NERNST EQUATION

$Ox + z\,e^- \rightarrow Red$ (reduction reaction)

$$E_{red} = E^\circ_{red} - \frac{RT}{zF} \ln \frac{a_{red}}{a_{ox}} = E^\circ_{red} - 2.3\,\frac{RT}{zF} \log \frac{a_{red}}{a_{ox}}$$

- E°_{red} = standard half cell reduction potential
- $R = 8{,}314 \left(\frac{J}{mol\ K}\right)$
- T [in K]
- z = moles of electrons transferred in the reaction [mol^{-1}]
- $F = 96\cdot485 \left(\frac{C}{mol}\right)$
- a_{red} = activity of the reduced form ($\simeq C_{red}$ at low concentrations)
- a_{ox} = activity of the oxidized form ($\simeq C_{ox}$ at low concentrations)

NOTE: the activity of pure substances (solid and liquids) is normally taken as equal to 1! You can consider only the concentration of the species dissolved in solution!

Example

$Zn^{2+} + 2e^- \rightarrow Zn\,(s)$

$$E = E^\circ - \frac{RT}{2F} \ln \frac{1}{[Zn^{2+}]}$$

At Room Temperature

$$E = E^\circ - \frac{0{,}059}{z} \log \frac{a_{red}}{a_{ox}}$$

Dependence on pH

$$\boxed{E = E^\circ - \frac{RT}{2F} \ln \frac{a_{red}}{a_{ox}} - \frac{2.3\,RT}{2F}\, pH}$$

$\left[= 0.059 \right.$
at room temperature$\left. \right]$