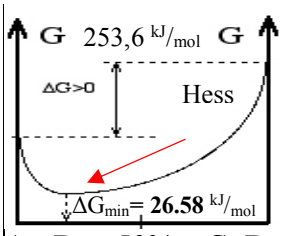
Oxidative stress cause **non-enzymatic** oxidation in multiple radical chain reactions and parallel products to contaminate and destroy the organism! Oxygen $O_{2aq}+4H_3O^++4e^-=5H_2O$ potential $-E°_{O2}$=**-1,0868 V** is strong oxidant, exoergonic, spontaneous Prigogine attractor $\Delta G_{O2}=-E_{O2}*F*n$=**-1,0868***96485*4/1000=**-419,44** $^{kJ}/_{mol}$. The oxygen spontaneously accepting four electrons with adding protons $4H_3O^+$, forming two water molecules. Solubility oxygen in water free energy content increases about **26.58** $^{kJ}/_{mol}$ from **303.1** $^{kJ}/_{mol}$ to **330** $^{kJ}/_{mol}$:

Substance	$\Delta H°_H$,$^{kJ}/_{mol}$	$\Delta S°_H$,$^{J}/_{mol/K}$	$\Delta G°_H$,$^{kJ}/_{mol}$
H_2O	-285.85	69.9565	-237.191
H_2O	**-286.65**	**-453.188**	**-151.549**
H_3O^+	$G_{AlbertyH3O}$=	**22.44**	**-257.46**
H_3O^+	-285,809	-182,5266	-231,3887
H_3O^+ G_{e-} formation		-231,3887	**26,121**
H_2^{gas}	Alberty	pH=7.36	**85.64**
$H_{2(aq)}$	**-5.02**	**-363.92**	**103.24**
$H_{2(aq)}$	23.4	-130	99.13
H(Pt)$_{(aq)}$	$E°_H$-$E°_{O2}$=	-1.3575	**48.56**
O_{2aqua}	**-11.70**	**-94.2**	**16.4**
O_{2aqua}	-11.715	110.876	16.4

$G_{O2aq}=G_{O2}^{gas}+G_{O2sp}$=**303.1**+**26.58**=**329.68**=**330** $^{kJ}/_{mol}$.
$G_{O2}^{gas}=2(G_{H2O}-(G_{H2}^{gas}-\Delta G°_{H2O}))=2*(0-(\mathbf{85.64}-237.19))$=**303.1** $^{kJ}/_{mol}$ pH=7.36 Massachusetts Technology Inst. Alberty [8]
$\Delta G°_{H3O\_absolute}=G_{H3O}-(0.5G_{H2}^{gas}+\mathbf{1.5}*G_{O2}^{gas})$=**-257.46** $^{kJ}/_{mol}$;
$\Delta H°_{H3O+}$=-285.809 $^{kJ}/_{mol}$ Mischenko 1972, Himia, Leningrad [26]
$G_{e-}=\Delta G°_{H3O+}-G_{H3O+}+(1,5*G_{H2}^{gas}+0,5*G_{O2}^{gas})$=**26,121** $^{kJ}/_{mol}$;
Biochem.Thermodyn. Massachusetts Technology Inst. [8] pH=7.36 [8] Biochem.Thermodyn. Massachusetts Technology Inst. CRC 2010 [1}
$G_{H(Pt)}=(2G_{H2O}-\Delta G_{eq2H2O}-G_{O2aqua})/4$=**48.56** $^{kJ}/_{mol}$;
pH=7.36 [8,1] Massachusetts Technology Inst. Alberty [8 CRC 1] CRC [1] G_{O2}^{gas}=**303** $^{kJ}/_{mol}$, G_{O2aq}=**329.68** $^{kJ}/_{mol}$;

Oxygen solubility free energy change is exothermic and endoergonic $O_2^{gas}+H_2O=O_{2aq}$, which mol fraction for gas $[O_2^{gas}]$=1 and value in water is $[O_{2aq}]/[H_2O]=1.22*10^{\wedge(-3)}\ ^M/_{55.3\ M}=2.206*10^{-5}$. [7] $\mathbf{K_{eq}}=[O_{2aq}]/[O_2^{gas}]/[H_2O]=2.206*10^{-5}/1=2.206*10^{-5}$ constant is less as one. The Hess standard change $\Delta G_{Hess}=\Delta G°_{O2aq}-\Delta G°_{H2O}-\Delta G°_{O2}^{gas}$=16.4-(0-237.191)=253.6 $^{kJ}/_{mol}$ is also endoergonic $\Delta G_{AlbertyO2aq}=G_{O2aq}-(G_{H2O}+G_{O2}^{gas})$=**330**-(0+**303.1**)=**26.58** $^{kJ}/_{mol}$, as Prigogine attractor endoergonic is $\Delta\mathbf{G_{eq}}=-\mathbf{R*T*ln(K_{eq})}$=-8.3144*298.15*ln(2.206*10^{-5})=**26.58** $^{kJ}/_{mol}$. The free energy of solubility is minimized from pure substances $\Delta\mathbf{G_{Hess}}$=253.6 $^{kJ}/_{mol}$ to $\Delta G_{eq}=-R*T*\ln(K_{eq})$=**26.58** $^{kJ}/_{mol}$ Prigogine attractor as equilibrium state mixture, because all non-equilibrium states tend to the minimum, to the established equilibrium state ΔG_{eq}.



Osmolar C_{osm}=0 M and ionic force **I**=0 M in water of air 20.95% oxygen solubility is
$[O_{2aq}]=\mathbf{K}_{speq}*[O_{2air}]*[H_2O]=2.206*10^{-5}*0.2095*55.3=0.00025546$ M.

The sum $O_{2aqua}+\underline{4H(Pt)}=2H_2O$; of the standard electrode potentials of oxygen reduction $-E°_{O2}$=**-1.0868** V plus the hydrogen oxidation $\underline{4H(Pt)}+4H_2O=4H_3O^++4e^-$ potential $E°_H$=**-0.27073** gives the Prigogine attractor $\Delta\mathbf{G_{eq}}=(E°_H-E°_{O2})•F•1•4=(\mathbf{-0.27073-1.0868})*96485*4$=-1.3575*96485*4/1000=-2***261.96**=**-523.925** $^{kJ}/_{mol}$ for free energy change. So $\Delta G_{eq2H2O}=2G_{H2O}-4G_{H(Pt)}-G_{O2aqua}=2*0-(4*G_{H(Pt)}+329.68)$=**-523.925** $^{kJ}/_{mol}$ metal hydrogen free energy content is $G_{H(Pt)}=(2G_{H2O}-\Delta G_{eq2H2O}-G_{O2aqua})/4=(2*0+\mathbf{523.925}-329.68)/4=\mathbf{194.251}/4$=**48.56** $^{kJ}/_{mol}$.

Biochemistry decreases oxygen O_{2aqua} free energy content to G_{O2aqua}=**329.68** $^{kJ}/_{mol}$ to $G_{O2Biochemistry}$=**88.22** $^{kJ}/_{mol}$.

