

Reactions in Acidic Aqueous Solution at 25 °C

Standard Reduction
Potential, E° (volts)

$\text{F}_2(\text{g}) + 2 \text{e}^- \longrightarrow 2 \text{F}^-(\text{aq})$	2.87
$\text{O}_3(\text{g}) + 2 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow \text{O}_2(\text{g}) + \text{H}_2\text{O}$	2.07
$\text{Co}^{3+}(\text{aq}) + \text{e}^- \longrightarrow \text{Co}^{2+}(\text{aq})$	1.842
$\text{Pb}^{4+}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Pb}^{2+}(\text{aq})$	1.8
$\text{H}_2\text{O}_2(\text{aq}) + 2 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow 2 \text{H}_2\text{O}$	1.776
$\text{N}_2\text{O}(\text{g}) + 2 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow \text{N}_2(\text{g}) + \text{H}_2\text{O}$	1.77
$\text{NiO}_2(\text{s}) + 4 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Ni}^{2+}(\text{aq}) + 2 \text{H}_2\text{O}$	1.7
$\text{PbO}_2(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) + 4 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow \text{PbSO}_4(\text{s}) + 2 \text{H}_2\text{O}$	1.685
$\text{Au}^+(\text{aq}) + \text{e}^- \longrightarrow \text{Au}(\text{s})$	1.68
$\text{MnO}_4^-(\text{aq}) + 4 \text{H}^+(\text{aq}) + 3 \text{e}^- \longrightarrow \text{MnO}_2(\text{s}) + 2 \text{H}_2\text{O}$	1.679
$2 \text{HClO}(\text{aq}) + 2 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Cl}_2(\text{g}) + 2 \text{H}_2\text{O}$	1.63
$\text{Ce}^{4+}(\text{aq}) + \text{e}^- \longrightarrow \text{Ce}^{3+}(\text{aq})$	1.61
$\text{NaBiO}_3(\text{s}) + 6 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Bi}^{3+}(\text{aq}) + \text{Na}^+(\text{aq}) + 3 \text{H}_2\text{O}$	≈ 1.6
$\text{MnO}_4^-(\text{aq}) + 8 \text{H}^+(\text{aq}) + 5 \text{e}^- \longrightarrow \text{Mn}^{2+}(\text{aq}) + 4 \text{H}_2\text{O}$	1.491
$\text{Au}^{3+}(\text{aq}) + 3 \text{e}^- \longrightarrow \text{Au}(\text{s})$	1.50
$2 \text{ClO}_3^-(\text{aq}) + 12 \text{H}^+(\text{aq}) + 10 \text{e}^- \longrightarrow \text{Cl}_2(\text{g}) + 6 \text{H}_2\text{O}$	1.47
$\text{BrO}_3^-(\text{aq}) + 6 \text{H}^+(\text{aq}) + 6 \text{e}^- \longrightarrow \text{Br}^-(\text{aq}) + 3 \text{H}_2\text{O}$	1.44
$\text{Cl}_2(\text{g}) + 2 \text{e}^- \longrightarrow 2 \text{Cl}^-(\text{aq})$	1.3583
$\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + 14 \text{H}^+(\text{aq}) + 6 \text{e}^- \longrightarrow 2 \text{Cr}^{3+}(\text{aq}) + 7 \text{H}_2\text{O}$	1.33
$\text{N}_2\text{H}_5^+(\text{aq}) + 3 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow 2 \text{NH}_4^+(\text{aq})$	1.275
$\text{MnO}_2(\text{s}) + 4 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Mn}^{2+}(\text{aq}) + 2 \text{H}_2\text{O}$	1.229
