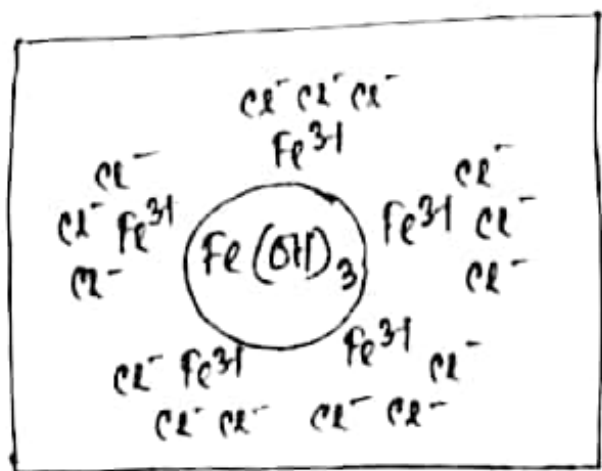


$Fe^{3+} / Al^{3+} / Cr^{3+} \xrightarrow{NH_4OH} Fe(OH)_3 / Al(OH)_3 / Cr(OH)_3$ precipitate in group IIIA.

$Fe(OH)_3$ precipitated materials + $FeCl_3 \rightarrow$ sol particle dispersion water.

$Al(OH)_3$ precipitated materials + $HCl \rightarrow$ sol particle dispersion water.



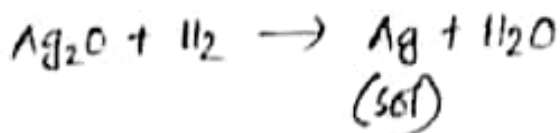
Peptization method.

The dispersal of a precipitated material into colloidal solution by the action of an electrolyte in solution, is termed

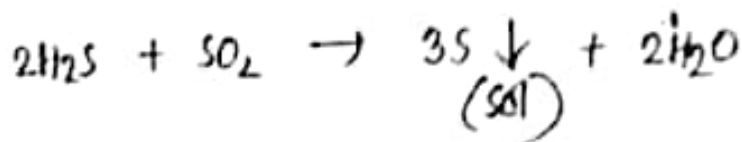
Reduction method:

This method can also be used for the preparation of sols of noble metals by the addition of reducing agent to a solution of suitable compounds of the metals. The compounds which are used as a reducing agent ($H_2, CO_2, NH_2-NH_2, NH_2OH$) would not be electrolyzed.

Example: sols of Ag can be prepared by passing H_2 gas through an aqueous suspension of Ag_2O .



Oxidation method: sols of sulphur or selenium can be prepared by oxidation of H_2S or selenium in SO_2 or air.



precipitation of 10 ml of a gold sol on the addition of 1 ml of 10 per cent sodium chloride solution.

The smaller the gold number of a hydrophilic colloid, the greater is its protective power.

Lyophilic colloid

Gelatin
Egg albumen
Gum arabic
Potato starch

Gold number

0.005 - 0.01
0.08 - 0.10
0.10 - 0.15
25

2. Emulsions

An emulsion may be defined as a dispersion of finely divided liquid droplets in another liquid.

3. Gel A gel is a jelly like colloidal system in which liquid is dispersed in a solid medium.

4. Application of colloids:

- (i) In purification of air from industrial smoke
- (ii) In removal of suspended solid particles from water.
- (iii) In textile industry to fasten die dye.

Properties of colloids: / sols:

- nature of colour
- optical properties of sols
- kinetic properties of sols
- Electrical properties of sols.

Nature of colour

The colour of a hydrophobic sol depends on the wavelength of the light scattered by the dispersed particles. The wavelength of the scattered light again depends on the size and the nature of the particles.

1 Electrical Dispersion / Bredig's arc method:

Sols of noble metals can be prepared by this method. An arc is struck between the two metal electrodes held close together beneath de-ionized water. The water is kept cold by immersing the container in ice-bath and a track of alkali ($\text{NaOH}/\text{K}_2\text{CO}_3$) is added. The intense heat of the spark across the electrodes vaporises some of the metal and the vapour condenses under water. Since the metal has been ultimately converted into sol particles, this method has been treated as a dispersion.