Osmolar Cosm=0.305 M, ionic strength I=0.25 M in arterial blood plasma from air 20.95% oxygen solubility $[O_{2aq}]=6\cdot10^{-5}$ M and venous $[O_{2aq}]=0.426\cdot10^{-5}$ M isooxia is maintained by osmosis of oxygen molecules through aquaporin channels crossing membranes against osmolar concentration gradients ΔC_{osm}.
Arterial plasma $[O_{2aqua}]=6*10^{-5}$ M and $[H_3O^+]=10^{-7.36}$ M concentrations oxygen spontaneous potential decrease to $E_{O2}=-E°_{O2}+^{0.0591}/_4•\log([H_2O]^5/[O_{2aqua}]/[H_3O^+]^4)$=**-1.0868**+$^{0.0591}/_4$*log(6*10$^{\wedge(-5)}$*10$^{\wedge(-7.36*4)}/_{55.346^{\wedge5}}$)=**-0.46174** V
by $\Delta E_{arterial}=-E_{oO2}-(E_{O2})$=**-1.0868**-(**-0.46174**)=-0.62506 Volts and
free energy content by $\Delta G_{arterial}=\Delta E_{H2O}*F*n$=0.62506*96485*4/1000=-241.24 $^{kJ}/_{mol}$.

The free energy content of $O_2^{gas}{}_{AIR}+H_2O=O_{2Blood}$ with solubility contribution increases by:

$$K_{speq}=\frac{[O_{2\ aqua}]}{[O_{2\ gas}]\cdot[H_2O]}=2.205*10^{-5};\ G_{O2speq}=-R•T•\ln(K_{speq})=-8.3144*298.15*\ln(2.205*10^{-5})=\mathbf{26.58}\ ^{kJ}/_{mol}.$$

Protolysis decreases free energy to $G_{O2Biochem\_arterial}=G_{O2aqu}+G_{O2sp}+\Delta G_{arterial}$=**303.1**+**26.58**-241.456=**88.22** $^{kJ}/_{mol}$ and oxygen becomes fire safe biochemical oxidant, forming arterial concentration $[O_{2aqua}]=6*10^{-5}$ M as safe Bioenergetic sustaining normal isooxia. [3];

1) Water 55.346 M decreases oxygen potential from **-1.0868 V** about **<u>0.1288</u>** V=**-1.0868**-(**-0.95805**)=$\Delta\mathbf{E}_{H2O}$.
$E_{oO2}=E°_{O2}+^{0.0591}/_4*\log([H_2O]^5)$=**-1.0868**+0.01478*log(55.346$^{\wedge5}$)=**-1.0868**+**<u>0.1288</u>**=**-0.95805** V ;
2) $[H_3O^+]$=10 times the potential decreases and free energy content increases about ΔE_{H3O+}=**-0.05912** V
$\Delta E_{H3O}=0.01478•\log(1/[H_3O^+]^4)$=**-0.05912** V and $\Delta\mathbf{G_{max}}=\Delta E_{H3O}*\mathbf{F*n}$=-0.05912*96485*4/1000=**-22.817** $^{kJ}/_{mol}$;
3) Air 20.95% replaced with 100% oxygen $[O_{2aqua}]$ concentration 5 times increase potential about
$\Delta E_{O2100\%}=0.01478•\log(1/[O_{2aqua}])=0.01478*\log(1/5)=$**<u>-0.01033</u>** V . Free energy content for oxygen increases about $\Delta\mathbf{G_{max}}=\Delta E_{H3O}*\mathbf{F*n}=$**<u>-0.01033</u>***96485*4/1000=**-3.987** $^{kJ}/_{mol}$.

NASA Apollo Moon project closes 1972 because of oxidative stress and hazards risk.

Formation from elements $\mathbf{C}+6\mathbf{H_2}^{gas}+3\mathbf{O_2}^{gas}=\mathbf{C_6H_{12}O_6}$ free energy change calculates from Alberty data at pH=7.36 $\Delta\mathbf{G}^{\circ}_{Alberty}=\mathbf{G_{C6H12O6}}-(6\mathbf{G}_{Cgraph}+12*G_{H2}^{gas}+6*G_{O2}^{gas})=\mathbf{-402.05}$ kJ/mol. Energy in the mol of glucose is: $\mathbf{G_{C6H12O6}}=\Delta\mathbf{G}^{\circ}_{Alberty}+(6\mathbf{G}_{Cgraph}+6*G_{H2}^{gas}+3*G_{O2}^{gas})=\mathbf{-402.05}+(6*91.26+6*85.6+3*303)=\mathbf{1568.1}$ kJ/mol .

Substance	ΔH°_H kJ/mol	ΔS°_H J/mol/K	ΔG°_H kJ/mol
$\mathbf{C_6H_{12}O_{6aq}}$	-1263.78	269.45	-919.96
pH=7.36 **Glc**	**-1267.13**	**-2901.49**	**-402.05**

2006, Massachusetts Technology Inst. Alberty [8] pH=7.36. CRC 2010 [8] formation $\Delta\mathbf{G}^{\circ}_{Alberty}=\mathbf{-402.05}$ kJ/mol;

Calculation of free energy in glucose oxidation $\mathbf{C_6H_{12}O_6}+6\mathbf{O_2}_{aqua}+12\mathbf{H_2O}=6\mathbf{H_3O^+}+6\mathbf{HCO_3}$ in three ways:

1) In reaction published Alberty $\Delta\mathbf{G}_{arterial\_C6H12O6}=6*G_{H3O+}+6*G_{HCO3-}-(G_{arterial\_C6H12O6}+6*G_{O2aqua}+12*G_{H2O})=$
$=6*(22.44+56.08)-(1568.1+6*88.22+12*85.64)=2653.98$ kJ/mol data give value $\mathbf{G_{C6H12O6}}=\mathbf{1568.1}$ kJ/mol .
Alberty reaction $\Delta G_{C6H12O6}=\mathbf{-2654}$ kJ/mol and oxygen inverse absolute and standard potentials sum
$\Delta\mathbf{E}^{\circ}=(\mathbf{E}^{\circ}_{C6H12O6}-\mathbf{E}^{\circ}_{O2})=\Delta\mathbf{G}_{Lehninger}/\mathbf{F}/\mathbf{n}=\mathbf{-2653980}/96485/24=-1.1461$ V give the absolute free energy change
$\Delta\mathbf{G}_{Alberty}=\Delta\mathbf{E}^{\circ}\bullet\mathbf{F}\bullet\mathbf{n}=(\mathbf{E}^{\circ}_{C6H12O6}-\mathbf{E}^{\circ}_{O2})\bullet\mathbf{F}\bullet\mathbf{n}=(-1.1461)*\ 96485*24=\mathbf{-2654}$ kJ/mol for the oxidation reaction
$\mathbf{C_6H_{12}O_6}+12\mathbf{H_2O}+6\mathbf{O_2}_{aqua}=6H_3O^+ +6HCO_3^-$ by published data $\Delta\mathbf{G}_{Alberty}=\mathbf{-2654}$ kJ/mol. [8]

The sum of the absolute standard potentials $(\mathbf{E}^{\circ}_{C6H12O6}-\mathbf{E}^{\circ}_{O2})=(\mathbf{E}_{C6H12O6}-\mathbf{1.0868})=-1.1461$ V of glucose and oxygen allows us to determine the absolute standard potential for glucose

$\mathbf{E}^{\circ}_{C6H12O6}=\Delta\mathbf{E}+\mathbf{E}^{\circ}_{O2}=-1.1461+\mathbf{1.0868}=\mathbf{-0.0593}$ V, which is calculated from the value of the inverse Nernst's half reaction absolute standard potential of oxygen reduction $-\mathbf{E}^{\circ}_{O2}=\mathbf{-1.0868}$ V.