$\text{O}_2(\text{g}) + 4 \text{H}^+(\text{aq}) + 4 \text{e}^- \longrightarrow 2 \text{H}_2\text{O}$	1.229
$\text{Pt}^{2+}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Pt}(\text{s})$	1.188
$2 \text{IO}_3^-(\text{aq}) + 12 \text{H}^+(\text{aq}) + 10 \text{e}^- \longrightarrow \text{I}_2(\text{aq}) + 6 \text{H}_2\text{O}$	1.195
$\text{ClO}_4^-(\text{aq}) + 2 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow \text{ClO}_3^-(\text{aq}) + \text{H}_2\text{O}$	1.19
$\text{Br}_2(\text{l}) + 2 \text{e}^- \longrightarrow 2 \text{Br}^-(\text{aq})$	1.065
$\text{AuCl}_4^-(\text{aq}) + 3 \text{e}^- \longrightarrow \text{Au}(\text{s}) + 4 \text{Cl}^-(\text{aq})$	1.00
$\text{NO}_3^-(\text{aq}) + 4 \text{H}^+(\text{aq}) + 3 \text{e}^- \longrightarrow \text{NO}(\text{g}) + 2 \text{H}_2\text{O}$	0.96
$\text{NO}_3^-(\text{aq}) + 3 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow \text{HNO}_2(\text{aq}) + \text{H}_2\text{O}$	0.94
$\text{Pd}^{2+}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Pd}(\text{s})$	0.915
$2 \text{Hg}^{2+}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Hg}_2^{2+}(\text{aq})$	0.908
$\text{Hg}^{2+}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Hg}(\text{l})$	0.854
$2 \text{NO}_3^-(\text{aq}) + 4 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow \text{N}_2\text{O}_4(\text{g}) + 2 \text{H}_2\text{O}$	0.80
$\text{Ag}^+(\text{aq}) + \text{e}^- \longrightarrow \text{Ag}(\text{s})$	0.7994
$\text{Hg}_2^{2+}(\text{aq}) + 2 \text{e}^- \longrightarrow 2 \text{Hg}(\text{l})$	0.792
$\text{Fe}^{3+}(\text{aq}) + \text{e}^- \longrightarrow \text{Fe}^{2+}(\text{aq})$	0.770
$\text{SbCl}_6^-(\text{aq}) + 2 \text{e}^- \longrightarrow \text{SbCl}_4^-(\text{aq}) + 2 \text{Cl}^-(\text{aq})$	0.75
$\text{PtCl}_4^{2-}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Pt}(\text{s}) + 4 \text{Cl}^-(\text{aq})$	0.73
$\text{O}_2(\text{g}) + 2 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow \text{H}_2\text{O}_2(\text{aq})$	0.682
$\text{PtCl}_6^{2-}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{PtCl}_4^{2-}(\text{aq}) + 2 \text{Cl}^-(\text{aq})$	0.68
$\text{H}_3\text{AsO}_4(\text{aq}) + 2 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow \text{H}_3\text{AsO}_3(\text{aq}) + \text{H}_2\text{O}$	0.58
$\text{I}_2(\text{s}) + 2 \text{e}^- \longrightarrow 2 \text{I}^-(\text{aq})$	0.535
$\text{TeO}_2(\text{s}) + 4 \text{H}^+(\text{aq}) + 4 \text{e}^- \longrightarrow \text{Te}(\text{s}) + 2 \text{H}_2\text{O}$	0.529
$\text{Cu}^+(\text{aq}) + \text{e}^- \longrightarrow \text{Cu}(\text{s})$	0.518
$\text{RhCl}_6^{3-}(\text{aq}) + 3 \text{e}^- \longrightarrow \text{Rh}(\text{s}) + 6 \text{Cl}^-(\text{aq})$	0.44

