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Free electrons reduce and oxidize solutes O_{2aq} and H_{2aq} creating In water, platinum, biochemical molecules, an electrode standard potential $\mathbf{E^\circ}$ proportional to the oxidation-reduction attractor $\Delta\mathbf{G_{eq}}=-RT\ln(\mathbf{K_{eq}})=\mathbf{E^\circ}\bullet F\bullet n$.

The Prigogine attractor constant logarithm $\Delta\mathbf{G_{eq}}=-RT\ln(\mathbf{K_{eq}})$ and in Hess sum expression too of the Nernst oxidation $\mathbf{H(Pt)+H_2O=H_3O^+ + e^-}$ is proportional to $\mathbf{E^\circ_H}$=-0.27073 V the standard potential: $\Delta\mathbf{G_{eq}}=-RT\ln(\mathbf{K_{eq}})=\mathbf{E^\circ_H}*F*n=G_{H3O+}-(G_{H(Pt)}+G_{H2O})=22.44-(\mathbf{48.56}+0)=\mathbf{-26.12}$ kJ/mol. The Prigogine attractor constant $\mathbf{K_{eq}}$ is favorable, exoergonic, spontaneous, because it is greater than one 37675.6: $\mathbf{K_{eq}}=[H_3O^+]*[\mathbf{e^-}]/[\mathbf{H_2O}]/[H(Pt)]=EXP(-\Delta G_{eq}/R/T)=EXP(\mathbf{26120}/8.3144/298.15)=37675.6$.

Electrochemical thermodynamics of Nernst oxidation $\underline{\mathbf{Red}}=\underline{\mathbf{Ox}}^{\Delta n+}+\mathbf{ne^-}$ and electrode potential E.

At equilibrium, the sums $\mu_{Red}+\mathbf{E^\circ nF}=\mu_{Ox}+n\mu_{e-}$ of the chemical potentials of the compounds and products are equal, but the chemical potential of the chemical substance $\mu=\Delta G^\circ_A+RT\ln(N_A)$, where N_A is the concentration of the substance in mole fractions. The standard of formation of a given substance ΔG°_A or the free energy content per mole G_A in Hessian expression gives the energy change at equilibrium state, the value of the Prigogine attractor to which tend all non-equilibrium states:

$$\Delta G_{eq}=\mathbf{-R\bullet T\bullet \ln(K_{eq})}=\Delta G^\circ_{Ox}{}^{\Delta n+}-\Delta G^\circ_{Red}=\mathbf{n}*\Delta G^\circ_{e-}=\mathbf{-nFE^\circ}.$$

In a chemical equilibrium mixture $\Delta G^\circ_{Red}+RT\ln(N_{Red})+\mathbf{E^\circ nF}=\Delta G^\circ_{Ox}{}^{\Delta n+}+RT\ln(N_{Ox}{}^{\Delta n+})+RT\ln(N_{e-})$

$$E=\frac{\Delta\mathbf{G^{o\Delta n+}_{Ox}}+\mathbf{n}\bullet\Delta\mathbf{G^\circ_{e^-}}-\Delta\mathbf{G^\circ_{Red}}}{\mathbf{nF}}+\frac{RT}{nF}\bullet\ln\left(\frac{\mathbf{N^{\Delta n+}_{Ox}}\bullet\mathbf{N^{n}_{e^-}}}{\mathbf{N_{Red}}}\right);$$

the electron gas concentration of a pure substance is one mole fraction Ne-=1 not affect the electrode potential E:

$$E=\frac{\Delta\mathbf{G^{o\Delta n+}_{Ox}}-\Delta\mathbf{G^\circ_{Red}}}{\mathbf{nF}}+\frac{RT}{nF}\bullet\ln\left(\frac{\mathbf{N^{\Delta n+}_{Ox}}\bullet\mathbf{N^{n}_{e^-}}}{\mathbf{N_{Red}}}\right);\ E=\frac{\mathbf{n}\bullet\Delta\mathbf{G^\circ_{e^-}}}{\mathbf{nF}}+\frac{RT}{nF}\bullet\ln\left(\frac{\mathbf{N^{\Delta n+}_{Ox}}}{\mathbf{N_{Red}}}\right)=\mathbf{E^\circ}+\frac{RT}{nF}\bullet\ln\left(\frac{\mathbf{N^{\Delta n+}_{Ox}}}{\mathbf{N_{Red}}}\right).$$

The standard potential $\mathbf{E^\circ}=\frac{\Delta\mathbf{G^{o\Delta n+}_{Ox}}+\mathbf{n}\bullet\Delta\mathbf{G^\circ_{e^-}}-\Delta\mathbf{G^\circ_{Red}}}{\mathbf{nF}}$ forms the equilibrium of the change in Prigogine attractors: $\Delta G_{eq}=\mathbf{-R\bullet T\bullet \ln(K_{eq})}=\Delta G^\circ_{Ox}{}^{\Delta n+}+\mathbf{n}*\Delta G^\circ_{e-}-\Delta G^\circ_{Red}=\mathbf{-nFE^\circ}$, if ratio under logarithm $(N_{Ox}{}^{\Delta n+}/N_{Red})=1$ is one, than ln(1)=0.

By switching to decimal logarithms and the thermodynamic standard T=298.15 K, the Nernst equation for the reaction is : reactants **Red**ucing form=$\underline{\mathbf{Ox}}^{\Delta n+}+\mathbf{ne^-}$ **Ox**idizing form products;

$$E=E^\circ+\frac{0{,}0591}{n}\bullet\log\left(\frac{[Ox]}{[Red]}\right).$$

The reaction $\mathbf{n_{e-}}$ electrons are lost, so **Δn+** positively charged ions are moved towards the solution. .Electrons remain in the metal electron gas. The movement of **Δn+** charge into the products the oxidized form $\underline{\mathbf{Ox}}^{\Delta n+}$ gives the electric electron $\mathbf{ne^-}$ part to the chemical potential $\mathbf{n\mu_{electr}=-nFE^\circ}$, kur $\mu_{electr}=\mathbf{-FE^\circ}$.

The absolute standard potential of the hydrogen electrode with respect to the zero point of the absolute scale is negative $\mathbf{E^\circ_H}$=-0,27073 V, because free electrons are spontaneously, exoergonically accumulated at the metal Nernst oxidation of metal $H(Pt)+\mathbf{H_2O=H_3O^+ + e^-}$. The negative absolute standard potential is the Nernst oxidation attractor $\Delta\mathbf{G_{eq}}=\mathbf{E^\circ_H}$ Fn=-0,27073*96485*1=**-26,12** kJ/mol. It is Prigogine attractor absolute free energy negative change on equilibrium state . [4]

Hess's law has an identical calculated absolute free energy change on an absolute scale, which $\Delta\mathbf{G_{Hess\_eq}}=G_{H3O+}+Ge^-(G_{H(Pt)}+G_{H2O})=22{,}44+0-(\mathbf{48{,}56}+0)=\mathbf{-26{,}12}$ kJ/mol , attributed to the zero free energy content $Ge^-=\mathbf{0{,}0}$ kJ/mol un $G_{H2O}=0$ kJ/mo for free electrons and water, because in the electron gas there is zero:

$$Ge^-=\Delta\mathbf{G}_{Hess\_eq}-G_{H3O+}+(G_{H(Pt)}+G_{H2O})=\mathbf{-26{,}12}-22{,}44-(\mathbf{48{,}56}+0)=\mathbf{0{,}0}\ kJ/mol.$$

The absolute standard potential of the hydrogen electrode sums from $E^\circ_{H\_Classic}$=0,0 V at classical zero, with a thermodynamic correction of 0.10166 V and an absolute scale correction value of -0.37239 V. The sum is the absolute electrode potential: $\mathbf{E^\circ_H}$=0,0+0,10166-0,37239=-0,27073 V.

