conductance - 5

1. Walden's Rule :

Considering an ion in a sol? Say, a +ve ion of charge 'e' which may termed as central ion. Let 'E' be the intensity of an external electric field which directs the ion to move in the the direction of x axis. There are four different forces which may play on the given ion. (Debye-Huckel-Onsager theory). One of such force may interpreted as -

As the ion move forward, there is a frictional force which retards its motion, this is viscous force. If the velocity of the ion be v in the x direction and the medium is assumed to be at rest, the frictional force would be

$$f = -Kv$$

$$\Rightarrow f = -6\pi\eta r v \quad \text{(By stoke's law)}$$

where, $\eta \rightarrow$ vicosity of the medium

$r \rightarrow$ radius of the ion

This leads to — frictional force would be counterbalanced by the electrical force → hence —

$$6\pi r \eta v \ (\times 300) = Ee$$

hence mobility of the ion $= \frac{v}{E}$

$$= \frac{e}{6\pi r \eta \times 300}$$

$$= \frac{K_1}{r\eta}$$

Then the equivalence conductance of the soln —

$$\lambda_0 = (\lambda_c - \lambda_a)$$

$$= \mathcal{F}(u+v)$$

$$= \frac{K_1 \mathcal{F}}{\eta}\left[\frac{1}{r_c} + \frac{1}{r_a}\right]$$

$$\Rightarrow \lambda_0 \eta = \text{Constant (for a specific electrolyte)}$$

This is Walden Rule. #