ELECTROCHEMICAL POTENTIAL

Faraday constant: $96485\ C\,mol^{-1} \equiv e\,N_A$ (charge of e^-)

$$\mu_i = \mu_i^o + RT\ln a_i + z_i F V$$

- z_i → charge of species
- V → electrical potential, V.

↑ for charged species, electrostatic forces between charges are taken into account.

if the electrochemical potential is different a positions p, q –

At p:

$$\mu_{ip} = \mu_i^o + RT\ln a_{ip} + z_i F V_p$$

At q:

$$\mu_{iq} = \mu_i^o + RT\ln a_{iq} + z_i F V_q$$

if μ_i is different somewhere: movement of i occurs:

$$\Delta\mu_i = \mu_{ip} - \mu_{iq} = RT\ln\frac{a_{ip}}{a_{iq}} + z_i F \Delta V \neq 0$$

where $\mu_p \neq \mu_q$ if: $V_p \neq V_q$ and $a = 1$ or a = constant

or if: $a_p \neq a_q$ and $V = 0$ or V = constant

or if: $V_p \neq V_q$ and $a_p \neq a_q$

if $\Delta\mu_i = 0$ everywhere
there is no net movement of i

and so, $\mu_p = \mu_q$ if

$V = 0$ and $a = 1$

or

V and a are constant everywhere

METALLIC CONDUCTORS

Metallic conductors obeys Ohm's law:

$$V = IR$$

- I → current, A or $C\,s^{-1}$
- R → resistance, ohms, Ω
- V → electric potential, V

For Metallic Conductors RESISTANCE is measured
For Solutions CONDUCTANCE is measured

$$R_{cell} = \frac{l}{\kappa A}$$

CONDUCTANCE (G)

$$G = 1/R$$

G → conductance, S (Siemens) or Ω^{-1}

Conductance: measure of how easily ions or e^- move through solution or material

CONDUCTIVITY

$$\kappa = \frac{1}{R}\frac{l}{A}$$

- l → length, m
- $\frac{l}{A}$ → ratio = cell constant, m^{-1}
- A → cross sectional area, m^2
- R → resistance, Ω (S)
- κ → conductivity, $S\ m^{-1}$

κ = ability of an electrolyte or metal to conduct electricity

MOLAR CONDUCTIVITY

$$\Lambda_m = \frac{\kappa}{c}$$

- Λ_m → $S\,m^2\,mol^{-1}$
- κ → conductivity, $S\ m^{-1}$
- c → conc., $mol\ dm^{-3}$