

20/02/20

## Electrical properties

Surface charge - zeta potential

→ Pure dielectric particle possess charge on the surfaces.

→ These charge can be expressed by electrical double layer (E.D.L)

→ when the particle move the electrical d.l also move and the electrical potential at the charge potential is called as zeta potential.

→ zeta potential is an application for predicting stability dispersion medium which can be explained by method of electro-phoresis.

→ electrophoresis involves the movement of charge particle through a liquid under the

→ Pure electrophoretic cell is fitted with 2 electrode when the potential is applied across the electrode the particles migrate towards oppositely charged electrode

→ The -ve charge particle migrate towards +ve electrode (Anode) and the +ve charge particle move towards negative charge electrode called cathode.

→ The ultramicroscope can be used to observe the migration of the particle.

→ As the potential gradient across the electrode increases the velocity of migration

of particle increases which can be explained by following expression,

velocity of migration of particles  $\propto$  potential gradient across the particle

$$v \propto \cdot E$$

$$\text{or } v = \sigma \times E$$

$$\text{or } \sigma = \frac{v}{E}$$

$\Rightarrow$  The proportionality constant  $\sigma$  is called zeta potential.

$\rightarrow$  zeta potential of colloidal system can be determined by the following equation.

$$\sigma = \frac{v}{E} \times \frac{4\pi\eta}{E}$$

where,  $\epsilon$  = dielectric constant of the medium

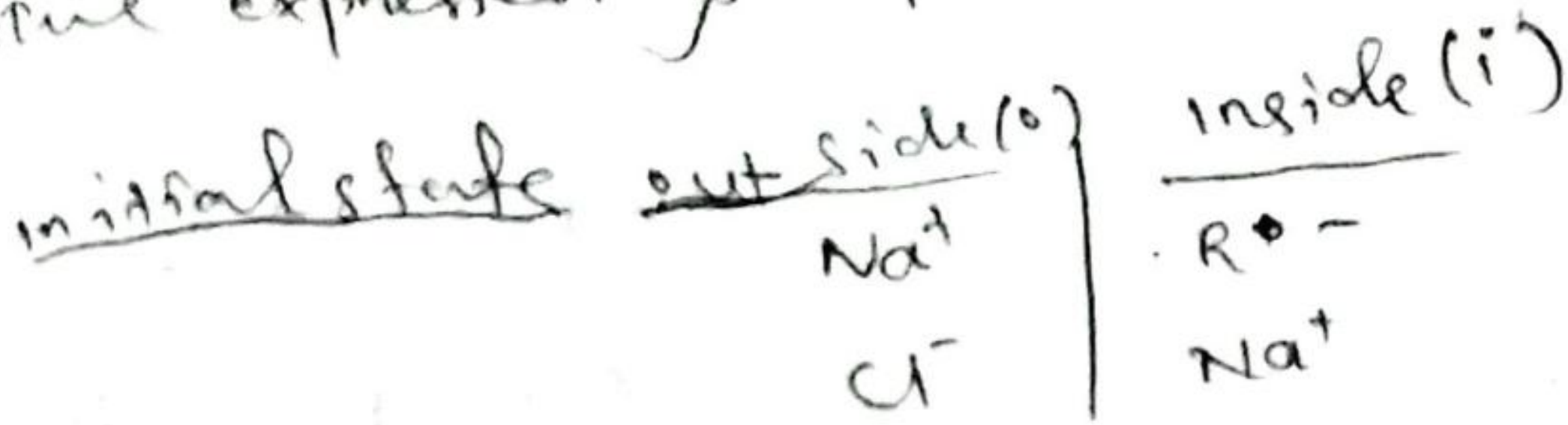
$\eta$  = viscosity of medium

\* Donnan membrane equilibrium — C DME

