6) Write notes on emulsions and gels?

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V.V.Imp.

Ans: Emulsions :-

The dispersion of finely divided droplets of a liquid in another liquid medium is called as emulsion.

Examples: ① Milk:
In this liquid - fat is dispersed in water.

② stiff grease:

classification of emulsions :-

They are classified into two types. They are

① oil in water (O/W) and

② Water in oil (W/O) (∵ O = oil and W = water)

① oil in water type emulsions :-

In this type of emulsions, the dispersed phase is oil and the dispersion medium is water.

Example: ① Milk : Fat in water.

② vanishing cream : fat in water.

② Water in oil (W/O) type emulsions :-

In this type of emulsions, the dispersed phase is water and the dispersion medium is oil.

Example: cold cream : Water in fat.

(II) Gels :-

colloidal systems containing a liquid dispersed in solid are called as gels.

Example: When a warm sol of gelatin is cooled, it sets to a semi-solid mass which is gel.