The absolute standard potential $\mathbf{E^\circ_H}$=-0,27073 volts corresponds to the Alberti data on the absolute free energy scale. [8] The Prigogine attractors in aqueous solutions $\Delta\mathbf{G_{eq}}=-RT\ln(\mathbf{K_{eq}})=\mathbf{E^\circ}\bullet F\bullet n$ are affected by the solubility constants of the solutes $\mathbf{K_{sp}}$, the unitless mole fraction constants of water as an acid $\mathbf{K_{H2O}}$ or acid $\mathbf{K_a}$, and the absolute standard potential of oxidation, e.g. the Nernst electrode $\mathbf{E^\circ_H}$. Therefore, the consideration of water molecules $[\mathbf{H_2O}]$ and hydroxonium ions $[H_3O^+]$ is an integral and indispensable part of the active mass law $\mathbf{H(Pt)+H_2O=H_3O^+ + e^-}$.

The Prigogine attractor $\Delta G_{eq}=-RTln(K_{eq})$ is proportional to the standard Nernst potential $E^{\circ}*F*n=\Delta G_{eq}$, whose value in volts is proportional to the negative or positive electron excess or deficiency in the metal. The value of the chemical potential for electrons in a Nernst reaction is proportional to the potential **E**. Free electron free energy content is zero $G_{e^-}=0$.

Hydrogen $\underline{H(Pt)}_{(s)}+H_2O=H_3O^++e^-$; $E^{\circ}_H=-0.27073$ V; spontaneous Nernst's $\underline{H(Pt)}_{(s)}$ oxidation standard to H_3O^+;

$\Delta G_{eq}=E^{\circ}_H*F*n=-0{,}27073*96485*1=\mathbf{-26{,}12}$ kJ/mol;

$\Delta G_{Hess\_eq}=G_{H3O+}+G_{e^-}-(G_{H(Pt)}+G_{H2O})=22{,}44+0-(\mathbf{48{,}56}+0)=\mathbf{-26{,}12}$ kJ/mol;

$G_{e^-}=\Delta G_{Hess\_eq}-G_{H3O+}+(G_{H(Pt)}+G_{H2O})=\mathbf{-26{,}12}-22{,}44-(\mathbf{48{,}56}+0)=\mathbf{0{,}0}$ kJ/mol.

Formation $G_{e^-}=\Delta G^{\circ}_{H3O+}-G_{H3O+}+(1{,}5*G_{H2}{}^{gas}+0{,}5*G_{O2}{}^{gas})=-231{,}3887-\mathbf{22{,}44}+(1{,}5*\mathbf{85{,}6}+\mathbf{303{,}1}/2)=\mathbf{26{,}121}$ kJ/mol.

Iron(II) $Fe_{(s)}+H_2O=Fe^{2+}+2e^-$; $E^{\circ}_{Fe/Fe2+}=\mathbf{-0{,}6662}$ V;

$\Delta G_{eq}=E^{\circ}_{Fe}\bullet F\bullet 2=\mathbf{-0{,}66623}*96485*2=\mathbf{-128{,}56}$ kJ/mol; spontaneous Nernst's Fe oxidation standard to Fe^{2+};

$\Delta G_{eq}=G_{Fe2+}+2G_{e^-}-(G_{Fe}+\mathbf{G_{H2O}})=\mathbf{12{,}049}+2*\mathbf{9{,}0}-(\mathbf{140{,}609}+\mathbf{0})=\mathbf{-128{,}56}$ kJ/mol;

$G_{e^-}=(\Delta G_{eq}-G_{Fe2+}+(G_{Fe}+\mathbf{G_{H2O}}))/2=(\mathbf{-128{,}56}-\mathbf{12{,}049}+(\mathbf{140{,}609}+\mathbf{0}))/2=\mathbf{0{,}0}$ kJ/mol;

Formation [8] $G_{e^-}=(G_{Fe}-(G_{Fe2+}+\Delta G^{\circ}))/2=(\mathbf{140{,}609}-(\mathbf{12{,}04855}-\mathbf{82{,}14}))/2=\mathbf{105{,}35}$ kJ/mol;

Formation [1] $G_{e^-}=(G_{Fe}-(G_{Fe2+}+\Delta G^{\circ}))/2=(\mathbf{140{,}609}-(\mathbf{12{,}04855}-78{,}9))/2=\mathbf{103{,}73}$ kJ/mol;

Iron(III) $Fe_{(s)}+H_2O=Fe^{3+}+\mathbf{3e^-}$; $E^{\circ}_{Fe/Fe2+}=\mathbf{-0.2734}$ V;

$\Delta G_{eq}=E^{\circ}_{Fe3+}\bullet F\bullet 3=\mathbf{-0.2734}*96485*3=\mathbf{-79.136}$ kJ/moll; spontaneous Nernst's Fe oxidation standard to Fe^{3+};

$\Delta G_{eq}=G_{Fe3+}+3G_{e^-}-(G_{Fe(s)}+\mathbf{G_{H2O}})=\mathbf{60{,}3136}+3G_{e^-}-(\mathbf{139{,}45}+\mathbf{0})=\mathbf{-79{,}136}$ kJ/mol;

$G_{e^-}=(G_{Fe3+}-\Delta G_{eq}+(G_{Fe(s)}+\mathbf{G_{H2O}}))/3=(\mathbf{60{,}3136}+\mathbf{79{,}136}+(\mathbf{139{,}45}+\mathbf{0}))/3=\mathbf{92{,}9665}$ kJ/mol;

Formation [1] $G_{e^-}=(G_{Fe}-(G_{Fe2+}+\Delta G^{\circ}))/3=(\mathbf{139{,}45}-(\mathbf{60{,}3136}+(-4{,}7)))/3=\mathbf{27{,}9455}$ kJ/mol;

Formation [8] $G_{e^-}=(G_{Fe}-(G_{Fe2+}+\Delta G^{\circ}))/3=(\mathbf{139{,}45}-(\mathbf{60{,}3136}+(\mathbf{-11{,}99})))/3=\mathbf{30{,}376}$ kJ/mol;

Iron(II/III) $Fe^{2+}=Fe^{3+}+\mathbf{e^-}$; $E^{\circ}_{Fe2+/Fe3+}=\mathbf{0{,}50027}$ V;

$Fe^{2+}=Fe^{3+}+\mathbf{e^-}$; $\Delta G_{eq}=E^{\circ}_{Fe3+/Fe2+}\bullet F\bullet 1=\mathbf{0{,}50027}*96485*1=\mathbf{48{,}268}$ kJ/mol;

$\Delta G_{eq}=G_{Fe3+}+G_{e^-}-(G_{Fe2+})=\mathbf{56{,}2755}+\mathbf{4{,}0405}-(\mathbf{12{,}048})=\mathbf{48{,}268}$ kJ/mol;

$G_{e^-}=G_{Fe3+}-\Delta G_{eq}+(G_{Fe2+})=\mathbf{56{,}2755}-\mathbf{48{,}268}+(\mathbf{12{,}048})=\mathbf{4{,}0405}$ kJ/mol;

Formation$[Fe(OH)]^++\mathbf{e^-}$; $G_{e^-}=\Delta G^{\circ}-G_{[Fe(OH)]+}+(G_{Fe}+G_{O2gas}/2+G_{H2}/2)=-277{,}4....=\mathbf{18{,}39245}$ kJ/mol;