The absolute standard potential of glucose oxidation is negative because the strong of 24-electron donor, what reduce the six oxygen molecules in Nernst's inverse reaction $O_{2aqua}+4H_3O^+ +4e^-=5H_2O$ with an absolute standard potential $-\mathbf{E}^{\circ}_{O2}=\mathbf{-1.0868}$ V.

Adding the classical standard potential of glucose $E^{\circ}_{classic}=0.031193$ V, counting 42 water molecules within Nernst logarithm $-0.0591/24*\log(1/55.3^{\wedge 42})=0.18024$ and the combined sum $\Delta E^{\circ}=+0.10166-0.37239$,
the absolute standard potential for the Nernst half-reaction of glucose oxidation

$\mathbf{C_6H_{12}O_6}+42\mathbf{H_2O}=24H_3O^+ +6H_3O^+ +6HCO_3^- +24\ e^-$ is

$E^{\circ}_{C6H12O6}=E^{\circ}_{classic}-0.0591/24*\log(1/55.3^{\wedge 42})+\Delta E^{\circ}=0.03119+0.18024+0.10166-0.37239=\mathbf{-0.05930}$ V.

2) Lehninger reaction $\Delta\mathbf{G}_{C6H12O6}=6*G_{H3O+}+6*G_{HCO3-}-(G_{StandardC6H12O6}+6*G_{O2aqua}+12*G_{H2O\_Biochem})=\underline{-2840}$ kJ/mol has classic standard content in the mol of glucose $\mathbf{G}_{C6H12O6}=6*(22.44+56.08)-(\underline{-2840}+6*330+12*0)=1331$ kJ/mol
Arterial oxygen $[O_{2arteriāla}]=6*10^{\wedge(-5)}$ M; hydroxonium $[H_3O^+]^{\wedge 30}=10^{\wedge(-7.36*30)}$ M and $[\mathbf{C_6H_{12}O_6}]=0.005$ M glucose concentrations in the blood arterial decrease the glucose reducing potential to $E_{arterial}=\mathbf{-0.9310}$ V:

$$E_{Alberty}=E^{\circ}_{C6H12O6}+{}^{0.0591}/_{24}\bullet\log([HCO_3^-]^6*[H_3O^+]^{30}/_{[H2O]}{}^{42}/[\mathbf{C_6H_{12}O_6}])=$$
$$=\mathbf{-0.0593}+{}^{0.0591}/_{24}*\log(0.0154*10^{\wedge(-7.36*30)}/_{0.005}/_{55.346}{}^{\wedge 42})=\mathbf{-0.7821}\ V.$$

Inverse oxygen reduction absolute arterial potential has less negative versus standard $E^{\circ}_{O2} < E_{O2arterial}$
$E_{O2arterial}=E^{\circ}_{O2}+{}^{0.0591}/_{4}\bullet\log([H_2O]^5/_{[O2aqua]}/_{[H3O+]}{}^4)=\mathbf{-1.0868}+{}^{0.0591}/_{4}*\log(55.346^{\wedge 5}/_6/_{10^{\wedge(-5)}}/_{10^{\wedge(-7.36*4)}})=\mathbf{-0.46068}$ Volts.
Homeostasis potential sum is more negative $\Delta E_{arterial}=E_{C6H12O6arterial}+E_{O2arterial}=\mathbf{-0.7821-0.46068}=\mathbf{-1.39168}$ Volts.

Free energy change $\Delta\mathbf{G}_{arterial}$ is more exoergonic negative as absolute standard classic value:

$\Delta\mathbf{G}_{arterial}=\Delta\mathbf{E}\bullet\mathbf{F}\bullet\mathbf{n}=(\mathbf{E}_{C6H12O6arterial}-\mathbf{E}_{O2arterial})\bullet\mathbf{F}\bullet\mathbf{n}=(\mathbf{-0.7821-0.46068})*96485*24=\mathbf{-28877.8}$ kJ/mol .

3) free energy content $\Delta\mathbf{G}_{arterial\_C6H12O6}=6*G_{H3O+}+6*G_{HCO3-}-(G_{arterial\_C6H12O6}+6*G_{O2aqua}+12*G_{H2O})=\underline{\mathbf{-2877.8}}$ kJ/mol at homeostasis of glucose is $G_{arterial\_C6H12O6}=6*G_{H3O+}+6*G_{HCO3-}-(\Delta\mathbf{G}_{arterial\_C6H12O6}+6*G_{O2aqua}+12*G_{H2O})=$
$=6*(22.44+56.08)-(\underline{\mathbf{-2877.8}}+6*88.22+12*85.64)=\mathbf{1791.92}$ kJ/mol.

Generated $\mathbf{6HCO_3^-}+\mathbf{6H_3O^+}$ ions drive reactants $6\mathbf{O_2}_{aqua}$ and $6\mathbf{H_2O}$ through membranes aquaporins channels by osmosis against the concentration gradients and transporting $\mathbf{6HCO_3^-}+\mathbf{6H_3O^+}$ ions down the gradients through bicarbonate and proton channels consuming released free energy $\Delta\mathbf{G}_{arterial\_C6H12O6}=\underline{\mathbf{-2877.8}}$ kJ/mol.

One mol glucose oxidize six mols of oxygen producing six mols bicarbonate $6H_3O^+ +6HCO_3^-$:

$\mathbf{C_6H_{12}O_6}+42\mathbf{H_2O}=24H_3O^+ +6H_3O^+ +6HCO_3^- +24\ e^-$ + sum + $6\mathbf{O_2}_{aqua}+24H_3O^+ +24e^-=30H_2O$;

$\mathbf{C_6H_{12}O_6}+42\mathbf{H_2O}+6\mathbf{O_2}_{aqua}+24H_3O^+ +24e^-=24H_3O^+ +6H_3O^+ +6HCO_3^- +24\ e^- +30H_2O$;

$\mathbf{C_6H_{12}O_6}+12\mathbf{H_2O}+6\mathbf{O_2}_{aqua}\quad=\quad 6H_3O^+ +6HCO_3^-$

in protolysis activate $12H_2O+6CO_2$gas from zero reactants $12\mathbf{G}_{H2O}+6G_{CO2}^{gas}=12*0+6*0=0$ kJ/mol
to products free energy actual content $6G_{H3O+}+6G_{HCO3-}=6*22.44+6*56.08=471.12$ kJ/mol.

Absolute potential and free energy values include accounting for hydroxonium H_3O^+ and water H_2O.