Non metal sols can be made by suspending coarse particles of the substances in the dispersion medium and striking an arc between iron electrodes.

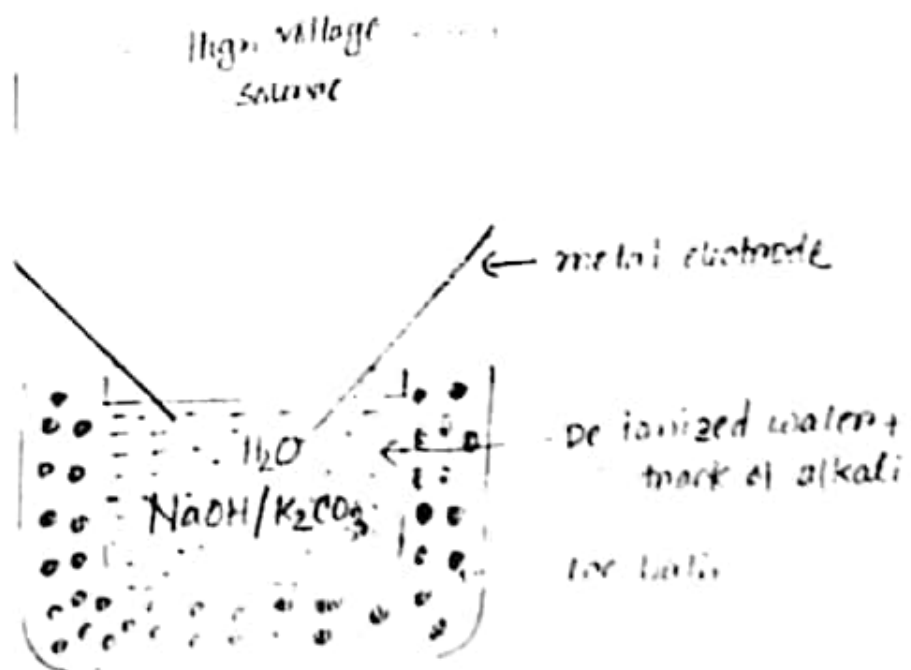


Fig: Bredig's Arc Method

- ④ In leather technology to clean raw hide
- ⑤ In cleansing action of soap and detergent.
- ⑥ In the formation of delta in the junction point of river
- ⑦ In warfare, for the purpose of concealment.

"Colloid"

Mishu
090092

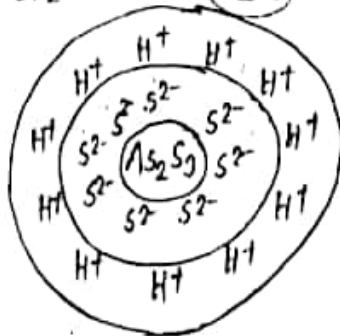
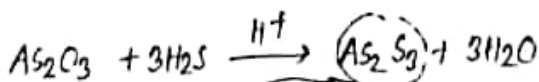
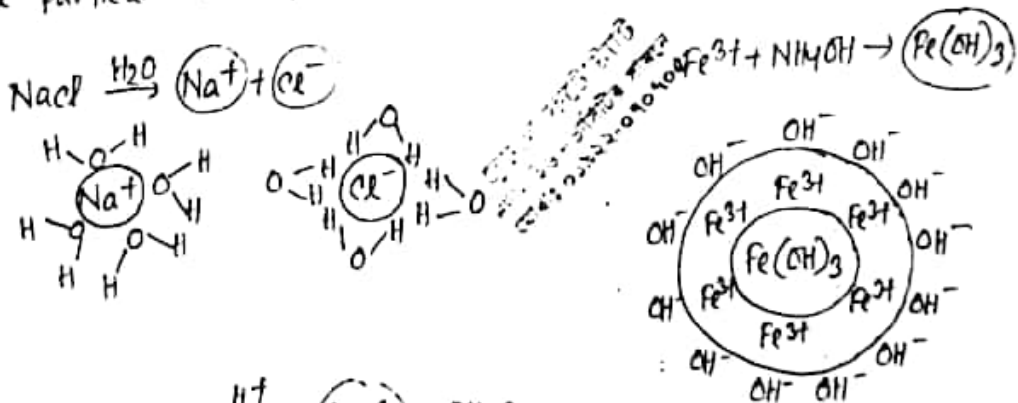
Q.1. Colloidal solution: When the diameter of the particles of a substance dispersed in a solvent ranges from about 10\AA to 2000\AA , the system is termed a colloidal solution, colloidal dispersion or simply a colloid.