Formation$[Fe(OH)]^{2+}+2\mathbf{e^-}$; $2G_{e^-}=\Delta G^{\circ}-G_{[Fe(OH)]2+}+(G_{Fe}+G_{O2gas}/2+G_{H2}/2)=-229{,}4=2*\mathbf{21{,}2773}$ kJ/mol;

Formation $[Fe(OH)_2]^++\mathbf{e^-}$; $G_{e^-}=\Delta G^{\circ}-G_{[Fe(OH)]2+}+(G_{Fe}+G_{O2gas}+G_{H2})=-438{,}0=\mathbf{42{,}3185}$ kJ/mol;

Zinc $Zn_{(s)}+H_2O=Zn^{2+}+2e^-$; $E^{\circ}_{Zn/Zn2+}=\mathbf{-0.980}$ V;

$\Delta G_{eqZn}=E^{\circ}_{Zn}\bullet F\bullet 2=\mathbf{-0{,}980}*96485*2=\mathbf{-189{,}11}$ kJ/mol,; spontaneous Nernst's Zn oxidation standard to Zn^{2+};

$\Delta G_{eqZn}=G_{Zn2+}+2G_{e^-}-(G_{Zn}+G_{H2O})=\mathbf{215{,}55}+2*\mathbf{0}-(\mathbf{404{,}657}+0)=\mathbf{-189{,}107}$ kJ/mol;

$2G_{e^-}=\Delta G_{eqZn}-G_{Zn2+}+(G_{Zn}+G_{H2O})=\mathbf{-189{,}107}-\mathbf{215{,}55}+(\mathbf{404{,}657}+0)=\mathbf{0{,}0}$ kJ/mol;

Formation [1] $Zn=Zn^{2+}+\mathbf{2e^-}$; $G_{e^-}=\Delta G^{\circ}-G_{Zn2+}+(G_{Zn})=(-147{,}1-\mathbf{215{,}55}+(\mathbf{391{,}48}))/2=\mathbf{14{,}415}$ kJ/mol;

Formation [1] $Zn+O_2{}^{gas}/2+H_2/2=[Zn(OH)]^++\mathbf{e^-}$;

$G_{e^-}=\Delta G^{\circ}-G_{[Zn(OH)]+}+(G_{Zn}+G_{O2gas}/2+G_{H2}/2)=-330{,}1-\mathbf{255{,}285}+(\mathbf{404{,}657}+\mathbf{303{,}1}/2+\mathbf{85{,}64}/2)=\mathbf{13{,}642}$ kJ/mol;

Copper $Cu(Hg)+H_2O=Cu^{2+}+(Hg)+\mathbf{2e^-}$; $E^{\circ}_{Cu/Cu2+}=\mathbf{0{,}1268}$ V; spontaneous Cu^{2+} reduction standard to Cu;

$\Delta G_{eq\_Cu}=E^{\circ}_{Cu}\bullet F\bullet 2=\mathbf{0{,}1268185}*96485*2=\mathbf{24{,}472}$ kJ/mol, ;

$\Delta G_{eq\_Cu}=G_{Cu2+}+2G_{e^-}-(G_{Cu}+G_{H2O})=\mathbf{108{,}618}+\mathbf{2}*\mathbf{0}-(\mathbf{84{,}148}+\mathbf{0})=\mathbf{24{,}47}$ kJ/mol;

$2G_{e^-}=\Delta G_{eq\_Cu}-G_{Cu2+}+(G_{Cu}+G_{H2O})=\mathbf{24{,}47}-\mathbf{108{,}618}+(\mathbf{84{,}148}+\mathbf{0})=\mathbf{2}*\mathbf{0}$ kJ/mol;

Copper $Cu+H_2O=Cu^++\mathbf{2e^-}$; $E^{\circ}_{Cu/Cu+}=\mathbf{0{,}35432}$ V; spontaneous Nernst's Cu^+ reduction standard to Cu;

$\Delta G_{eqCu/Cu+}=E^{\circ}_{Cu/Cu+}\bullet F\bullet 1=\mathbf{0{,}35432}*96485*1=\mathbf{34{,}1866}$ kJ/mol;

$\Delta G_{eq\_Cu}=G_{Cu+}+G_{e^-}-(G_{Cu}+G_{H2O})=\mathbf{118{,}33}+\mathbf{0{,}00460}-(\mathbf{84{,}148}+\mathbf{0})=\mathbf{34{,}1866}$ kJ/mol;

$G_{e^-}=\Delta G_{eqCu}-G_{Cu+}+(G_{Cu}+G_{H2O})=\mathbf{34{,}1866}-\mathbf{118{,}33}+(\mathbf{84{,}148}+\mathbf{0})=\mathbf{0{,}00460}$ kJ/mol;

Formation [1] $Cu^{2+}+\mathbf{2e^-}=Cu$; $G_{e^-}=(\Delta G^{\circ}-G_{Cu2+}+(G_{Cu}))/2=(65{,}5-\mathbf{108{,}618}+(\mathbf{84{,}148}))/2=\mathbf{20{,}515}$ kJ/mol;

Formation [1] $Cu=Cu^++\mathbf{e^-}$; $G_{e^-}=\Delta G^{\circ}-G_{Cu+}+(G_{Cu})=50-\mathbf{118{,}33}+(\mathbf{84{,}148})=\mathbf{15{,}818}$ kJ/mol;

Silver $Ag_{(s)}+H_2O=Ag^++e^-$; $E_{Ag/Ag+}=\mathbf{0{,}631865}$ V; spontaneous Nernst's Ag^+ reduction standard Ag;

$\Delta G_{eq\_Ag}=E^{\circ}_{Ag}\bullet F\bullet n=\mathbf{0{,}631865}*96485*1=\mathbf{60{,}9655}$ kJ/mol;

$G_{e^-}=\Delta G_{eq\_Ag}-G_{Ag+}+(G_{Ag}+\mathbf{G_{H2O}})=\mathbf{60{,}9655}-\mathbf{103{,}825}+(\mathbf{42{,}8595}+\mathbf{0})=\mathbf{0{,}0}$ kJ/mol;

Formation [1] $\mathbf{Ag}=\mathbf{Ag}^++e^-$; $G_{e^-}=\Delta G_{eq\_Ag}-G_{Ag+}+(G_{Ag})=77{,}1-\mathbf{103{,}825}+(\mathbf{42{,}8595})=\mathbf{16{,}1345}$ kJ/mol;

Chromium $Cr_{(s)}+H_2O=Cr^{2+}+\mathbf{2e^-}$; $E^{\circ}_{Cr/Cr2+}=\mathbf{-1{,}13118}$ V; spontaneous Nernst's Cr oxidation standard Cr^{2+};

$\Delta G_{eq\_Cr}=E^{\circ}_{Cr}\bullet F\bullet 2=\mathbf{-1{,}13118}*96485*2=\mathbf{-218{,}284}$ kJ/mol,;

$2G_{e^-}=\Delta G_{eq\_CR}-G_{Cr2+}+(G_{Cr}+G_{H2O})=-218,284-83,516+(301,8+0)=2*0$ kJ/mol ;
Formation $Cr=Cr^{2+}+2e^-$, $2G_{e^-}=\Delta G°-G_{Cr2+}+(G_{Cr})=-143,5-83,516+(301,8)=2*37,392$ kJ/mol ;
Formation $Cr=Cr^{2+}+2e^-$, $2G_{e^-}=\Delta G°-G_{Cr2+}+(G_{Cr})=-158,5-83,516+(301,8)=2*29,892$ kJ/mol ;
$Cr+H_2O=Cr^{3+}+3e^-$; $E°_{Cr/Cr3+}=-0.97935$ V; spontaneous Nernst's Cr oxidation standard Cr^{3+};

$$\Delta G_{eq\_Cr}=E°_{Cr}•F•3=-0.97935*96485*3=-283.5 \text{ kJ/mol};$$

$3G_{e^-}=\Delta G_{eq\_CR}-G_{Cr3+}+(G_{Cr}+G_{H2O})=(-283,5)-18,3+(301,8+0)=3*0$ kJ/mol ;
Formation [1] $Cr=Cr^{3+}+3e^-$; ?