$\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Cu}(\text{s})$	0.337
$\text{Hg}_2\text{Cl}_2(\text{s}) + 2\text{e}^- \longrightarrow 2\text{Hg}(\text{l}) + 2\text{Cl}^-(\text{aq})$	0.268
$\text{AgCl}(\text{s}) + \text{e}^- \longrightarrow \text{Ag}(\text{s}) + \text{Cl}^-(\text{aq})$	0.222
$\text{SO}_4^{2-}(\text{aq}) + 4\text{H}^+(\text{aq}) + 2\text{e}^- \longrightarrow \text{SO}_2(\text{g}) + 2\text{H}_2\text{O}$	0.20
$\text{SO}_4^{2-}(\text{aq}) + 4\text{H}^+(\text{aq}) + 2\text{e}^- \longrightarrow \text{H}_2\text{SO}_3(\text{aq}) + \text{H}_2\text{O}$	0.17
$\text{Cu}^{2+}(\text{aq}) + \text{e}^- \longrightarrow \text{Cu}^+(\text{aq})$	0.159
$\text{Sn}^{4+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Sn}^{2+}(\text{aq})$	0.154
$\text{S}_8(\text{s}) + 16\text{H}^+(\text{aq}) + 16\text{e}^- \longrightarrow 8\text{H}_2\text{S}(\text{aq})$	0.141
$\text{AgBr}(\text{s}) + \text{e}^- \longrightarrow \text{Ag}(\text{s}) + \text{Br}^-(\text{aq})$	0.0713
$2\text{H}^+(\text{aq}) + 2\text{e}^- \longrightarrow \text{H}_2(\text{g})$	0
$\text{N}_2\text{O}(\text{g}) + 6\text{H}^+(\text{aq}) + \text{H}_2\text{O} + 4\text{e}^- \longrightarrow 2\text{NH}_3\text{OH}^+(\text{aq})$	-0.05
$\text{Pb}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Pb}(\text{s})$	-0.1263
$\text{Sn}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Sn}(\text{s})$	-0.1364
$\text{AgI}(\text{s}) + \text{e}^- \longrightarrow \text{Ag}(\text{s}) + \text{I}^-(\text{aq})$	-0.152
$\text{SnF}_6^{2-}(\text{aq}) + 4\text{e}^- \longrightarrow \text{Sn}(\text{s}) + 6\text{F}^-(\text{aq})$	-0.25
$\text{Ni}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Ni}(\text{s})$	-0.231
$\text{Co}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Co}(\text{s})$	-0.277
$\text{Tl}^+(\text{aq}) + \text{e}^- \longrightarrow \text{Tl}(\text{s})$	-0.336
$\text{PbSO}_4(\text{s}) + 2\text{e}^- \longrightarrow \text{Pb}(\text{s}) + \text{SO}_4^{2-}(\text{aq})$	-0.355
$\text{Se}(\text{s}) + 2\text{H}^+(\text{aq}) + 2\text{e}^- \longrightarrow \text{H}_2\text{Se}(\text{g})$	-0.37
$\text{Cd}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Cd}(\text{s})$	-0.402
$\text{Cr}^{3+}(\text{aq}) + \text{e}^- \longrightarrow \text{Cr}^{2+}(\text{aq})$	-0.41
$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Fe}(\text{s})$	-0.440
$2\text{CO}_2(\text{g}) + 2\text{H}^+(\text{aq}) + 2\text{e}^- \longrightarrow \text{H}_2\text{C}_2\text{O}_4(\text{aq})$	-0.49
$\text{Ga}^{3+}(\text{aq}) + 3\text{e}^- \longrightarrow \text{Ga}(\text{s})$	-0.53
$\text{HgS}(\text{s}) + 2\text{H}^+(\text{aq}) + 2\text{e}^- \longrightarrow \text{Hg}(\text{l}) + \text{H}_2\text{S}(\text{g})$	-0.72
$\text{Cr}^{3+}(\text{aq}) + 3\text{e}^- \longrightarrow \text{Cr}(\text{s})$	-0.74
$\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Zn}(\text{s})$	-0.7628
$\text{Cr}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Cr}(\text{s})$	-0.91
$\text{FeS}(\text{s}) + 2\text{e}^- \longrightarrow \text{Fe}(\text{s}) + \text{S}^{2-}(\text{aq})$	-1.01
$\text{V}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{V}(\text{s})$	-1.18
$\text{Mn}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Mn}(\text{s})$	-1.182
$\text{CdS}(\text{s}) + 2\text{e}^- \longrightarrow \text{Cd}(\text{s}) + \text{S}^{2-}(\text{aq})$	-1.21
$\text{ZnS}(\text{s}) + 2\text{e}^- \longrightarrow \text{Zn}(\text{s}) + \text{S}^{2-}(\text{aq})$	-1.44
$\text{Zr}^{4+}(\text{aq}) + 4\text{e}^- \longrightarrow \text{Zr}(\text{s})$	-1.539
$\text{Al}^{3+}(\text{aq}) + 3\text{e}^- \longrightarrow \text{Al}(\text{s})$	-1.66
$\text{Mg}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Mg}(\text{s})$	-2.375
$\text{Na}^+(\text{aq}) + \text{e}^- \longrightarrow \text{Na}(\text{s})$	-2.711
$\text{Ca}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Ca}(\text{s})$	-2.868
$\text{Sr}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Sr}(\text{s})$	-2.886
$\text{Ba}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Ba}(\text{s})$	-2.912
$\text{Rb}^+(\text{aq}) + \text{e}^- \longrightarrow \text{Rb}(\text{s})$	-2.924
$\text{K}^+(\text{aq}) + \text{e}^- \longrightarrow \text{K}(\text{s})$	-2.925
$\text{Li}^+(\text{aq}) + \text{e}^- \longrightarrow \text{Li}(\text{s})$	-3.045