Oxygen in the inverse half-reaction with free energy G_{O2aqua}=**330** $^{kJ}/_{mol}$ and potential $-E°_{O2}$=**-1.0868 V** reduces to water $O_{2aqua}+4H_3O^++4e^-=5H_2O$ by oxidizing four metallic hydrogen atoms $4\underline{H(Pt)}+4H_2O=4H_3O^++4e^-$ in the Nernst half-reaction with free energy content $\mathbf{G_{H(Pt)}}$=**48.56** $^{kJ}/_{mol}$, where the absolute standard potential of the electrode is $E°_H$=**-0.27073** V. Standard free energy change in reaction $O_{2aq}+\underline{4H(Pt)}=2H_2O$ from aqua elements is $\Delta G_{Hes2H2O}=2G_{H2O}-4G_{H(Pt)}-G_{O2aqua}=2*0-(4*$**48.56**$+$**330**$)=$**-524.24**$=2*$**-262** $^{kJ}/_{mol}$. The sum of the electrode standard $\Delta\mathbf{G_{eq}}=(E°_H-E°_{O2})\bullet F\bullet 4=($**-0.27073-1.0868**$)*96485*4=-1.3575*96485*4=$**-523.925**$=2*$**-262** $^{kJ}/_{mol}$ allows us to calculate the energy change for the formation of water from elements metallic hydrogen H(Pt) and oxygen O_{2aqua}, which coincide with the absolute free energy scale $G_{H(Pt)}$=**48.56** $^{kJ}/_{mol}$, G_{O2aqua}=**330** $^{kJ}/_{mol}$ and the absolute potential scale $E°_H$=**-0.27073** V, $-E°_{O2}$=**-1.0868b** V experimentally obtained for free aqua elements O_{2aqua}, H(Pt).

Hydrogen standard free energy in water solution G_{H2aqua}=**103.24** $^{kJ}/_{mol}$ is at pH=7.36. [8] $O_{2aqua}+\underline{2H_{2aqua}}=2H_2O$; Free energy $\Delta G_{HessCRCaqua}=2\Delta G°_{H2O}-2\Delta G°_{H2aqu}-\Delta G°_{O2aqua}=2*-237.191-(2*99.13/2+$**16.4**$)=-589.91=2*-295$ $^{kJ}/_{mol}$ standard change calculated from CRC data for the formation of elements pure reactants convert into products, that is maximum possible $\Delta G_{HessCRCaqua}=-295$ $^{kJ}/_{mol}>\Delta G_{eqH(Pt)\_H2O}$=**-261.96** $^{kJ}/_{mol}$ therefor greater than equilibrium. Formation from aqua elements at Homeostasis Alberty data pH=7.36, G_{H2aqua}=**103.24** $^{kJ}/_{mol}$ and G_{O2aq}=**88.22** $^{kJ}/_{mol}$ gives $\Delta G_{H2OHomeostasis}=G_{H2O}-(G_{H2aq}+G_{O2aq}/2)=$**0**$-($**103.24**$+$**88.22**$/2)=$**-147.35** $^{kJ}/_{mol}$ fire safe, smaller changes. [8]

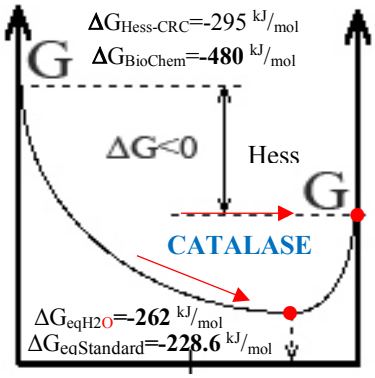
Substance	$\Delta H°_H$, $^{kJ}/_{mol}$	$\Delta S°_H$, $^{J}/_{mol/K}$	$\Delta G°_H$, $^{kJ}/_{mol}$
H_2O	-285.85	69.9565	-237.191
H_2O	**-286.65**	**-453.188**	**-151.549**
H_3O^+	$G_{AlbertyH3O}$=	**22.44**	**-257.46**
H_3O^+	-285.809	-168,8	-235,48
$H_3O^+G_{e-}$ formation		-235,48	**22,029**
$H_{2(aq)}$	23.4	-130	99.13
$H_{2(aq)}$	**-5.02**	**-363.92**	**103.24**
$E°\ \underline{H(Pt)}$	**-0.27073**	$E°_{O2}$**-1.0868**	**48.56**
O_{2aqua}	**-11.70**	**-94.2**	**16.4**
O_{2aqua}	-11.715	110.876	16.4

Water environment of Biochemistry has energy $\mathbf{G_{H2O}}$=**85.6** $^{kJ}/_{mol}$ $\mathbf{G_{H2O}}=\Delta G_{\mathbf{H2O}Alberty}-(\Delta G°_{H2O})=$**-151.549**$-(-237.191)=$**85.6** $^{kJ}/_{mol}$. [8] $\Delta G_H=\Delta H_H-T*\Delta S_H=$**-286.65**$-298.15*$**-0.453188**$=$**-151.5** $^{kJ}/_{mol}$; $\Delta G°_{H3O\_absolute}=G_{H3O}-(0.5G_{\mathbf{H2}}{}^{gas}+$**1.5**$*G_{O2}{}^{gas})=$**-257.46** $^{kJ}/_{mol}$; $\Delta H°_{\mathbf{H3O}^+}=285.809$ $^{kJ}/_{mol}$ Mischenko 1972, Himia, Leningrad [26] $G_{e-}=\Delta\mathbf{G}°_{H3O+}-G_{H3O+}+(1,5*G_{H2}{}^{gas}+0,5*G_{O2}{}^{gas})=$**22,029** $^{kJ}/_{mol}$; CRC [1] $G_{H2}{}^{gas}=$**85.6** $^{kJ}/_{mol}$; pH=7.36 [8] Biochem. Thermodyn. Massachusetts Techn. Inst.

$G_{H(Pt)}=(2G_{\mathbf{H2O}}-\Delta\mathbf{G_{eq}}_{2H2O}-G_{O2aqua})/4=$**48.56** $^{kJ}/_{mol}$ pH=7.36 [8] Biochem. Thermodyn Massachusetts Technology Inst. CRC [1] The equilibrium constant is favorably greater than one:

$\mathbf{K_{eq}}_{2H2O}=\mathbf{K}_{OxRed}=\mathbf{exp(-\Delta G}_{OxRed}\mathbf{/R/T)}=\exp($**261960.6**$/8.3144/298.15)=\exp(105.675)=7.832*10^{45}$.

Exothermic and exoergonic O_{2aqua} reduction with metal hydrogen Hess free energy change negative, but reaching equilibrium state $\Delta\mathbf{G_{eq}}_{2H2O}$=**-262** $^{kJ}/_{mol}$ at minimum has constant greater of one $\mathbf{K_{eq}}_{2H2O}=7.832*10^{45}$. The equilibrium state is attractor $\Delta\mathbf{G_{eq}}=-R*T*\ln(K_{\mathbf{eq}})$ for all non equilibrium states. Equilibrium is reached when the change has minimum in free energy. Oxidation Ox $H_2O_2+2H_2O=O_{2aqua}+2H_3O^++2e^-$ $E°_{H2O2Ox}$=**0.52677** V and reduction Red $H_2O_2+2H_3O^++2e^-=4H_2O$ absolute inverse standard potential $-E°_{H2O2Red}$=**-1.7113** V sum $E°_{H2O2Ox}-E°_{H2O2Red}$=**-1.18449** V. Protolytic dismutation of peroxide molecules is $\Delta G_{eqStandard\_H2O2}$=**-228.6** $^{kJ}/_{mol}$ exergonic, negative. The solubility of oxygen O_{2aqua} compensates the water $O_2{}^{gas}+H_2O=O_{2aqua}$ in products as like dismutation $\mathbf{2H_2O_2}=O_{2aqua}+H_2O$.