Mercury $2Hg+H_2O=Hg_2^{2+}+2e^-$; $E°_{2Hg}=0,5781$ V; spontaneous Nernst's Hg_2^{2+} reduction standard 2Hg;

$$\Delta G_{eq\_2Hg}=E°_{Hg}•F•n=0,5781*96485*2=111,55 \text{ kJ/mol,};$$

$2G_{e^-}=\Delta G_{eq\_2Hg}-G_{Hg22+}+(2G_{Hg}+G_{H2O})=111,55-183,0782+(2*35,7641+0)=2*0$ kJ/mol ; Formation $2Hg+H_2O=Hg_2^{2+}+2e^-$; $2G_{e^-}=\Delta G_{eq\_2Hg}-G_{Hg22+}+(2G_{Hg}+G_{H2O})=153,5-183,0782+(2*35,7641+0)=2*20,975$ kJ/mol ;
$Hg+H_2O=Hg^{2+}+2e^-$; $E°_{Hg}=0,6318$ V; patvaļīga Nernsta Hg^{2+} reducēšanas standartā $Hg_{(l)}$;

$$\Delta G_{eq\_Hg}=E°_{Hg}•F•n=0,6318*96485*2=121,91 \text{ kJ/mol};$$

$2G_{e^-}=\Delta G_{eq\_Hg}-G_{Hg2+}+(G_{Hg}+G_{H2O})=121,91-193,438+(2*35,7641+0)=2*0$ kJ/mol; Formation $2Hg+H_2O=Hg_2^{2+}+2e^-$;
$2G_{e^-}=\Delta G_{eq\_2Hg}-G_{Hg22+}+(2G_{Hg}+G_{H2O})=153,5-183,0782+(2*35,7641+0)=2*20,975$ kJ/mol ;
Formation $Hg+H_2O=Hg^{2+}+2e^-$; $2G_{e^-}=\Delta G_{eq\_Hg}-G_{Hg2+}+(G_{Hg}+G_{H2O})=164,4-157,674+(35,7641+0)=2*21,245$ kJ/mol;

Lead $Pb+H_2O=Pb^{2+}+2e^-$; $E°_{Pb/Pb2+}=-0.3454$ V; spontaneous Nernst's Pb oxidation standard Pb^{2+};

$$\Delta G_{eqPb\downarrow Pb2+}=E°_{Pb\downarrow Pb2+}*F*n=-0.3454*96485*2=-66.66 \text{ kJ/mol};$$

$2G_{e^-}=\Delta G_{eqPb\downarrow Pb2+}-G_{Pb2+}+(G_{Pb}+G_{H2O})=-66,6576-215,4144+(282,0676+0)=2*0$ kJ/mol;
Formation $Pb=Pb^{2+}+2e^-$; $2G_{e^-}=\Delta G°-G_{Pb2+}+(G_{Pb})=-24,43-215,414+(282,0676)=42,2236=2*21,1118$ kJ/mol;

Aluminum $Al+H_2O=Al^{3+}+3e^-$; $E°_{Al/Al3+}=-1,9124$ V; spontaneous Nernst's Al oxidation standard Al^{3+};

$$\Delta G_{eqAl/Al3+}=E°_{Al/Al3+}•F•n=-1,9124*96485*3=-553,55 \text{ kJ/mol};$$

$3G_{e^-}=\Delta G_{eqAl/Al3+}-G_{Al3+}+-(G_{Al}+G_{H2O})=-553,55316-256,5103+(810,0635+0)=0,0$ kJ/mol;
[1] Formation $Al+H_2^{gas}+0,5O_2^{gas}=Al(H_2O)^{3+}+3e^-$;
$3G_{e^-}=\Delta G°_{Al3+}-G_{Al(H2O)3+}+(G_{Al}+G_{H2}+0,5G_{O2})=-485-493,6605+(810,0635+0,5*303,1+85,6)=3*22,85$ kJ/mol;

Calcium $Ca_{(s)}+H_2O=Ca^{2+}+2e^-$; $E°_{Ca/Ca2+}=-3,087$ V; spontaneous Nernst's Ca oxidation standard to Ca^{2+};

$$\Delta G_{eq\_Ca}=E°_{Ca2+}•F•2=-3,087*96485*2=-595,74 \text{ kJ/mol};$$

$2G_{e^-}=\Delta GE_{eq\_Ca}-G_{Ca(H2O)2+}+(G_{Ca}+G_{H2O})=-595,743-51,5763+(647,319+0)=2*0,0$ kJ/mol;
$Ca(H_2O)^{2+}$ [1] Formation $Ca+0,5*O_2+H_2=Ca(H_2O)^{2+}+2e^-$;
$2G_{e^-}=\Delta G°_{Ca2+}-G_{Ca(H2O)2+}+(G_{Ca}+0,5*G_{O2}+G_{H2})=-553,6-284,92+(647,319+0,5*303,1+85,64)=2*22,9745$ kJ/mol;
$CaOH^+$ [1] Formation $Ca+0,5*O_2+0,5H_2=CaOH^++e-$;
$G_{e^-}=\Delta G°_{CaOH+}-G_{CaOH}+(G_{Ca}+0,5*G_{O2}+0,5*G_{H2})=-718,4-101,071+(647,32+0,5*303,1+0,5*85,64)=22,2184$ kJ/mol;

Solubility of gases and solids, Prigogine constant K_{eq}, standard potential **E**°, protolysis hydroxonium H_3O^+.

The solubility constant K_s divided by the concentration $[H_2O]=55.3$ M is the Prigogine equilibrium constant $K_{eq}=K_{sp}/[H_2O]$ in mole fractions, which forms an attractor as the logarithm $\Delta Geq=-RTln(Keq)$ for solubility of:
oxygen $O_2^{gas}+H_2O=O_{2aq}$; $K_{eq}=K_{sp}/[H_2O]=[O_{2aq}]/[O_2^{gas}]/[H_2O]=1.22*10^{\wedge(-3)}$ M/**1**/55.3 M=$2.206*10^{-5}$; [7]
hydrogen $H_2^{gas}+H_2O=H_{2aq}$; $K_{eq}=K_{sp}/[H_{2aq}]/[H_2^{gas}]/[H_2O]=0.04564/1/55.3=0.00082526$, if $[H_2^{gas}]=1$; [8]
nitrogen $N_2^{gas}+H_2O=N_{2aq}$; $K_{eq}=K_{sp}/[H_2O]=0.000622045/1/55.3=10^{-4.9489}$; [1,8]
hydrogen sulfide $H_2S^{gas}+H_2O=H_2S_{aq}$; $K_{eq}=K_{sp}/[H_2O]=0.116784/1/55.3=0.0021118$; [30]
sulfur dioxide $SO_2^{gas}+H_2O=H_2SO_{3aq}$; $K_{eq}=K_{sp}/[H_2O]=[H_2SO_3]/[SO_2^{gas}]/[H_2O]=1,46724/1/51,64=0,028413$;
https://en.wikipedia.org/wiki/Sulfur_dioxide;
nitric oxide $NO^{gas}+H_2O=NO_{aq}$; $K_{eq}=K_{sp}/[H_2O]=[NO_{aq}]/[NO^{gas}]/[H_2O]=0.001865/1/55.3=10^{\wedge(-4.472)}$;
https://en.wikipedia.org/wiki/Nitric_oxide

