

Standard Reduction Potentials

TABLE A6.1 Standard Reduction Potentials at 25°C		
Half-Reaction	<i>n</i>	<i>E</i> ^o (V)
$F_2(g) + 2 e^- \rightarrow 2 F^-(aq)$	2	2.866
$H_2N_2O_2(s) + 2 H^+(aq) + 2 e^- \rightarrow N_2(g) + 2 H_2O(\ell)$	2	2.65
$O(g) + 2 H^+(aq) + 2 e^- \rightarrow H_2O(\ell)$	2	2.421
$Cu^{3+}(aq) + e^- \rightarrow Cu^{2+}(aq)$	1	2.4
$XeO_3(s) + 6 H^+(aq) + 6 e^- \rightarrow Xe(g) + 3 H_2O(\ell)$	6	2.10
$O_3(g) + 2 H^+(aq) + 2 e^- \rightarrow O_2(g) + H_2O(\ell)$	2	2.076
$OH(g) + e^- \rightarrow OH^-(aq)$	1	2.02
$Co^{3+}(aq) + e^- \rightarrow Co^{2+}(aq)$	1	1.92
$H_2O_2(\ell) + 2 H^+(aq) + 2 e^- \rightarrow 2 H_2O(\ell)$	2	1.776
$N_2O(g) + 2 H^+(aq) + 2 e^- \rightarrow N_2(g) + H_2O(\ell)$	2	1.766
$Ce(OH)^{3+}(aq) + H^+(aq) + e^- \rightarrow Ce^{3+}(aq) + H_2O(\ell)$	1	1.70
$Au^+(aq) + e^- \rightarrow Au(s)$	1	1.692
$PbO_2(s) + SO_4^{2-}(aq) + 4 H^+(aq) + 2 e^- \rightarrow PbSO_4(s) + 2 H_2O(\ell)$	2	1.6913
$PbO_2(s) + HSO_4^-(aq) + 3 H^+(aq) + 2 e^- \rightarrow PbSO_4(s) + 2 H_2O(\ell)$	2	1.685
$MnO_4^-(aq) + 4 H^+(aq) + 3 e^- \rightarrow MnO_2(s) + 2 H_2O(\ell)$	3	1.673
$NiO_2(s) + 4 H^+(aq) + 2 e^- \rightarrow Ni^{2+}(aq) + 2 H_2O(\ell)$	2	1.678
$HClO(\ell) + H^+(aq) + e^- \rightarrow \frac{1}{2} Cl_2(g) + H_2O(aq)$	1	1.63
$Ce^{4+}(aq) + e^- \rightarrow Ce^{3+}(aq)$	1	1.61
$Mn^{3+}(aq) + e^- \rightarrow Mn^{2+}(aq)$	1	1.542
$MnO_4^-(aq) + 8 H^+(aq) + 5 e^- \rightarrow Mn^{2+}(aq) + 4 H_2O(\ell)$	5	1.507
$BrO_3^-(aq) + 6 H^+(aq) + 5 e^- \rightarrow \frac{1}{2} Br_2(\ell) + 3 H_2O(\ell)$	5	1.52
$ClO_3^-(aq) + 6 H^+(aq) + 5 e^- \rightarrow \frac{1}{2} Cl_2(g) + 3 H_2O(\ell)$	5	1.47
$PbO_2(s) + 4 H^+(aq) + 2 e^- \rightarrow Pb^{2+}(aq) + 2 H_2O(\ell)$	2	1.455
$Au^{3+}(aq) + 3 e^- \rightarrow Au(s)$	3	1.40
$Cl_2(g) + 2 e^- \rightarrow 2 Cl^-(aq)$	2	1.3583
$Cr_2O_7^{2-}(aq) + 14 H^+(aq) + 6 e^- \rightarrow 2 Cr^{3+}(aq) + 7 H_2O(\ell)$	6	1.33
$2 NiO(OH)(s) + 2 H_2O(\ell) + 2 e^- \rightarrow 2 Ni(OH)_2(s) + 2 OH^-(aq)$	2	1.32
$MnO_2(s) + 4 H^+(aq) + 2 e^- \rightarrow Mn^{2+}(aq) + 2 H_2O(\ell)$	2	1.23

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TABLE A6.1 Standard Reduction Potentials at 25°C (Continued)

Half-Reaction	<i>n</i>	<i>E</i> ^o (V)