Reactants $\underline{4H(Pt)}+O_{2aqua}$ and products $2H_2O$

All reactants $\mathbf{2H_2O_2}$ and products $O_{2aqua}+H_2O$ are aqua CATALASE erase peroxide molecules $\mathbf{H_2O_2}$ reaching 100% efficiency for ω=6, ω=3 fatty acids elongation synthesis of C20:4 in peroxisomes. CATALASE reactivity is indispensable irreversible homeostasis Brownian molecular engine for evolution and survival. Exothermic and exoergonic $\mathbf{H_2O_2}$ dismutation free energy change is negative, but minimized $\Delta\mathbf{G}_{eqAlberty}$=**-228.6** $^{kJ}/_{mol}$ reaching equilibrium state favored constant $\mathbf{K}_{eq}=1.11*10^{40}$. Attractor is zero state sum $0=\Delta\mathbf{G}=\Delta\mathbf{G_{eq}}+R*T*\ln(K_{\mathbf{eq}})$ of equilibrium state. Biosphere attractors pH=7.36, oxygen 20.95% in air are in equilibrium, while elongation of ω=6, ω=3 fatty acids in peroxisomes proceeds with 100% yield, because the peroxide concentration is quenched by CATALASE by zeroing $[\mathbf{H_2O_2}]=>0$.

Ox potential has $E°_{classicH2O2Ox}=0.6945$ V [1,19], water logarithm $-0.0591/2*\log(1/[H_2O]^2)=0.103$, sum $\Delta E°$: $E°_{H2O}=E°_{classic}-0.0591/2*\log(1/[H_2O]^2)+\Delta E°=0.6945+0.103+0.10166-0.37239=$**0.52677** V. Reduction potential has $E°_{classic}=1.776$ V [1], water logarithm $-0.0591/2*\log(1/[H_2O]^4)=0.206$, sum $\Delta E°=+0.10166-0.37239$:

$E°_{H2O2Red}=E°_{classicH2O2Red}-0.0591/2*\log(1/[H_2O]^4)+\Delta E°=1.776+0.206+0.10166-0.37239=$**1.71126** V.

Inverse reduction $H_2O_2+2H_3O^++2e^-=4H_2O$; $\Delta G_{eqStandard\_H2O2}=-E°_{H2O2Red}*\mathbf{F}*\mathbf{n}=$**-1.71126***96485*2=**-330.222** $^{kJ}/_{mol}$ is exoergonic negative $\Delta\mathbf{G_{eq}}=4G_{\mathbf{H2O}}-(G_{Alberty\mathbf{H2O2}}+2G_{H3O+})=$**4*0-(285.342+2*22.44)=-330.222** $^{kJ}/_{mol}$. [8]

Free energy content is $G_{Alberty\mathbf{H2O2}}=4G_{\mathbf{H2O}}-(\Delta\mathbf{G_{eq}}+2G_{H3O+})=4*0-($**-330.222**$+2*$**22.44**$)=$**285.342** $^{kJ}/_{mol}$. Dismutation pH=7.36 is favored $\Delta G_{Hess2H2O2}=G_{H2O}+G_{O2aq}-(2G_{H2O2})=2*0+$**330**$-(2*$**285.342**$)=$**-240.684** $^{kJ}/_{mol}$.

$2G_{H2O2}=2G_{H2O}+G_{O2}^{gas}-(\Delta G_{Hess2H2O2})=2*0+\mathbf{303.1}-(-155.12)=2*\mathbf{229.1}$ kJ/mol. [1,8]

Peroxide oxidation and inverse reduction standard potentials sum calculates standard free energy change:

$\Delta E°_{H2O2}=(E°_{H2O2Ox}-E°_{H2O2Red})=(\mathbf{0.52677-1.7113})=\mathbf{-1.18449}$ V.

$\Delta G_{eq\_H2O2}=(E°_{H2O2Ox}-E°_{H2O2Red})*\mathbf{F*n}=(\mathbf{0.52677-1.7113})*96485*2=(\mathbf{-1.18449})*96485*2=\mathbf{-228.5788}$ kJ/mol.

$\mathbf{2H_2O_2}=O_{2aqua}+H_2O$; $\Delta\mathbf{G_{eqH2O2}}=G_{O2aqua}+G_{H2O}-2G_{Alberty\mathbf{H2O2}}=\mathbf{330+0-2*279.2855=-228.5788}$ kJ/mol. [8]

$G_{Alberty\mathbf{H2O2}}=(G_{O2Biochem}+G_{H2O}-\Delta\mathbf{G_{eqH2O2}})/2=(\mathbf{330+0+228.5788})/2=\mathbf{279.2855}$ kJ/mol.

Absolute potential **scale** coinciding with **Alberty absolute** free energy **scale**.

$\mathbf{K_{H2O2}}=[O_{2aqua}]*[H_2O]/[\mathbf{H_2O_2}]^2=\mathbf{exp(-\Delta G_{eq}/R/T)}=\exp(228578.8/8.3144/298.15)=1.11*10^{40}$.

Bio concentrations $[O_{2aqua}]=6*10^{-5}$ M, $[H_3O^+]=10^{-7.36}$ M, $[H_2O]=55.3$ M, activate CATALASE $[H_2O_2]=1$ M .

$E_{Ox}=E°_{H2O2}+0.0591/2•\lg([O_{2aqua}]*[H_3O^+]^2/[H_2O_2]/[H_2O]^2)=\mathbf{0.52677}+0.0591/2*\lg(6*10^{\wedge(-5)}*10^{\wedge(-7.36*2)}/1/55.3^{\wedge2})=\mathbf{-0.13596}$ V

$E_{Red}=-E°_{H2O2Ox}+0.0591/2•\log([H_2O_2]*[H_3O^+]^2/[H_2O]^4)=\mathbf{-1.71126}+0.0591/2*\lg(1*10^{\wedge(-7.36*2)}/55.3^{\wedge4})=\mathbf{-2.3522}$ V

Sum Nernst's + inverse reaction homeostasis absolute free energy electrochemical change has energy content $[\mathbf{H_2O_2}]=1$ M; $\Delta\mathbf{G_{eq}}_{BioChem}=(\mathbf{E_{Red}+E_{Ox}})*\mathbf{F*n}=(\mathbf{-0.13596-2.3522})*96485*2=(\mathbf{-2.5197})*96485*2=\mathbf{-486.23}$ kJ/mol ;