Ionic crystals solubility product divided by the water concentration to the power of n is Prigogine constant $K_{eq}=K_{sp}/[H_2O]^n$ with the unitless mole fraction under the logarithm in the attractor $\Delta G_{eq}=-RTln(K_{eq})$ of:
silver chloride $AgCl_{(s)}+2H_2O=Ag^++Cl^-$; $[H_2O]^2=55.3^{\wedge 2}$ M$^{\wedge 2}$;
calomel $Hg_2Cl_{2(s)}+3H_2O=Hg_2^{2+}+2Cl^-$; $[H_2O]^3=55.3^{\wedge 3}$ M$^{\wedge 3}$;
mercury(II) oxide $Hg+H_2O+2OH^-=HgO_{(s)}+2H_2O+2e^-$; $1/[H_2O]^1=1/55.3^{\wedge 1}$ M$^{\wedge 1}$;
mercury sulfate $Hg_2SO_{4(s)}+2H_2O=Hg_2^{2+}+SO_4^{2-}$; $[H_2O]^2=55.3^{\wedge 2}$ M$^{\wedge 2}$

Protolysis equilibria for acids, bases and water.

Divided the acid constant K_a by water concentration $[H_2O]=55.3$ M is the Prigogine constant $K_{eq}=K_a/[H_2O]$ with unitless mol fraction value under the logarithm in the Prigogine attractor $\Delta G_{eq}=-RTln(\mathbf{K_{eq}})$ for::

[1] water $2H_2O=H_3O^+ + OH^-$ $pK_w=14$; $K_{H2O}=K_w/[H2O]^2=10^{\wedge(-14)}/55{,}3^{\wedge 2}=3{,}261\cdot10^{-18}$;

peroxide $H_2O_2+\mathbf{H_2O}=H_3O^+ + HOO^-$ $pK_a=11{,}75$; $K_{eq}=K_a/[\mathbf{H_2O}])=10^{\wedge(-11{,}75)}/55{,}3==3{,}2157*10^{\wedge(-14)}$;

[1] sulfuric acid 1st $H_2SO_4+\mathbf{H_2O}=HSO_4^- + H_3O^+$; $pK_{a1}=-2{,}8$; $K_{eq1}=K_{a1}/[H_2O]=10^{\wedge(2{,}8)}/55{,}3=11{,}41$;

[1] sulfuric acid 2nd $HSO_4^- + \mathbf{H_2O}=SO_4^{2-} + H_3O^+$ $pK_{a2}=1{,}99$; $K_{eq2}=K_{a2}/[\mathbf{H_2O}]=10^{\wedge(-1{,}99)}/55{,}3=0{,}0001850$;

[1] sulfurous acid 1st $H_2SO_3+\mathbf{H_2O}=HSO_3^- + H_3O^+$; $pK_{a1}=1.85$; $K_{eq1}=K_{a1}/[\mathbf{H_2O}]=10^{\wedge(-1{,}85)}/55{,}3=0{,}0002554$ is

2nd [1] $HSO_3^- + \mathbf{H_2O}=SO_3^{2-} + H_3O^+$; $pK_{a2}=7.21$; $K_{eq2}=K_{a2}/[\mathbf{H_2O}]=10^{\wedge(-7.21)}/55.3= 0.000000001115$;

Bicarbonate buffer acid $CO_{2aqua}+2H_2O \underset{CA}{=} H_3O^+ + HCO_3^-$; protolytic constant $pK_{a\_CO2aqua}=7{,}0512$

constant of Prigogine attractor $K_{eqCAHCO3aqua}=K_{a\_CO2aqua}/[H_2O]^2=10^{\wedge(-7{,}0512)}/55{,}3^{\wedge 2}=2{,}906*10^{-11}=10^{\wedge(-10{,}53665)}$.

[1] Bicarbonate protolysis $HCO_3^- + \mathbf{H_2O}=H_3O^+ + CO_3^{2-}$; $pK_a=10{,}33$ $K_{eq}=K_a/[H_2O]=10^{\wedge(-10{,}33)}/55{,}3=10^{\wedge(-12{,}07273)}$;

[1] Nitrous acid $HNO_2+H_2O=NO_2^- + H_3O^+$;$pK_a=3.15$; $K_{eq}=K_a/[\mathbf{H_2O}]=10^{\wedge(-3.15)}/55.3=0.0000128$;

[1] Nitric acid $HNO_3+H_2O=NO_3^- + H_3O^+$;$pK_a=-1.4$; $K_{eq}=K_a/[\mathbf{H_2O}]=10^{\wedge(1.4)}/55.3=0.4542$;

The standard potential $E°_{O2aq}=\mathbf{1.0868}$ V for the oxidation of water to oxygen $5H_2O=O_{2aq}+4H_3O^+ + 4\mathbf{e}^-$ gives the Nernst oxidation endoergonic attractor $\Delta G_{eq}=(E^\circ_H-E°_{O2aq})Fn=\mathbf{523{,}924}$ kJ/mol for the accumulation of absolute free energy in oxygen, four hydroxonium ions, and four free electrons $O_{2aq}+4H_3O^+ + 4\mathbf{e}^-$, separating protons and electrons forming hydroxonium $4H_3O^+ + 4\mathbf{e}^-$, generating oxygen $\mathbf{O_{2aq}}$, as in plant chlorophyll:

$\Delta G_{eqO2}=G_{O2aqua}+4G_{H3O+}+4G^{e-}-(5G_{H2O})=\mathbf{329{,}68}+4*\mathbf{22{,}44}+4*\mathbf{26{,}121}-(5*\mathbf{0})=\mathbf{523{,}924}$ kJ/mol in absolute potential and free energy scales with a common zero point, as $\Delta G_{eq}=0=E°_{O2aq}*F*n=0*F*n=0$ kJ/mol zero is zero.

The solubility of gaseous oxygen $\mathbf{O_2}^{gas}+H_2O=\mathbf{O_{2aq}}$ in the Nernst half-reaction one water molecule is consumed out of six, leaving five intact $5H_2O=O_{2aq}+4H_3O^+ + 4e$. It decreases the free energy content of H(Pt) electrode from $G_{H(Pt)}=\mathbf{51.05}$ kJ/mol to $G_{H(Pt)}=\mathbf{48.56}$ kJ/mol. The H(Pt) electrode potential increases from $E^\circ_H=-0.29654$ V [25] to $E^\circ_H=-0.27073$ V less negative. Standard potential $5H_2O=O_{2aq}+4H_3O^+ + 4e^-$ of oxygen decreases to $E°_{O2}=1.2288+0.1287+0.10166-0.37239=\mathbf{1.0868}$ V absolute standard of half reaction.

The example of the oxygen Nernst half-reaction shows the sequence of steps for restoring all absolute standard Nernst potentials from classic references $E°_{classic}$, with the water concentration in the Prigogine constants $\mathbf{K_{eq}}$ under logarithm in expression $\Delta G_{eq}=-RTln(\mathbf{K_{eq}})$ of the attractor.

The sequence of operations for the absolute potential recovery of the aqueous Nernst half-reactions. In the example $5H_2O=O_{2aq}+4H_3O^+ + 4e^-$ of the Nernst classical value $E°_{classicO2}=1.2288$ V subtract the logarithmic value of five water molecules $E°_{H2O}=-0.0591/4*\log(1/55.3^{\wedge 5})=0.1287$. Then add the combined correction sum $\Delta E°=+0.10166-0.37239$. These are the three addends $E°_{classic}$+water logarithm account+$\Delta E°$:

$E°_{O2}=E°_{ClassicO2}-0.0591/4*\log(1/55.3^{\wedge 5})+\Delta E°=1.2288+0.1287+\underline{0.10166}-0.37239=\mathbf{1.0868}$ Volts.