$\text{O}_2(\text{g}) + 4 \text{H}^+(\text{aq}) + 4 \text{e}^- \rightarrow 2 \text{H}_2\text{O}(\ell)$	4	1.229
$\text{IO}_3^-(\text{aq}) + 6 \text{H}^+(\text{aq}) + 5 \text{e}^- \rightarrow \frac{1}{2} \text{I}_2(\text{s}) + 3 \text{H}_2\text{O}(\ell)$	5	1.195
$\text{IO}_3^-(\text{aq}) + 6 \text{H}^+(\text{aq}) + 6 \text{e}^- \rightarrow \text{I}^-(\text{aq}) + 3 \text{H}_2\text{O}(\ell)$	6	1.085
$\text{Br}_2(\ell) + 2 \text{e}^- \rightarrow 2 \text{Br}^-(\text{aq})$	2	1.066
$\text{HNO}_2(\ell) + \text{H}^+(\text{aq}) + \text{e}^- \rightarrow \text{NO}(\text{g}) + \text{H}_2\text{O}(\ell)$	1	1.00
$\text{VO}_2^+(\text{aq}) + 2 \text{H}^+(\text{aq}) + \text{e}^- \rightarrow \text{VO}^{2+}(\text{aq}) + \text{H}_2\text{O}(\ell)$	1	1.00
$\text{NO}_3^-(\text{aq}) + 4 \text{H}^+(\text{aq}) + 3 \text{e}^- \rightarrow \text{NO}(\text{g}) + 2 \text{H}_2\text{O}(\ell)$	3	0.96
$2 \text{Hg}^{2+}(\text{aq}) + 2 \text{e}^- \rightarrow \text{Hg}_2^{2+}(\text{aq})$	2	0.92
$\text{ClO}^-(\text{aq}) + \text{H}_2\text{O}(\ell) + 2 \text{e}^- \rightarrow \text{Cl}^-(\text{aq}) + 2 \text{OH}^-(\text{aq})$	2	0.89
$\text{HO}_2^-(\text{aq}) + \text{H}_2\text{O}(\ell) + 2 \text{e}^- \rightarrow 3 \text{OH}^-(\text{aq})$	2	0.88
$\text{Hg}^{2+}(\text{aq}) + 2 \text{e}^- \rightarrow \text{Hg}(\ell)$	2	0.851
$\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s})$	1	0.7996
$\text{Hg}_2^{2+}(\text{aq}) + 2 \text{e}^- \rightarrow 2 \text{Hg}(\ell)$	2	0.7973
$\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+}(\text{aq})$	1	0.770
$\text{PtCl}_4^{2-}(\text{aq}) + 2 \text{e}^- \rightarrow \text{Pt}(\text{s}) + 4 \text{Cl}^-(\text{aq})$	2	0.73
$\text{O}_2(\text{g}) + 2 \text{H}^+(\text{aq}) + 2 \text{e}^- \rightarrow \text{H}_2\text{O}_2(\ell)$	2	0.68
$\text{MnO}_4^-(\text{aq}) + 2 \text{H}_2\text{O}(\ell) + 3 \text{e}^- \rightarrow \text{MnO}_2(\text{s}) + 4 \text{OH}^-(\text{aq})$	3	0.59
$\text{H}_3\text{AsO}_4(\text{s}) + 2 \text{H}^+(\text{aq}) + 2 \text{e}^- \rightarrow \text{H}_3\text{AsO}_3(\text{aq}) + \text{H}_2\text{O}(\ell)$	2	0.559
$\text{I}_2(\text{s}) + 2 \text{e}^- \rightarrow 2 \text{I}^-(\text{aq})$	2	0.5355
$\text{Cu}^+(\text{aq}) + \text{e}^- \rightarrow \text{Cu}(\text{s})$	1	0.521