2. II. Types of colloidal system

A colloidal system is made of two phases

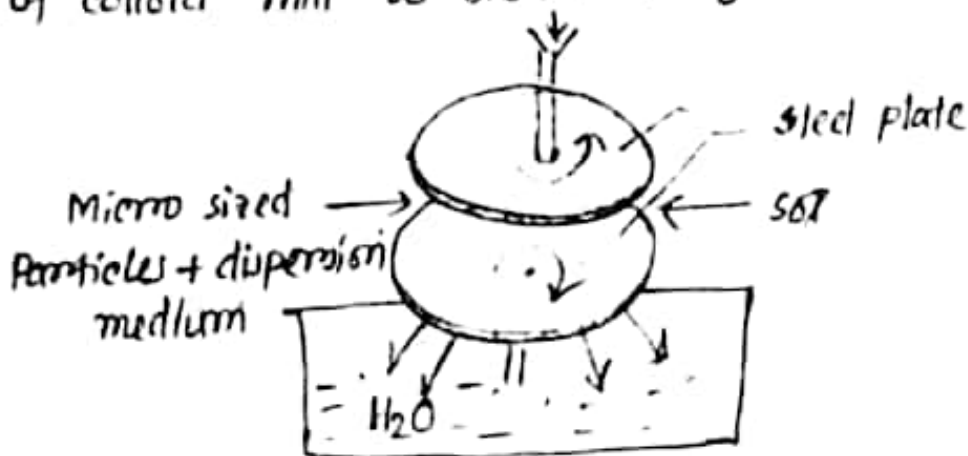
(i) Dispersed phase: The substance distributed as the colloidal particles is called the dispersed phase.

(ii) Disperse medium: The medium in which dispersion of the particles take place is called disperse medium.



Mechanical Dispersion Method

A slurry of coarse suspension is sheared between the plates of colloid mill as shown in figure.



Under the influence of pressure the bulk materials disintegrated into particles of various dimension and may reunite to ...

Classification based on the nature of dispersed phase and medium

Type Name	Dispersed Phase	Dispersed medium	Examples
Foam	gas	liquid	Whipped cream, shaving cream
Solid foam	gas	solid	foam cork, foam rubber
No sols available	gas	gas	
Aerosol	liquid	gas	fog, mist, clouds
Emulsion	liquid	liquid	milk, hair cream
Solid emulsion (gel)	liquid	solid	butter, cheese
Smoke	solid	gas	dust, soot in air
Sol	solid	liquid	paint, ink, colloidal gold
Solid sol	solid	solid	ruby glass, alloys.

Properties of colloid:

- (i) They show tyndal effect when viewed with proper illumination.
- (ii) They can't pass through a semipermeable membrane under suitable electric potential.
- (iii) They show brownian movement.
- (iv) They can be separated from the dispersion medium when an electrolyte is applied.

N.B True solute do not show these properties.

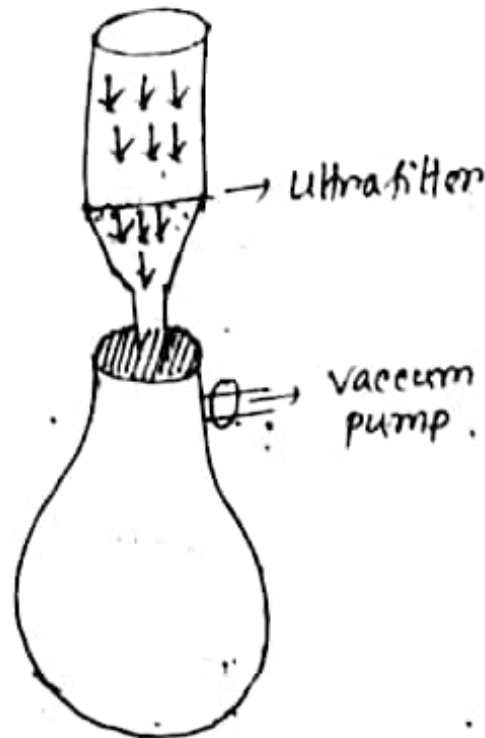
Q. Purification of colloids/sols:

In the method of preparation, the resulting sol frequently contains besides colloidal particles appreciable amount of electrolytes. To obtain the pure sol, the excess electrolytes have to be removed from the sol is called the purification of colloids.

