- A large negative free energy change may or may not be accompanied by a high corrosion rate.
- But when, ΔG^{o} is positive, it can be stated with certainty that the reaction will not go at all under the particular conditions described. Therefore, gold does not corrode in aerated aqueous environment.

(e) $Au + \frac{3}{2} H_2O + \frac{3}{4} O_2 \longrightarrow Au(OH)_3$; $\Delta G^{o} = +\ 15.7$ Kcal/mol.

- The stability of elemental gold makes it less thermodynamically favorable to oxidized gold. Hence, it is more corrosion resistant.

...stance the metallic substances or less

- For example:

(a) $Mg \longrightarrow Mg^{+2} + 2e^-$ (Dissolution of magnesium)

$H_2O + \frac{1}{2}O_2 + 2e^- \longrightarrow 2OH^-$ (Oxygen Reduction)

$Mg + H_2O + \frac{1}{2}O_2 \longrightarrow Mg(OH)_2$

$\Delta G^o = -142.6$ Kcal/mol.

(b) $Cr \longrightarrow Cr^{+3} + 3e^-$ (Dissolution of chromium)

$\frac{3}{2}H_2O + \frac{3}{4}O_2 + 3e- \longrightarrow 3OH^-$ (Reduction Reaction)

$Cr + \frac{3}{2}H_2O + \frac{3}{4}O_2 \longrightarrow Cr(OH)_3$

$\Delta G^o = -117.0$ Kcal/mol.

(c) $Fe \longrightarrow Fe^{+3} + 3e^-$ (Dissolution of iron)

$\frac{3}{2}H_2O + \frac{3}{4}O_2 + 3e- \longrightarrow 3OH^-$ (Reduction Reaction)

$Fe + \frac{3}{2}H_2O + \frac{3}{4}O_2 \longrightarrow Fe(OH)_3$; $\Delta G^o = -80.0$ Kcal/mol.

(d) $Cu \longrightarrow Cu^{+2} + 2e^-$

(Dissolution of magnesium)

$H_2O + \frac{1}{2}O_2 + 2e- \longrightarrow 2OH^-$

(Reduction Reaction)

$Cu + H_2O + \frac{1}{2}O_2 \longrightarrow Cu(OH)_2$

$\Delta G^o = -28.6$ Kcal/mol.

- The tendency of corrosion is enhanced due to the spontaneous instability of metallic substance with its environments.
- More stable the substance, more corrosion resistance the metallic substances or less corroded the substances in the given environments.
- In general, thermodynamics of both the metallic dissolution (anodic) and reduction (cathodic) reactions can be used to show the tendency of corrosion.
- For example, free energy change (ΔG^o) of the anodic and cathodic reactions in a given environment can be indicated the tendency of the metallic corrosion.

$$\Delta G^o = -nF\,\phi^o$$

- Higher the value of (ϕ^o) of a corrosion cell, higher is the tendency for the corrosion to go.
- Corrosion tendency of Mg metal is more pronounced than those of Cr, Fe and Cu metals in aerated aqueous environment, because the total standard free energy change (ΔG^o) of Mg dissolution and oxygen reduction reactions is more negative value than those of Cr, Fe and Cu.

$Al_2(SO_4)_3$ $105x^5$

$Fe(OH)_3$ $27x^3$ $Mg(OH)_2$ $4x^3$