$\text{H}_2\text{SO}_3(\ell) + 4 \text{H}^+(\text{aq}) + 4 \text{e}^- \rightarrow \text{S}(\text{s}) + 3 \text{H}_2\text{O}(\ell)$	4	0.449
$\text{Ag}_2\text{CrO}_4(\text{s}) + 2 \text{e}^- \rightarrow 2 \text{Ag}(\text{s}) + \text{CrO}_4^{2-}(\text{aq})$	2	0.4470
$\text{O}_2(\text{g}) + 2 \text{H}_2\text{O}(\ell) + 4 \text{e}^- \rightarrow 4 \text{OH}^-(\text{aq})$	4	0.401
$\text{Fe}(\text{CN})_6^{3-}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}(\text{CN})_6^{4-}(\text{aq})$	1	0.36
$\text{Ag}_2\text{O}(\text{s}) + \text{H}_2\text{O}(\ell) + 2 \text{e}^- \rightarrow 2 \text{Ag}(\text{s}) + 2 \text{OH}^-(\text{aq})$	2	0.342
$\text{Cu}^{2+}(\text{aq}) + 2 \text{e}^- \rightarrow \text{Cu}(\text{s})$	2	0.342
$\text{BiO}^+(\text{aq}) + 2 \text{H}^+(\text{aq}) + 3 \text{e}^- \rightarrow \text{Bi}(\text{s}) + \text{H}_2\text{O}(\ell)$	3	0.32
$\text{AgCl}(\text{s}) + \text{e}^- \rightarrow \text{Ag}(\text{s}) + \text{Cl}^-(\text{aq})$	1	0.2223
$\text{HSO}_4^-(\text{aq}) + 3 \text{H}^+(\text{aq}) + 2 \text{e}^- \rightarrow \text{H}_2\text{SO}_3(\ell) + \text{H}_2\text{O}(\ell)$	2	0.17
$\text{Sn}^{4+}(\text{aq}) + 2 \text{e}^- \rightarrow \text{Sn}^{2+}(\text{aq})$	2	0.154
$\text{Cu}^{2+}(\text{aq}) + \text{e}^- \rightarrow \text{Cu}^+(\text{aq})$	1	0.153
$2 \text{MnO}_2(\text{s}) + \text{H}_2\text{O}(\ell) + 2 \text{e}^- \rightarrow \text{Mn}_2\text{O}_3(\text{s}) + 2 \text{OH}^-(\text{aq})$	2	0.15
$\text{S}(\text{s}) + 2 \text{H}^+(\text{aq}) + 2 \text{e}^- \rightarrow \text{H}_2\text{S}(\text{g})$	2	0.141
$\text{HgO}(\text{s}) + \text{H}_2\text{O}(\ell) + 2 \text{e}^- \rightarrow \text{Hg}(\ell) + 2 \text{OH}^-(\text{aq})$	2	0.0977

TABLE A6.1 Standard Reduction Potentials at 25°C (Continued)

Half-Reaction	<i>n</i>	<i>E</i> ^o (V)
$\text{AgBr}(s) + e^- \rightarrow \text{Ag}(s) + \text{Br}^-(aq)$	1	0.095
$\text{Ag}(\text{S}_2\text{O}_3)_2^{3-}(aq) + e^- \rightarrow \text{Ag}(s) + 2 \text{S}_2\text{O}_3^{2-}(aq)$	1	0.01
$\text{NO}_3^-(aq) + \text{H}_2\text{O}(\ell) + 2 e^- \rightarrow \text{NO}_2^-(aq) + 2 \text{OH}^-(aq)$	2	0.01
$2 \text{H}^+(aq) + 2 e^- \rightarrow \text{H}_2(g)$	2	0.000
$\text{Pb}^{2+}(aq) + 2 e^- \rightarrow \text{Pb}(s)$	2	-0.126
$\text{CrO}_4^{2-}(aq) + 4 \text{H}_2\text{O}(\ell) + 3 e^- \rightarrow \text{Cr}(\text{OH})_3(s) + 5 \text{OH}^-(aq)$	3	-0.13