Standard $\Delta G_{Alberty}=G_{\mathbf{O2}Biochem\_arterial}+G_{\mathbf{H2O}BioChemistry}-2*G_{\mathbf{H2O2}}=\mathbf{88.22+85.64-2*279.2855=-384.711}$ kJ/mol;

Biochemistry concentrations $[H_2O_2]=10^{\wedge(-10)}$ M, $[O_{2aqua}]=6*10^{-5}$ M, $[H_3O^+]=10^{-7.36}$ M, $[H_2O]=55.3$ M

$E_{Ox}=E°_{H2O2}+0.0591/2•\lg([O_{2aqua}]*[H_3O^+]^2/[H_2O_2]/[H_2O]^2)=\mathbf{0.52677}+0.0591/2*\lg(6*10^{\wedge(-5)}*10^{\wedge(-7.36*2)}/10^{-10}/55.3^{\wedge2})=\mathbf{0.15954}$ V;

$E_{Red}=-E°_{H2O2Ox}+0.0591/2•\log([H_2O_2]*[H_3O^+]^2/[H_2O]^4)=\mathbf{-1.71126}+0.0591/2*\lg(10^{\wedge(-10)}*10^{\wedge(-7.36*2)}/55.3^{\wedge4})=\mathbf{-2.64773}$ V

$\Delta\mathbf{G_{eq}}_{BioChem}=(\mathbf{E_{Red}+E_{Ox}})*\mathbf{F*n}=(\mathbf{0.15954-2.64773})*96485*2=(\mathbf{-2.51964})*96485*2=\mathbf{-480.146}$ kJ/mol;

$\Delta G_{Alberty}=G_{\mathbf{O2}Biochem\_arterial}+G_{\mathbf{H2O}BioChemistry}-2*G_{\mathbf{H2O2}}=\mathbf{88.22+85.64-2*282.32=-390.78}$ kJ/mol. **Absolute** potential scale is proportional to **Alberty absolute** free energy scale at all $10^{\wedge(-10)}$ M $<[H_2O_2]<1$ M concentrations.

High rate protolysis peroxide anions collisions in peroxisomes proceeds with 100% yield of essential ω=6, ω=3 fatty acids C20:4, oxygen, water and heat: $\mathbf{2H_2O_{2\mathit{aq}}}+2\mathbf{H_2O}=\mathbf{O_2}_{aqua}+3\mathbf{H_2O}+\mathbf{Q}$.

Collision $\mathbf{H^+}+\mathbf{HOO^-}><\mathbf{^-OOH}+\mathbf{H^+}$ in water activation energy is high Ea=79000 J/mol with slow rate of reaction. In collision $\mathbf{HOO^-}=>\mathbf{Fe^{3+}}$ with iron(III) ion peroxide has small activation energy Ea=29 J/mol. It increases reaction rate thirty million times faster. The formation of H_2O_2 from the elements gaseous and aqua is negative, exergonic $\Delta G°^{gas}_{Format}=G_{\mathbf{H2O2}}+(G_{\mathbf{O2}}^{gas}+G_{\mathbf{H2}}^{\mathbf{gas}})=\mathbf{279.2855-(85.64+303.1)}=\mathbf{-109.4545}$ kJ/mol with molar energy content $G_{\mathbf{H2O2}}=\Delta G°^{gas}_{Format}+(G_{\mathbf{O2}}^{gas}+G_{\mathbf{H2}}^{\mathbf{gas}})=\mathbf{-109.4545+(85.64+303.1)}=\mathbf{279.2855}$ kJ/mol. From aqua elements formation exoergonic $\Delta G°_{aqaFormH2O2}=G_{\mathbf{H2O2}}-G_{H2aqu}-G_{O2aqua}=\mathbf{279.2855-(103.24+330)}=\mathbf{-153.9545}$ kJ/mol with identic molar energy content $G_{\mathbf{Hu2O2}}=\Delta G°_{aqaFormH2O2}+(G_{H2aqu}+G_{O2aqua})=\mathbf{-153.9545+(103.24+330)}=\mathbf{279.2855}$ kJ/mol. [8]

$\mathbf{H_2O_2}$ formation data in literary sources: $\Delta\mathbf{G}°_{Alberty}=\mathbf{-48.39}$ kJ/mol [8]; $\Delta G°^{gas}_{Format}=\mathbf{-109.4545}$ kJ/mol; $\Delta G°_{CRC}=-120.4(-155.12)$ kJ/mol [1]; $\Delta\mathbf{G}°_{UnivAlberta}=-134.03$ kJ/mol [19], $\Delta G°_{aqaFormH2O2}=\mathbf{-153.9545}$ kJ/mol;

Substance	$\Delta H°_H$, kJ/mol	$\Delta S°_H$, J/mol/K	$\Delta G°_H$, kJ/mol
$\mathbf{H_2O_{2\mathit{aq}}}$	**-191.99**	**-481.688**	**-48.39**
$\mathbf{H_2O_{2\mathit{aq}}}$	-191.17	143.9	-134.03
$\mathbf{H_2O_2}_{aq}$	Formation	**-48.39**	**340.25**
$\mathbf{H_2O_2}_{aq}$	Formation	**-109.4545**	**279.2855**
$\mathbf{H_2O_2}_{aq}$	Formation	-155.12	**229.1**
$\mathbf{H_2O_2}_{aq}$	Formation	**-153.9545**	**279.2855**
$\mathbf{H_2O_2}_{aq}$	$-E°_{H2O2Red}$	**-1.71126**	**285.342**
$\mathbf{H_2O_2}_{aq}$	$\Delta E°_{H2O2RedOx}$	**-1.18449**	**279.2855**
$\mathbf{HOO^-}$	pK_a=11.75	**77.016**	**333.86**
$\mathbf{H_2O_2}_{\mathit{l}}$	-187.8	109.6	-120.4

Peroxide protolysis pK_a=11.75 give molar $G_{\mathbf{HOO^-}}=\mathbf{333.86}$ kJ/mol; **Biochem.Thermodynamic 2006** Massachusetts Technology Ins.[8] $\Delta G_H=\Delta H_H-T*\Delta S_H=-148.266$ kJ/mol; University Alberta 1997. [19] $G_{\mathbf{H2O2}\mathit{aq}}=\Delta G_{\mathbf{H2O2}Alberty}+(G_{\mathbf{O2}}^{gas}+G_{\mathbf{H2}}^{\mathbf{gas}})=\mathbf{340.25}$ kJ/mol; [8] $\Delta G_{AlbertyFormat}=G_{\mathbf{H2O2}}+(G_{\mathbf{O2}}^{gas}+G_{\mathbf{H2}}^{\mathbf{gas}})=\mathbf{-109.4545}$ kJ/mol; [8] $2G_{H2O2}=2\Delta G°_{H2O2}=2G_{H2O}+G_{O2}^{gas}-(\Delta G_{Hess2H2O2})=2*\mathbf{229.1}$ kJ/mol. [1,8] $G_{\mathbf{H2O2}\mathit{aq}}=\Delta G_{\mathbf{H2O2}form}+(G_{\mathbf{O2}aqua}+G_{\mathbf{H2}aqua})=\mathbf{279.2855}$ kJ/mol; absolute $G_{Alberty\mathbf{H2O2}}=4G_{\mathbf{H2O}}-(\Delta\mathbf{G_{eq}}+2G_{H3O+})=\mathbf{285.342}$ kJ/mol; $G_{Alberty\mathbf{H2O2}}=(G_{\mathbf{O2}Biochem}+G_{\mathbf{H2O}}-\Delta\mathbf{G_{eqH2O2}})/2=\mathbf{279.2855}$ kJ/mol. $G_{\mathbf{HOO^-}}=-G_{\mathbf{H3O^+}}+\Delta\mathbf{G}_{aH2O2}+(G_{H2O2}+G_{H2O})=\mathbf{333.861}$ kJ/mol; CRC [1] $\Delta G_H=\Delta H_H-T*\Delta S_H=-187{,}8-298{,}15*-0{,}1096=-155{,}12$ kJ/mol;