The Nernst oxidation half-reaction $5H_2O=O_{2aq}+4H_3O^+ + 4e^-$ is expressed as absolute potential:

$$E_{O2}=E°_{O2}+0.0591/4*\log\frac{[O_2]_{aqua}\cdot[H_3O^+]^4}{[H_2O]^5}=\mathbf{1.0868}+0.0591/4*\log\frac{[O_2]_{aqua}\cdot[H_3O^+]^4}{55{,}3^{\wedge 5}}\ \text{Volts.}$$

The oxygen reduction $\Delta G_{eqO2}=-E°_{O2}\cdot F\cdot n=-\mathbf{1.0868}*96485*4/1000=-\mathbf{419.44}$ kJ/mol is exoergonic attractor $\Delta G_{eqO2}=5G_{H2O}-(G_{O2aq}+4G_{H3O+})=5*0-(\mathbf{329.68}+4*\mathbf{22.44})=-\mathbf{419.44}$ kJ/mol in absolute potential and energy scales. Oxygen energy content $G_{O2}^{gas}=\mathbf{303.1}$ kJ/mol grows at solubility $G_{O2aq}=G_{O2}^{gas}+G_{O2sp}=\mathbf{303.1}+26.58=\mathbf{329.68}$ kJ/mol. Nernst's hydrogen oxidation $\underline{4H(Pt)}+4H_2O=4H_3O^+ + 4e^-$ standard absolute potential has $E^\circ_H=-0.27073$ Volts. In sum reduction of oxygen with metallic hydrogen synthesize two water molecules:

$O_{2aqua}+\underline{4H(Pt)}=2H_2O$ with absolute free energy exoergonic attractor **-523.925** kJ/mol :

$\Delta G_{eq}=(E^\circ_H-E°_{O2})\cdot F\cdot 1\cdot 4=(-0.27073-\mathbf{1.0868})*96485*4=-1.3575*96485*4/1000=2*\mathbf{261.96}=-\mathbf{523.925}$ kJ/mol.

Attractor $\Delta G_{eq2H2O}=2G_{H2O}-4G_{H(Pt)}-G_{O2aqua}=2*0-(4*G_{H(Pt)}+\mathbf{329.68})=-\mathbf{523.925}$ kJ/mol gives metal hydrogen molar free energy content $G_{H(Pt)}=(2G_{H2O}-\Delta G_{eq2H2O}-G_{O2aqua})/4=(2*0+\mathbf{523.925}-\mathbf{329.68})/4=\mathbf{194.245}/4=\mathbf{48.56}$ kJ/mol .

Hydrogen metal **H(Pt)** absolute electrode potential discovery at H_3O^+ solution. [25]

The biosphere attractor pH=7.36 plays a centripetal role in maintaining the complex reactions (processes) of perfect order homoeostasis. In current article have been extrapolated on to attractor value of pH=7.36 the free energy values from Alberty calculation tables at pH 5, 6, 7, 8, 9. Respecting the pH=7.36, the hydrogen gas G_{H2}^{gas}=**85,64** $^{kJ}/_{mol}$ and the free energy of saturated hydrogen solution G_{H2aq}=**103,24** $^{kJ}/_{mol}$ are given. [8]

Water formation $\mathbf{H_2^{gas}}+\mathbf{O_2}^{gas}/2=\mathbf{H_2O}$ from free elements standard change is $\Delta\mathbf{G}°_{H2O}$=-237,191 $^{kJ}/_{mol}$

calculate $\Delta\mathbf{G}°_{H2O}=G_{H2O}-(G_{H2}^{gas}+G_{O2}^{gas}/2)=\mathbf{0}-(\mathbf{85,64}+G_{O2}^{gas}/2)$=-237,191 $^{kJ}/_{mol}$

with Alberty' data [8] gives the free energy content per mole of gaseous oxygen G_{O2}=**303,1** $^{kJ}/_{mol}$

$G_{O2}^{gas}=(G_{H2O}-(G_{H2}^{gas}+\Delta\mathbf{G}°_{H2O}))*2=(\mathbf{0}-(\mathbf{85,64}-237,191))*2=$**303,1** $^{kJ}/_{mol}$. [1,15]

During the formation of $\mathbf{H_2^{gas}}$ and $\mathbf{O_2}^{gas}/2$, energy was spontaneously lost to the zero value of water G_{H2O}=**0** $^{kJ}/_{mol}$.

Since the 1920 Nobel Prize in Chemistry, the classical standard potential of the hydrogen electrode, forming the classical zero reference of the scale. [1] Zero is an unusual standard potential $E_{o\_classic}$=0 Volts for a metal, as the reducing agents accumulate free electrons in superiority negative cathode, forming $\mathbf{E}_{classic}$<0 Volts a negative potential, while the oxidizers capture free electrons leaving in the minority positive anode, a positive potential $\mathbf{E}_{classic}$>0 Volts. The accounting for hydroxonium and water is critically necessary for the assessment of the active masses law and the Prigogine constant under logarithm of attractor expression, since all non-equilibrium states tend to the Prigogine attractor, which has only one unique value to strive for $\Delta\mathbf{G}_{eq}=-\mathbf{R}\bullet\mathbf{T}\bullet\ln(\mathbf{K}_{eq})=\mathbf{E}°\mathbf{nF}$. [2]

The classical Nernst equation $\underline{\mathbf{H}}(\mathbf{Pt})=\mathbf{H}^+\mathbf{+e}^-$; for metallic hydrogen is expressed under standard conditions, the concentration in mol fraction of the pure metal is one [$\underline{\mathbf{H}}$**(Pt)**]=1 in solution [**H+**]=1 M of sulfuric acid. The equilibrium constant is one $\mathbf{K}_{classic\mathbf{H}(Pt)}=[\mathbf{H}^+]/[\underline{\mathbf{H}}(\mathbf{Pt})]$=1 M/1=1 M but with the unit of measurement molarity 1 M:

$\mathbf{E}_{classic}=E_{o\_classic}+0,0591\bullet\log\mathbf{K}_{classic\mathbf{H}(Pt)}=0+0,0591\bullet\log[\mathbf{H}^+]=0+0,0591\bullet\log(1\ M)=0$ Volts. [1]

The standard electrode for the Nernst hydrogen oxidation reaction $\underline{\mathbf{H}}(\mathbf{Pt})+\mathbf{H_2O}=\mathbf{H_3O}^+\mathbf{+e}^-$.