Q. Types of purification of colloid:

① **Ultrafiltration:** Reduction of pore size of ordinary filtering media is achieved by impregnating the filtering media collodion or cellophane. Such a modified filter paper is called **ultrafilter**. **Collodion** is a partially evaporated solution of cellulose nitrate in alcohol and ether.

The separation of the sol particles from the liquid medium and electrolytes by filtration through an ultrafilter is called **ultrafiltration**.



Optical properties of sol:

① Sols exhibit Tyndall effect

[True solution] does not show Tyndall

effect. Since ions or solute molecules are too small to scatter light, the beam of light passing through a true solution is not visible when viewed from the side. This Tyndall effect can be used to distinguish a colloidal solution from a true solution

The phenomenon of scattering of light by the sol particles is called Tyndall effect.

② Ultramicroscope shows up the presence of individual particles.

③ Sol particles can be seen with an electron microscope.

Electrical Property of sols

- ① The sol particles carry an electric charge
- ② Electrophoresis: The movement of sol particles under an applied electric potential is called electrophoresis.
- ③ Electro-osmosis: The movement of the dispersion medium under the influence of applied potential is known as electroosmosis.
- ④ Coagulation or precipitation: The flocculation and settling down of the discharged sol particles is called coagulation or precipitation of the sol.

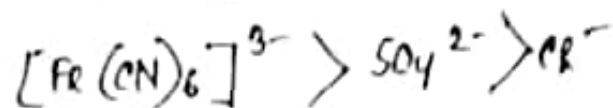
Coagulation of precipitation can be brought out

- (i) By adding of electrolytes
- (ii) By electrophoresis
- (iii) By mixing two oppositely charged sol
- (iv) By boiling.

Hardy - Schulze Rule states that the precipitating effect

order $Al^{3+} > Ca^{2+} > Na^+$

Similarly for precipitating $Fe(OH)_3$ sol (positive) the precipitating power of anion $[Fe(CN)_6]^{3-}$, SO_4^{2-} , Cl^- is in the order



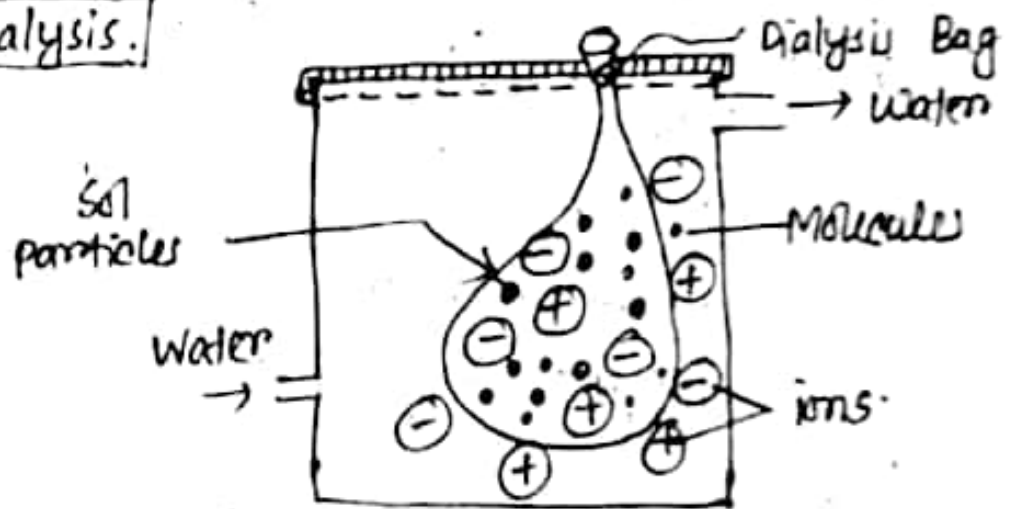
11. Flocculation value:

The minimum concentration value in millimoles per litre required to cause the precipitation of a sol in 2 hours.