1. Peroxide protolysis $\mathbf{H_2O_2}+\mathbf{H_2O}=\mathbf{H_3O^+}+\mathbf{HOO^-}$ pK_a=11.75 give the free energy change is endoergonic. So is for $\Delta\mathbf{G}_{aH2O2}=\mathbf{-R•T•ln(K_a/[H_2O])}=-8.3144*298.15*\ln(10^{\wedge(-11.75)}/55.3)=\mathbf{-8.3144*298.15*-31.07}=\mathbf{77.016}$ kJ/mol and Hess law $\Delta\mathbf{G}_{aH2O2}=G_{\mathbf{H3O^+}}+G_{\mathbf{HOO^-}}-(G_{H2O2}+G_{H2O})=\mathbf{22.44+333.86-(279.2855+0)}=\mathbf{77.016}$ kJ/mol. Free energy molar content is $G_{\mathbf{HOO^-}}=-G_{\mathbf{H3O^+}}+\Delta\mathbf{G}_{aH2O2}+(G_{H2O2}+G_{H2O})=\mathbf{-22.44+77.016}+(\mathbf{279.2855}+0)=\mathbf{333.86}$ kJ/mol.

Protolysis accumulates energy molar content of peroxide from $G_{\mathbf{H2O}}+G_{\mathbf{HOOH}}=0+\mathbf{279.2855}=\mathbf{279.2855}$ kJ/mol to $G_{\mathbf{H3O^+}}+G_{\mathbf{HOO^-}}=\mathbf{22.4+333.86}=\mathbf{356.26}$ kJ/mol.

Dismutation summary $\mathbf{2H_2O_2}=O_{2aqua}+H_2O$ reducing peroxide $H_2O_2+2H_3O^++2e^-=4H_2O$ at inverse potential $-E°_{H2O2Red}=\mathbf{-1.71126}$ Volts give a bit greater free energy content both this $G_{Alberty\mathbf{H2O2}}=\mathbf{285.43}$ kJ/mol and that anjon $G_{\mathbf{HOO^-}}=-G_{\mathbf{H3O^+}}+\Delta\mathbf{G}_{aH2O2}+(G_{H2O2}+G_{H2O})=\mathbf{-22.44+77.016}+(\mathbf{285.34}+0)=\mathbf{339.916}$ kJ/mol.

$\mathbf{HOO^-}+\mathbf{H_2O}=\mathbf{O_2}_{aqua}+\mathbf{H_3O^+}+2\mathbf{e^-}$ half reaction standard potential $E°_{\mathbf{HOO^-}}=\Delta\mathbf{G_{HOO^-}}/F/2=\mathbf{15544}/96485/2=\mathbf{0.08055}$ V is in free energy change $\Delta\mathbf{G}_{NernstHOO^-}=G_{\mathbf{O2}aqua}+G_{\mathbf{H3O^+}}-(G_{\mathbf{HOO^-}}+G_{H2O})=\mathbf{330+22.44-(336.896+0)}=\mathbf{15.544}$ kJ/mol.

Absolute potential has $E°_{classic}=0.29978$ V, water logarithm $-0.0591/2*\log(1/[H_2O]^1)=0.0515$, sum $\Delta E°$:

$E°_{\mathbf{HOO}Ox}=E°-0.0591/2*\log(1/[H_2O]^1)+0.10166-0.37239=0.29978-0.0515+0.10166-0.37239=\mathbf{0.080551}$ V.

Equilibrium $\mathbf{K_{eq}}$, electrode standard potentials $\mathbf{E°}$ are determinants of attractors $\mathbf{\Delta G_{eq}=-R•T•\ln(K_{eq})=E°nF}$.
The electrode potential has a common zero point and proportional to the absolute free energy $\Delta\mathbf{G_{eq}=E°nF}$.

Endoergonic protolysis $H_2O+H_2O=H_3O^++OH^-$; $K_{eq}=\frac{[OH^-]\cdot[H_3O^+]}{[H_2O]\cdot[H_2O]}=3{,}26•10^{-18}$; accumulate free energy calculates from Prigogine attractor $\Delta G_{eq}=-R•T•\ln(K_{eq})$ and Hess sums $\Delta G_{eqHess}=\Sigma\Delta G_{products}-\Sigma\Delta G_{reactants}$ [1,2,3,4]
$\Delta G_{eq}=-R•T•\ln(K_{eq})=-8{,}3144*298{,}15*\ln(3{,}261*10^{\wedge(-18)})=G_{H3O+}+G_{OH-}-(2*\ G_{H2O})=\mathbf{22{,}44+77{,}36}-(2*\mathbf{0})=99{,}8\ ^{kJ}/_{mol}$.
Water as the final product has zero free energy $\mathbf{G_{H2O}=0}\ ^{kJ}/_{mol}$ and is the background reference in Biochemistry. It $H_2+0{,}5O_{2aq}=H_2O$ state formation zero from free elements of hydrogen $G_{H2}=\mathbf{85{,}64}\ ^{kJ}/_{mol}$ and $G_{O2}^{gas}=\mathbf{303}\ ^{kJ}/_{mol}$. The standard value of water formation $\Delta\mathbf{G}°_{H2O}=237{,}191\ ^{kJ}/_{mol}$ loses the remainder small part of the standard

$$\mathbf{G}_{H2O}=\Delta\mathbf{G}°_{H2O}+(G_{H2}+0{,}5G_{O2}^{gas})=-237{,}191+(\mathbf{85{,}64}+0{,}5*\mathbf{303})=-0{,}051\ ^{kJ}/_{mol}\ ;$$

free energy of formation of pure water and is the fraction of the protolysis products $[H_3O^+]+[OH^-]=10^{-7}$ M$+10^{-7}$ M per mole of water, additionally reducing the standard free energy of formation $\Delta\mathbf{G}°_{H2O}$ by $\mathbf{G}_{H2O}=-0{,}051\ ^{kJ}/_{mol}$.
The standard value $\Delta H°_{\mathbf{H3O}}=-285{,}809\ ^{kJ}/_{mol}$ Mischenko [1, 26] is confirmed by neutralization heat amount:
$\Delta H_{neutralisation}=-55{,}851\ ^{kJ}/_{mol}$ $\Delta H_{Hess}=2•\Delta H°_{H2O}-(\Delta H°_{H3O}+\Delta H°_{OH-})=2*-285{,}83-(-285{,}809-230)=-55{,}851\ ^{kJ}/_{mol}$.