The Prigogine attractor $\Delta\mathbf{G}_{eq\mathbf{H}(Pt)}=-\mathbf{R}\bullet\mathbf{T}\bullet\ln(\mathbf{K}_{eq\mathbf{H}(Pt)})=\mathbf{E}°\mathbf{nF}$ in mathematics uses the equilibrium constant $\mathbf{K}_{eq\mathbf{H}(Pt)}$ without units (as unitless mol fractions) should be used also for $\Delta\mathbf{G}_{\mathbf{H}(Pt)}=-\mathbf{R}\bullet\mathbf{T}\bullet\ln(\mathbf{K}_{\mathbf{H}(Pt)})=E\mathbf{nF}$ non-equilibrium states. All non-equilibrium states $\Delta\mathbf{G}_{\mathbf{H}(Pt)}=-\mathbf{R}\bullet\mathbf{T}\bullet\ln(\mathbf{K}_{\mathbf{H}(Pt)})=E\mathbf{nF}$ tend to the equilibrium state $|\ \Delta\mathbf{G}_{\mathbf{H}(Pt)}\ |>|\ \Delta\mathbf{G}_{eq\mathbf{H}(Pt)}\ |$ as absolute and unique minimum of the free energy change $|\ \Delta\mathbf{G}_{eq\mathbf{H}(Pt)}\ |$. [3] The free electron concentration [e] and the number of electrons in the electrochemical reaction n are included in the expression of the standard potential **E°**. The Classical standard potential is determined experimentally against the hydrogen standard electrode Classical zero =0 Volts. To use the absolute free energy scale, it is necessary to determine the absolute standard potential $E^\circ_H=\Delta\mathbf{G}_{eqH(Pt)}/F/n=$**-26,12**/96485/1=-0.27073 Volts of the standard hydrogen electrode $\underline{\mathbf{H}}(\mathbf{Pt})+\mathbf{H_2O}=\mathbf{H_3O}^+\mathbf{+e}^-$.

In the Nernst oksidation reaction of the standard electrode of hydrogen, the reactant hydrogen metal in the platinum crystal lattice and the water molecule are in the reduced form Red($\underline{\mathbf{H}}$**(Pt)**+H_2O), which donates an electron to the electron gas, charging it negatively $\underline{\mathbf{H}}(\mathbf{Pt})+H_2O=H_3O^+\mathbf{+e}^-$; and in the products the oxidized form $Ox^{\Delta n+}(H_3O^+)$ hydroxonium ion with a negative charge in the metal electron gas.

The standard potential forms the Prigogine attractor $\Delta G_{eq}=\mathbf{E}°\mathbf{nF}=-\mathbf{R}\bullet\mathbf{T}\bullet\ln(\mathbf{K}_{eq})=\Delta G°Ox^{\Delta n+}-\Delta G°_{Red}$ minimum of the free energy change at equilibrium for hydrogen $\Delta G_{eq}=\mathbf{E}°\mathbf{nF}=-\mathbf{R}\bullet\mathbf{T}\bullet\ln(\mathbf{K}_{eq})=\Delta G°_{H3O+}-(\Delta G°_{H2O}+\Delta G°_{\underline{\mathbf{H}}(Pt)})$; The standard potential $\Delta\mathbf{G}_{eqH(Pt)}=E^\circ_H\bullet F\bullet n=-0.27073*96485*1=$**-26,12** $^{kJ}/_{mol}$ coincide with Hess's calculation based on Alberty' data $\Delta\mathbf{G}_{eqH(Pt)}=G_{H3O+}+G_{e-}-(G_{\mathbf{H}(Pt)}+G_{\mathbf{H2O}})=22,44+0-(\mathbf{48,56}+0)=$**-26,12** $^{kJ}/_{mol}$.

When established equilibrium, the sum of the chemical potentials of reactants the reducing agents and of products the oxidizing agents plus the electrons are equal $\mu Red+EnF=\mu Ox^{\Delta n+}+n\mu e-$. For each substance, the chemical potential can be calculated as $\mu=\Delta G°_A+RT\ln(N_A)$, where N_A is the concentration of substance A in mole fractions and $\Delta G°_A$ is the standard free energy change of a given substance A at formation from free elements. For example, $\mathbf{H_2O}$ formation

$\mathbf{H_2^{gas}}+\mathbf{O_2}^{gas}/2=\mathbf{H_2O}$; from the elements the published standard change is $\Delta\mathbf{G}°_{H2O}$=-237,191 $^{kJ}/_{mol}$ [1]:

$\Delta\mathbf{G}°_{H2O}=G_{H2O}-(G_{H2}^{gas}+G_{O2}^{gas}/2)=\mathbf{0}-(\mathbf{85,64}+\mathbf{303,1}/2)$=-237,191 $^{kJ}/_{mol}$.

$\mathbf{H_3O}^+$ formation $1,5\mathbf{H_2^{gas}}+\mathbf{O_2}^{gas}/2=\mathbf{H_3O}^+\mathbf{+e}^-$;

The electron free energy content Ge is Hess standard formation reaction from free elements $\mathbf{e}^-$, $\mathbf{H_2^{gas}}$, $\mathbf{O_2}^{gas}$:

$\Delta\mathbf{G}°_{H3O+}=G_{H3O}+G_{e-}-(1,5G_{H2aq}+G_{O2aq}/2)=\mathbf{22,4}+$**26,121**$-(1,5*\mathbf{85,64}+\mathbf{303,1}/2)$=-231,3887 $^{kJ}/_{mol}$;

Free electron formation energy content in one mol is

$G_{e-}=\Delta\mathbf{G}°_{H3O+}-G_{H3O+}+(1,5*G_{H2}^{gas}+0,5*G_{O2}^{gas})=-231,3887-\mathbf{22,44}+(1,5*\mathbf{85,6}+\mathbf{303,1}/2)=$**26,121** $^{kJ}/_{mol}$.

$\mathbf{OH}^-$ formation $\mathbf{H_2^{gas}}/2+\mathbf{O_2}^{gas}/2)+\mathbf{e}^-=\mathbf{OH}^-$;

$\Delta\mathbf{G}°_{OH-}=G_{\mathbf{OH}-}-(G_{H2}^{gas}/2+G_{O2aq}/2+G_{e-})=\mathbf{77.36}-(\mathbf{85,64}/2+\mathbf{303,1}/2+\mathbf{40,19})$=-157,2 $^{kJ}/_{mol}$;

$G_{e-}=G_{\mathbf{OH}-}-(G_{H2}^{gas}/2+G_{O2aq}/2+\Delta\mathbf{G}°_{OH-})=\mathbf{77.36}-(\mathbf{85,64}/2+\mathbf{303,1}/2-157,2)=$ **40,19** $^{kJ}/_{mol}$;

In the equilibrium mixture, $\Delta G°_{Red}+\mathbf{E}°\mathbf{nF}=\Delta G°Ox^{\Delta n+}+\mathbf{n}\Delta G°e-$ the change in the free energy of formation in the Hessian equation contains $\Delta G°Ox^{\Delta n+}$, $\Delta G°$Red the product ratio of oxidants over reductants $N_{Ox}^{\Delta n+}/N_{Red}=1$

under the logarithmic sign one, therefore R*T/n/F*ln($N_{Ox}^{\Delta n+}/N_{Red}$)=0 is zero. The sum of the electrode potentials E includes the standard potential E°. Free electrons are not bound in compounds $\Delta G°_{\underline{e}^-}=0$ $^{kJ}/_{mol}$. Concentration of free electrons [e]=1 not shown: $E=\frac{\Delta G°_{Ox^{\Delta n+}}-\Delta G°_{Red}}{nF}+\frac{RT}{nF}\bullet\ln\left(\frac{N_{Ox^{\Delta n+}}}{N_{Red}}\right)=E°+\frac{RT}{nF}\bullet\ln\left(\frac{N_{Ox^{\Delta n+}}}{N_{Red}}\right)$.