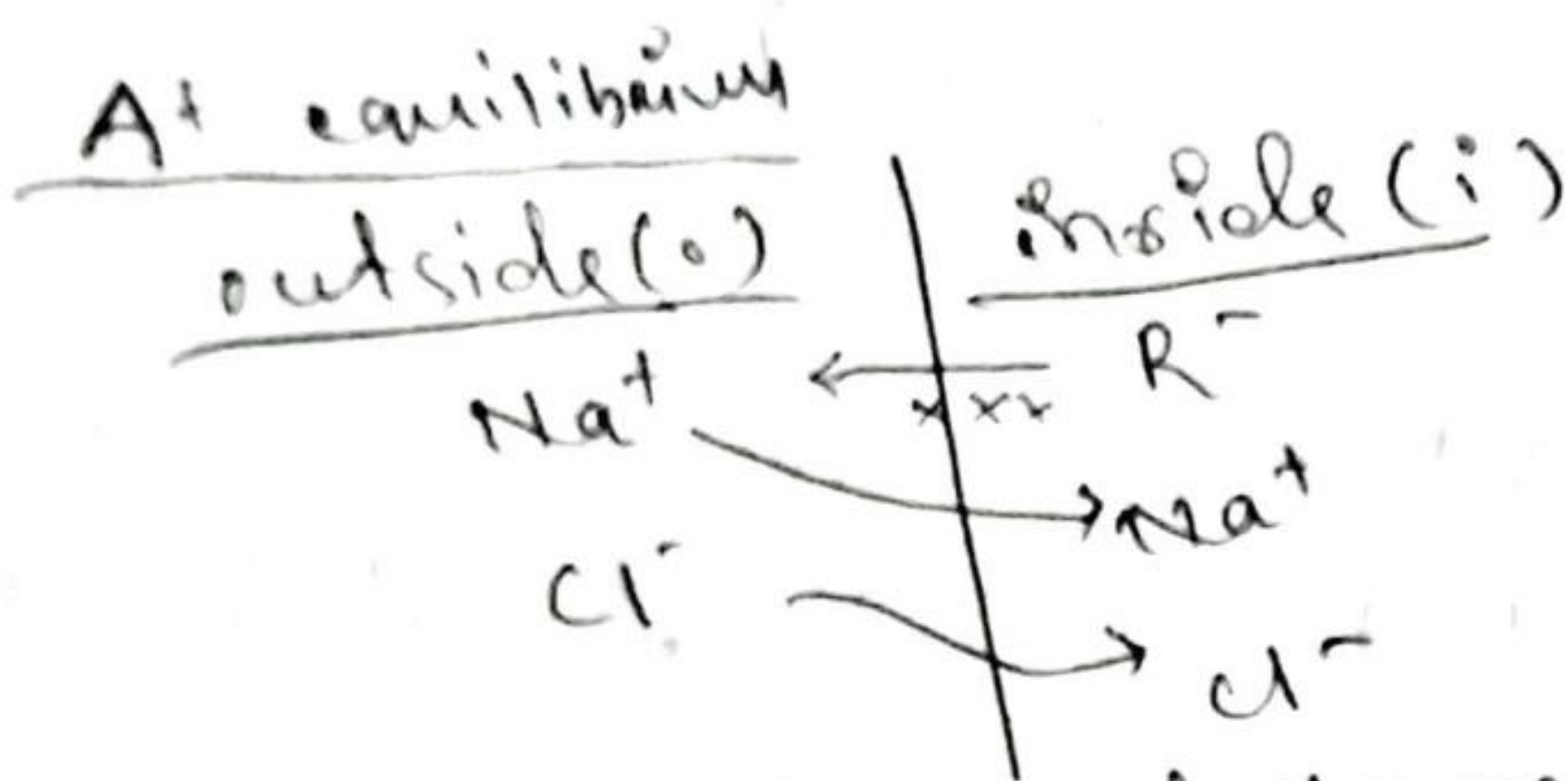
The principle of DME is as follows

- (1) A solution of NaCl is placed in one side of semipermeable membrane.
- (2) Another side the solution of unely charge colloid along with solvent or counter ions are placed.
- (3) The volume of solution of 2 sides of membrane are considered to be equal.

→ the expression is expressed as



$\text{Na}^+$  &  $\text{Cl}^-$  ions moves freely across the semipermeable membrane but the colloidal particle  $\text{R}^-$  are not dissolved diffusible so at equilibrium



Applying the condition of electroneutrality, the +ve and -ve charge on either side must be balance accordingly the following equation can be written.

$$\frac{\text{outside}}{[\text{Na}^+]_o} = [\text{Cl}^-]_o \quad \text{--- (1)}$$

$$[\text{Na}^+]_i = [\text{R}^-]_i + [\text{Cl}^-]_i \quad \text{--- (2)}$$

→ According to the principle of escaping tendency the electrostatic the concentration of both side of the membrane must be same. then the equation will be

$$([\text{Na}^+]_o + [\text{Cl}^-]_o) = ([\text{Na}^+]_i + [\text{Cl}^-]_i) \quad \text{--- (3)}$$

substituting eq. 2 in eq. 3 then we get

$$\begin{aligned}
 [Cl^-]_o \times [Cl^-]_i &= [Cl^-]_i [R^-]_i + [Cl^-]_i \\
 &= [Cl^-]_i^2 + [R^-]_i [Cl^-]_i \\
 &= [Cl^-]_i^2 \cdot (1 + [R^-]_i / [Cl^-]_i)
 \end{aligned}$$

$$\frac{[Cl^-]_o^2}{[Cl^-]_i^2} = 1 + \frac{[R^-]_i}{[Cl^-]_i}$$

$$\frac{[Cl^-]_o}{[Cl^-]_i} = \sqrt{1 + \frac{[R^-]_i}{[Cl^-]_i}} \quad (5)$$

This is called the Donnan membrane equilibrium, and this equation is useful for calculating the ratio of concentrations of diffusible anion and outside & inside of the membrane at equilibrium.