Substance	$\Delta H°_H,\ ^{kJ}/_{mol}$	$\Delta S°_H,\ ^{J}/_{mol/K}$	$\Delta G°_H,\ ^{kJ}/_{mol}$
H_2O	**-286,65**	**-453,188**	**-151,549**
H_2O	-285,85	69,9565	-237,191
OH^-	–230.00	-10,8	-157,2
H_3O^+	-285,809	-737,98	-65,780
H_3O^+	-285,809	-182,1905	-231,4889
G_{e-} H_3O^+	formation	-231,4889	**26,121**
H_3O^+	$K_{eq1}=3{,}26•10^{\wedge(-18)}$		**22,44**
G_{e-} OH^-	$K_{eq1}=3{,}26•10^{\wedge(-18)}$		**77,36**

$\Delta H°_{\mathbf{H3O}}=-285{,}809\ ^{kJ}/_{mol}$ Mischenko 1972 ,Himia, Leningrad [1,26]
$\Delta G_H=\Delta H_H-T*\Delta S_H=\mathbf{-286{,}65}-298{,}15*\mathbf{-0{,}453188}=\mathbf{-151{,}549}\ ^{kJ}/_{mol}$; [8]
$\Delta G_H=\Delta H_H-T*\Delta S_H=-285{,}85-298{,}15*-0{,}0699565=-264{,}99\ ^{kJ}/_{mol}$;
CRC [1] $\Delta\mathbf{G}°_{OH-}=\Delta H-T*\Delta S=-230-298{,}15*-0{,}0108=-226{,}78\ ^{kJ}/_{mol}$;
$\Delta\mathbf{G}°_{H3O+}=\Delta H-T*\Delta S=-285{,}809-298{,}15*-737{,}98/1000=-65{,}780\ ^{kJ}/_{mol}$;
$\Delta H-T*\Delta S=-285{,}809-298{,}15*-0{,}1821905=-231{,}4889\ ^{kJ}/_{mol}$;
$G_{e-}=\Delta\mathbf{G}°_{H3O+}-G_{H3O+}+(1{,}5*G_{H2}^{gas}+0{,}5*G_{\mathbf{O2}}^{gas})=\mathbf{26{,}121}\ ^{kJ}/_{mol}$;
The equilibrium state $\Delta G_{eq1}=G_{H3O+}+G_{OH-}=\mathbf{22{,}44+77{,}36}=99{,}8\ ^{kJ}/_{mol}$; is an attractor for all non-equilibrium states, including the maximal

$\Delta H_{Hess}=\Delta H°_{H3O+}+\Delta H°_{OH-}-2•\Delta H°_{H2O}=-285{,}809-230-2*-285{,}85=55{,}851\ ^{kJ}/_{mol}$.Enthalpy is from [1,8,26]
$\Delta S_{Hess}=\Delta S°_{H3O}-\Delta S°_{OH}-2•\Delta S°_{H2O}=-182{,}1905-10{,}8-2*69{,}956=-332{,}9025\ ^{J}/_{mol/K}$;Corrected $\Delta\mathbf{S}°_{H3O+}=-182{,}191\ ^{J/K}/_{mol}$;
$\Delta G_{Hess\_protolysis}=\Delta H_{Hess}-T•\Delta S_{Hess}=55{,}851-298{,}15*-0{,}319512=\mathbf{151{,}11}\ ^{kJ}/_{mol}$; Corrected $\Delta\mathbf{G}°_{H3O+}=-231{,}4889\ ^{kJ}/_{mol}$;
$\Delta S_{dispersed}=-\Delta H_{Hess}/_T=-55{,}851/298{,}15=-187{,}325\ ^{J}/mol/K$;
$\Delta S_{total}=\Delta S_{Hess}+\Delta S_{dispersed}=-319{,}512-187{,}325=-506{,}837\ ^{J}/_{(mol\ K)}$;
$T\Delta S_{total}=\underline{\Delta G_{dispersed}\text{ or dissipated free energy}}$ $T•\Delta S_{total}=-0{,}506837\ ^{J}/_{K}/_{mol}•298{,}15\ K=\mathbf{-151{,}1058}\ ^{kJ}/_{mol}$.
In the entire set of non-equilibrium states $\Delta G_{eq}=-R•T•\ln(K_{non\_equilibrium})$ there is one state with the smallest absolute energy change $\Delta G_{eq}=-R•T•\ln(K_{eq})$ Prigogine attractor .
The inverse of protolysis is a neutralization reaction, a heat of reaction experiment in which pure reactants, acids H_3O^+ (HCl vai HNO_3) and hydroxides OH^- (NaOH vai KOH), react to produce pure water. The heat of reaction is calculated as the sum of the net products minus the sum of the net reactants:
$\Delta H_{Hess}=2•\Delta H°_{H2O}-(\Delta H°_{H3O}+\Delta H°_{OH-})=2*-285{,}83-(-285{,}809-230)=-55{,}851\ ^{kJ}/_{mol}$. The enthalpies are from {1,8,26], where temperature measurements

$$\mathbf{Q}=-\Delta H_{eksperimentāls}=\mathbf{C_{H2O}•m_{H2O}}•\Delta T/\mathbf{n}=4{,}184*200*2{,}1357935/\mathbf{0{,}032}=55{,}851\ ^{kJ}/_{mol}$$

confirm the data of $\Delta H°_{\mathbf{H3O}+}=-285{,}809\ ^{kJ}/_{mol}$ Mischenko 1972, Himia, Leningrad [26].
Each of the non-equilibrium reaction states tends to an equilibrium state with a minimum energy change $\Delta G_{eq}=99{,}8\ ^{kJ}/_{mol}$, because in a mixture of substances at equilibrium with a constant K_{eq} value, the free energy change $\Delta G_{eq}=-R•T•\ln(K_{eq})$ is the Prigogine attractor:
$\Delta G_{eq}=-R•T•\ln(K_{eq})=-8{,}3144*298{,}15*\ln(3{,}261*10^{\wedge(-18)})=G_{H3O+}+G_{OH-}-(2*\ G_{H2O})=\mathbf{22{,}44+77{,}36}-(2*\mathbf{0})=99{,}8\ ^{kJ}/_{mol}$, which is the minimum of the absolute value of the free energy change in water protolysis .[1,2,3,4]
In the environment, water is activates $G_{H2O\_Biochemistry}=\Delta G_{\mathbf{H2O}Alberty}-(\Delta G°_{H2O})=\mathbf{-151{,}549}-(-237{,}191)=\mathbf{85{,}6}\ ^{kJ}/_{mol}$ according to Alberty data. [8] Protolysis of water $H_3O^++OH^-$, abundant formation of hydrogen bonds, coordination with donor-acceptor bonds in organisms with water-rich biochemistry environment activates effective free energy storing $G_{H2O\_Biochemistry}=\mathbf{85{,}6}\ ^{kJ}/_{mol}$ from absolute zero of pure distilled water $G_{H2O}=0\ ^{kJ}/_{mol}$,

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