The standard potential $\mathbf{E°}=\frac{\Delta G°_{Ox^{\Delta n+}}-\Delta G°_{Red}}{nF}$ in the Prigogine attractor is the change minimum of free energy at equilibrium state $\Delta G_{eq}=\mathbf{E°nF}=\mathbf{-R\bullet T\bullet ln(K_{eq})}=\Delta G°_{Ox}^{\Delta n+}-\Delta G°_{Red}$. By switching to decimal logarithms and the thermodynamic standard T=298.15 K, we have the Nernst equation for the electrochemical oxidation reaction $\underline{\mathbf{H}}\mathbf{(Pt)}+\mathbf{H_2O}=\mathbf{H_3O^+}+\mathbf{e^-}$ in $[H_2SO_4]=[H_3O^+]=1$ M unimolar solution:

$E=\mathbf{E°}+0{,}0591/n*\log([\mathbf{H_3O^+}]*[\mathbf{e^-}]/[\mathbf{H_2O}]/[\mathbf{H(Pt)}])=\mathbf{-0{,}27073}+0{,}0591/n*\log(1\text{ M}*1/52.5\text{ M}/1)$.

Of products / reactants ratio Oxidized form =$\underline{\mathbf{Ox}}^{\Delta n+}$+on- $\underline{\mathbf{Red}}$uced form due to logarithm one is zero.

Absolute standard hydrogen electrode potential is $\mathbf{E°}_H$=**-0.27073** Volts instead of arbitrarly taken classic zero:

$\mathbf{E°}_{H\_classic}+0{,}0591\bullet\log\mathbf{K}_{classic\mathbf{H(Pt)}}=0+0{,}0591\bullet\log[\mathbf{H^+}]=0+0{,}0591\bullet\log(1\text{ M})=0$ Volts.

In the reaction, **ne-** electrons are removed, so for electroneutrality, additional positively charged ions **Δn+** are moved towards the solution. Electrons remain in the metal electron gas. The movement of the **Δn+** charge in the system the products of the oxidized form $\underline{\mathbf{Ox}}^{\Delta n+}$ brings the negative charged electrons **ne-** part of the chemical potential $\mathbf{n}\mu_{\mathbf{electr}}=\mathbf{n}\Delta G°e^-=\mathbf{-nFE°}$, the free energy of which is proportional to the potential -0,27073 ~ **-26,121**

$\Delta G°e^-=\mathbf{-FE°}=-96485*-0{,}27073=\mathbf{-26{,}121}$ $^{kJ}/_{mol}$.

Prigogine attractor $\Delta\mathbf{G}_{eq\mathbf{H(Pt)}}=\mathbf{-R\bullet T\bullet ln(K}_{eq\mathbf{H(Pt)}})=\mathbf{E°nF}$ applies mathematics to the full extent of the Nernst electrochemical oxidation reaction $\underline{\mathbf{H}}\mathbf{(Pt)}+H_2O=H_3O^++\mathbf{e^-}$, listing four things in full composition:

1. Classical standard potential $E°_{Hclassic}$=0 Volts [1] of Nernst's classic electrochemistry reference zero 0 Volts;
2. the logarithm of water is listed -0,0591*log(1/[H_2O])=-0,0591*log(1/55,3)=0,103 V including the accounting of diluted hydroxonium ions. Hydrogen electrode in sulfuric acid $[H_2SO_4]=[H_3O^+]$=1 M solution with a density of 1,061 $^{g}/_{mL}$ and water concentration [$\mathbf{H_2O}$]=963/18=52,5 M. [11]
3. Classical hydrogen zero water, hydroxonium correction thermodynamic $E°_{HclassicH2Ocorrection}$=0,10166 Volts;
   E=$E°_{HclassicThermodynamic}$-0,591/1*log([$H_3O^+$]/[$H_2O$])=0+0,0591*log(1/52,5)=0,10166-0,10166=0 V.
4. The absolute potential scale from classical 0.10166 V to sum absolute scale -0.27073-0.10166=-0.37239 V.

$E°_{H\_OH}=E°_{Hclassic}$-0,0591/1*lg(1/[H_2O]^0)+0,10166-0,37239=0-0,0591/1*log(1/55,3^0)+0,10166-0,37239=**-0,27073** V;

The amount of water per liter of sulfuric acid $[H_2SO_4]=[H_3O^+]$=1 M solution concentrations is with a density of 1.061 g/mL Absolute hydroxonium ion, water calculation shows $E°_H$=-0.27073 V standard potential for metallic hydrogen. Hydrogen incorporated into the platinum crystal lattice is an active metal electrode with an inactive crystal lattice of platinum atoms.

The ratio $[H_3O^+]/[H_2O]$=1 M/52.5 M=N_{H3O+}/N_{H2O} has mole fraction unitless instead moles per liter [H+]=1 M in the classical potential zero in the expression $\mathbf{E}=E°_{Hclassic}+0{,}0591/1\bullet\log([\mathbf{H^+}])=0+0{,}0591/1*\log(1)=0+0=0$ V. Mole fraction instead of the classical standard potential zero requires the classical thermodynamic standard potential $E°_{HclassicThermodynamic}$=0.10166 V, which is arbitrarily taken to be zero:

$\mathbf{E}=E°_{HclassicThermodynamic}+\ln(10)\bullet R\bullet T/F/1\bullet\log(N_{H3O+}/N_{H2O})=0{,}10166+0{,}0591*\log(1/52{,}5)=0{,}10166-0{,}10166=0$ V.

Absolute hydrogen electrode $\underline{\mathbf{H}}\mathbf{(Pt)}+\mathbf{H_2O}=\mathbf{H_3O^+}+\mathbf{e^-}$; potential

$\mathbf{E}=E°_H+0{,}0591/n*\log(\mathbf{K}_{\mathbf{H(Pt)}})=\mathbf{-0{,}27073}+0{,}0591/1*\log(1)=\mathbf{-0{,}27073\text{ V}}=E°_H$

is the standard potential $\mathbf{E}=E°_H$ as the logarithm of the equilibrium constant one is zero

$\log(\mathbf{K}_{\mathbf{H(Pt)}})=\log([\mathbf{H_3O^+}]*[\mathbf{e^-}]/[\mathbf{H_2O}]/[\mathbf{H(Pt)}])=\log(1)=0$ Volts.

Alberty data give exoergonical change $\Delta\mathbf{G}_{eqH(Pt)}=G_{H3O+}+G_{\underline{e}^-}-(G_{\mathbf{H(Pt)}}+G_{\mathbf{H2O}})=22{,}44+0-(\mathbf{48{,}56}+0)=\mathbf{-26{,}12}$ $^{kJ}/_{mol}$.

The change in free energy is determined on an absolute scale with reference to zero $G_{\mathbf{H2O}}=G_{\mathbf{CO2}}^{gas}=G_{\underline{e}^-}=0$ $^{kJ}/_{mol}$.

The calculated hydrogen standard potential on an proportional scales of absolute free energy and potential is

$E°_H=\Delta\mathbf{G}_{eqH(Pt)}/F/n=\mathbf{-26{,}12}*1000/96485/1=\mathbf{-0.27073\text{ V}}$.

The equilibrium state minimum of free energy is exorgonic, spontaneous and negative

$\Delta\mathbf{G}_{eqH(Pt)}=E°_H\bullet F\bullet n=\mathbf{-0.27073}*96485*1/1000=\mathbf{-26{,}12}$ $^{kJ}/_{mol}$,

in agreement with Alberty's data. The absolute potential scale is shifted down by

ΔE=-0.27073-0,10166=-0,37239 Volts

lower relative to the classical thermodynamic scale of hydrogen standard electrode potential value +0.10166. The Nernst equilibrium reaction is spontaneous, favorable, greater than one, for the oxidation of a metal to the hydroxonium ion $\mathbf{K}_{\mathbf{H(Pt)}}=[H_3O^+]*[\mathbf{e^-}]/[\mathbf{H_2O}]/[\mathbf{H(Pt)}]=EXP(-\Delta\mathbf{G}_{eqH(Pt)}/R/T)=EXP(\mathbf{26120}/8{,}3144/298{,}15)=37675{,}6$.

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