Colloidal state.

(1) The foundation of colloidal chemistry was laid down by an English scientist, **Thomas Graham,** in 1861**.** The credit for the various advances in this field goes to eminent scientists like **Tyndall, Hardy, Zsigmondy, N.R. Dhar, S.S. Bhatnagar and others.**

(2) **Thomas Graham** classified the soluble substances into two categories depending upon the rate of diffusion through animal and vegetable membranes or **parchment paper.**

(i) **Crystalloids:**They have higher rate of diffusion and diffused from parchment paper.

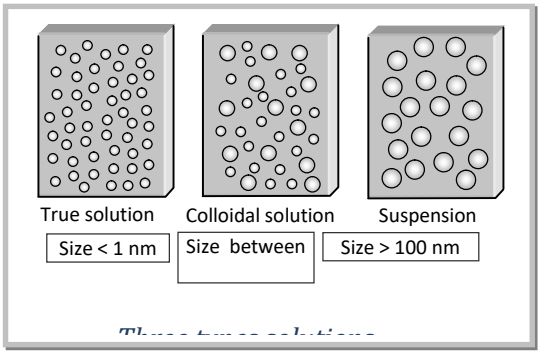
Examples: All organic acids, bases and salts and organic compounds such as sugar, urea etc.

(ii) **Colloids** (Greek word, kolla, meaning glue-like)**:**They have slower rate of diffusion and cannot diffused from parchment paper. Examples: Starch, gelatin, gums, silicic acid and hdemoglobin etc.

(3) The above classification was discarded i.e., the terms colloid does not apply to a particular class of substances but is a state of matter like solid, liquid and gas. Any substance can be brought into colloidal state.

(4) The colloidal state depends on the particle size. If is regarded as intermediate state between true solution and suspension.

- **True Solution:** In true solutions the size of the particles of solute is very small and thus, these cannot bedetected by any optical means and freely diffuse through membranes. It is a homogenous system.
- **Suspension:**The size of particles is large and, thus it can be seen by naked eye and do not pass through filter paper. It is a heterogeneous system.



The size of different solutions are sometimes expressed in other units also as given below:

Size (diameter) of particles in particles in different units

True solutions	Colloids	Suspensions	Relation
$<10^{-9}$m <1nm <10 Å <1000 pm	10^{-9} m to 10^{-7}m 1 nm - 100 nm 10 Å – 1000 Å 1000 pm –10^{5} pm	$>10^{-7}$ m > 100 nm > 1000 Å >10^{5} pm	1 nm = 10^{-9} m 1 Å = 10^{-10} m 1 pm = 10^{-12} m

The important distinguishing features of the three types of solutions

Property	Suspension	Colloid solution	True solution
Nature	Heterogeneous	Heterogeneous	Homogeneous
Particle size	> 100 nm	1 nm – 100 nm	< 1 nm
Separation by (i) Ordinary filtration (ii) Ultra- filtration	 Possible Possible	 Not possible Possible	 Not possible Not possible
Settling of particles	Settle under gravity	Settle only on centrifugation	Do not settle
Appearance	Opaque	Generally transparent	Transparent
Tyndall effect	Shows	Shows	Does not show
Diffusion of particles	Does not diffuse	Diffuses slowly	Diffuses rapidly
Brownian movement	May show	Shows	Negligible

(5) Roughly speaking the colloidal state is a heterogeneous dispersion of solute particles of size between true solution and suspension.

Note: Colloidal particles do not settle down under the force of gravity even a long keeping.
The surface area of colloidal particle is very large in comparison to suspension.