$\text{Sn}^{2+}(aq) + 2 e^- \rightarrow \text{Sn}(s)$	2	-0.136
$\text{AgI}(s) + e^- \rightarrow \text{Ag}(s) + \text{I}^-(aq)$	1	-0.1522
$\text{CuI}(s) + e^- \rightarrow \text{Cu}(s) + \text{I}^-(aq)$	1	-0.185
$\text{N}_2(g) + 5 \text{H}^+(aq) + 4 e^- \rightarrow \text{N}_2\text{H}_5^+(aq)$	4	-0.23
$\text{Ni}^{2+}(aq) + 2 e^- \rightarrow \text{Ni}(s)$	2	-0.257
$\text{PbSO}_4(s) + \text{H}^+(aq) + 2 e^- \rightarrow \text{Pb}(s) + \text{HSO}_4^-(aq)$	2	-0.356
$\text{Co}^{2+}(aq) + 2 e^- \rightarrow \text{Co}(s)$	2	-0.277
$\text{Ag}(\text{CN})_2^-(aq) + e^- \rightarrow \text{Ag}(s) + 2 \text{CN}^-(aq)$	1	-0.31
$\text{Cd}^{2+}(aq) + 2 e^- \rightarrow \text{Cd}(s)$	2	-0.403
$\text{Cd}(\text{OH})_2(s) + 2 e^- \rightarrow \text{Cd}(s) + 2 \text{OH}^-(aq)$	2	-0.403
$\text{Cr}^{3+}(aq) + e^- \rightarrow \text{Cr}^{2+}(aq)$	1	-0.41
$\text{Fe}^{2+}(aq) + 2 e^- \rightarrow \text{Fe}(s)$	2	-0.447
$2 \text{CO}_2(g) + 2 \text{H}^+(aq) + 2 e^- \rightarrow \text{H}_2\text{C}_2\text{O}_4(s)$	2	-0.49
$\text{Ni}(\text{OH})_2(s) + 2 e^- \rightarrow \text{Ni}(s) + 2 \text{OH}^-(aq)$	2	-0.72
$\text{Cr}^{3+}(aq) + 3 e^- \rightarrow \text{Cr}(s)$	3	-0.74
$\text{Zn}^{2+}(aq) + 2 e^- \rightarrow \text{Zn}(s)$	2	-0.762
$2 \text{H}_2\text{O}(\ell) + 2 e^- \rightarrow \text{H}_2(g) + 2 \text{OH}^-(aq)$	2	-0.828
$\text{SO}_4^{2-}(aq) + \text{H}_2\text{O}(\ell) + 2 e^- \rightarrow \text{SO}_3^{2-}(aq) + 2 \text{OH}^-(aq)$	2	-0.92
$\text{N}_2(g) + 4 \text{H}_2\text{O}(\ell) + 4 e^- \rightarrow 4 \text{OH}^-(aq) + \text{N}_2\text{H}_4(\ell)$	4	-1.16
$\text{Mn}^{2+}(aq) + 2 e^- \rightarrow \text{Mn}(s)$	2	-1.185
$\text{Zn}(\text{OH})_2(s) + 2 e^- \rightarrow \text{Zn}(s) + 2 \text{OH}^-(aq)$	2	-1.249
$\text{ZnO}(s) + \text{H}_2\text{O}(\ell) + 2 e^- \rightarrow \text{Zn}(s) + 2 \text{OH}^-(aq)$	2	-1.25
$\text{Al}^{3+}(aq) + 3 e^- \rightarrow \text{Al}(s)$	3	-1.662
$\text{Mg}^{2+}(aq) + 2 e^- \rightarrow \text{Mg}(s)$	2	-2.37
$\text{Na}^+(aq) + e^- \rightarrow \text{Na}(s)$	1	-2.71
$\text{Ca}^{2+}(aq) + 2 e^- \rightarrow \text{Ca}(s)$	2	-2.868
$\text{Ba}^{2+}(aq) + 2 e^- \rightarrow \text{Ba}(s)$	2	-2.912
$\text{K}^+(aq) + e^- \rightarrow \text{K}(s)$	1	-2.95
$\text{Li}^+(aq) + e^- \rightarrow \text{Li}(s)$	1	-3.05