This is called the flocculation value. The smaller the flocculation value, the higher the precipitating power of an ion.

12. Stabilization of colloids; Protection of colloids

(i) **Dialysis** when a sol containing dissolved ions (electrolyte) or molecules is placed in a bag of permeable membrane dipping in pure water, the ions diffuse through the membrane. By using a continuous flow of fresh water, the concentration of the electrolyte outside the membrane tends to be zero. Thus diffusion of the ions into pure water remains brisk all the time. In this way, practically all the electrolyte present in the sol can be removed easily. The process of removing ions from a sol by diffusion through a permeable membrane is called **dialysis**.



(ii) **Electrodialysis:**

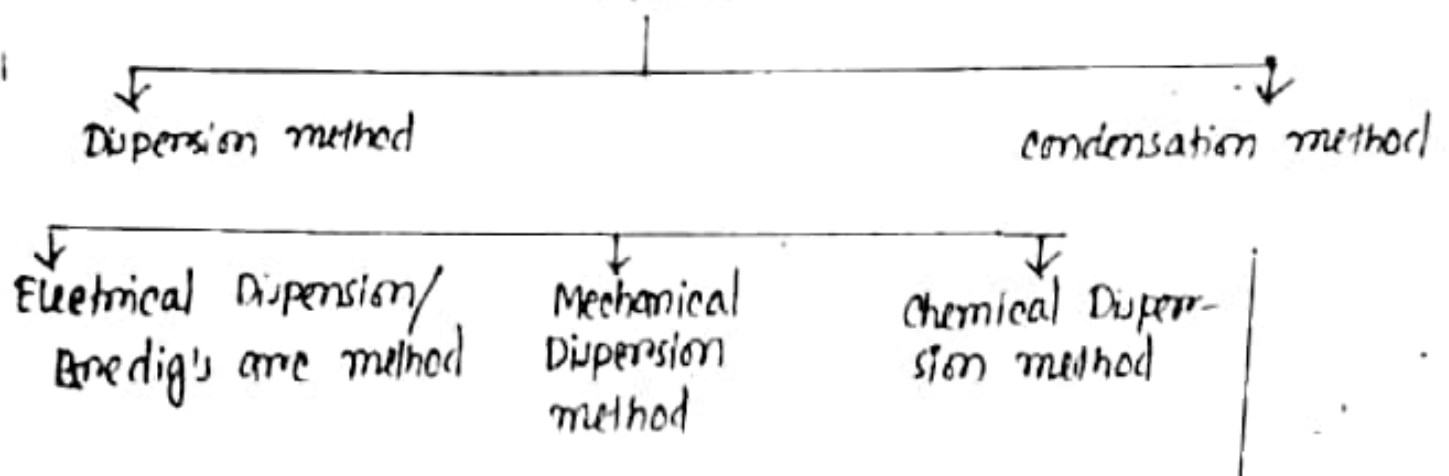
In this process, dialysis is carried under the influence of electric field. Potential is applied between the metal screens supporting the membranes. This speeds up the migration of ions to the opposite electrode. Hence, dialysis is greatly accelerated.

Q.1

Preparation of colloids

small particles → large particles → dispersion/condensation

Methods



Classification of colloids

① **Lyophobic colloids** Lyophobic sols are those in which the dispersed phase has no attraction for the medium or the solvent (Au, $\text{Fe}(\text{OH})_3$ in water)

② **Lyophilic sols** Lyophilic sols are those in which the dispersed phase exhibits a definite affinity for the medium or the solvent. (dispersion of starch, gum, protein in water)

Comparison between Lyophobic and Lyophilic sols

Suspensoid

- ① They show little attraction between disperse phase and disperse medium.
- ② They are prepared by indirect method.
- ③ The viscosity of the sol (particles) is similar to that of the solvent.
- ④ They are mostly inorganic.
- ⑤ They carry electric charge on their surface.

Emulsoid

- ① This is a definite force of attraction between the particles of disperse phase and disperse medium.
- ② They are prepared by simple mixing method.
- ③ Viscosity is higher than the solvent.
- ④ They are mostly organic.
- ⑤ They carry little or no charge.