Reactions in Basic Aqueous Solution at 25 °C

Standard Reduction
Potential, E° (volts)

$\text{ClO}^- (\text{aq}) + \text{H}_2\text{O} + 2 \text{e}^- \longrightarrow \text{Cl}^- (\text{aq}) + 2 \text{OH}^- (\text{aq})$	0.89
$\text{HOO}^- (\text{aq}) + \text{H}_2\text{O} + 2 \text{e}^- \longrightarrow 3 \text{OH}^- (\text{aq})$	0.88
$2\text{NH}_2\text{OH} (\text{aq}) + 2 \text{e}^- \longrightarrow \text{N}_2\text{H}_4 (\text{aq}) + 2 \text{OH}^- (\text{aq})$	0.74
$\text{ClO}_3^- (\text{aq}) + 3 \text{H}_2\text{O} + 6 \text{e}^- \longrightarrow \text{Cl}^- (\text{aq}) + 6 \text{OH}^- (\text{aq})$	0.62
$\text{MnO}_4^- (\text{aq}) + 2 \text{H}_2\text{O} + 3 \text{e}^- \longrightarrow \text{MnO}_2 (\text{s}) + 4 \text{OH}^- (\text{aq})$	0.588
$\text{MnO}_4^- (\text{aq}) + \text{e}^- \longrightarrow \text{MnO}_4^{2-} (\text{aq})$	0.564
$\text{NiO}_2 (\text{s}) + 2 \text{H}_2\text{O} + 2 \text{e}^- \longrightarrow \text{Ni}(\text{OH})_2 (\text{s}) + 2 \text{OH}^- (\text{aq})$	0.49
$\text{Ag}_2\text{CrO}_4 (\text{s}) + 2 \text{e}^- \longrightarrow 2 \text{Ag} (\text{s}) + \text{CrO}_4^{2-} (\text{aq})$	0.446
$\text{O}_2 (\text{g}) + 2 \text{H}_2\text{O} + 4 \text{e}^- \longrightarrow 4 \text{OH}^- (\text{aq})$	0.40
$\text{ClO}_4^- (\text{aq}) + \text{H}_2\text{O} + 2 \text{e}^- \longrightarrow \text{ClO}_3^- (\text{aq}) + 2 \text{OH}^- (\text{aq})$	0.36
$\text{Ag}_2\text{O} (\text{s}) + \text{H}_2\text{O} + 2 \text{e}^- \longrightarrow 2 \text{Ag} (\text{s}) + 2 \text{OH}^- (\text{aq})$	0.34
$2 \text{NO}_2^- (\text{aq}) + 3 \text{H}_2\text{O} + 4 \text{e}^- \longrightarrow \text{N}_2\text{O} (\text{g}) + 6 \text{OH}^- (\text{aq})$	0.15
$\text{N}_2\text{H}_4 (\text{aq}) + 2 \text{H}_2\text{O} + 2 \text{e}^- \longrightarrow 2 \text{NH}_3 (\text{aq}) + 2 \text{OH}^- (\text{aq})$	0.10
$\text{Co}(\text{NH}_3)_6^{3+} (\text{aq}) + \text{e}^- \longrightarrow \text{Co}(\text{NH}_3)_6^{2+} (\text{aq})$	0.10
$\text{HgO} (\text{s}) + \text{H}_2\text{O} + 2 \text{e}^- \longrightarrow \text{Hg} (\text{l}) + 2 \text{OH}^- (\text{aq})$	0.0984
$\text{O}_2 (\text{aq}) + \text{H}_2\text{O} + 2 \text{e}^- \longrightarrow \text{HOO}^- (\text{aq}) + \text{OH}^- (\text{aq})$	0.076
$\text{NO}_3^- (\text{aq}) + \text{H}_2\text{O} + 2 \text{e}^- \longrightarrow \text{NO}_2^- (\text{aq}) + 2 \text{OH}^- (\text{aq})$	0.01
$\text{MnO}_2 (\text{s}) + 2 \text{H}_2\text{O} + 2 \text{e}^- \longrightarrow \text{Mn}(\text{OH})_2 (\text{s}) + 2 \text{OH}^- (\text{aq})$	-0.05
$\text{CrO}_4^{2-} (\text{aq}) + 4 \text{H}_2\text{O} + 3 \text{e}^- \longrightarrow \text{Cr}(\text{OH})_3 (\text{s}) + 5 \text{OH}^- (\text{aq})$	-0.12
$\text{Cu}(\text{OH})_2 (\text{s}) + 2 \text{e}^- \longrightarrow \text{Cu} (\text{s}) + 2 \text{OH}^- (\text{aq})$	-0.36
$\text{S}_8 (\text{s}) + 16 \text{e}^- \longrightarrow 8 \text{S}^{2-} (\text{aq})$	-0.48
$\text{Fe}(\text{OH})_3 (\text{s}) + \text{e}^- \longrightarrow \text{Fe}(\text{OH})_2 (\text{s}) + \text{OH}^- (\text{aq})$	-0.56
$2 \text{H}_2\text{O} + 2 \text{e}^- \longrightarrow \text{H}_2 (\text{g}) + 2 \text{OH}^- (\text{aq})$	-0.8277
$2 \text{NO}_3^- (\text{aq}) + 2 \text{H}_2\text{O} + 2 \text{e}^- \longrightarrow \text{N}_2\text{O}_4 (\text{g}) + 4 \text{OH}^- (\text{aq})$	-0.85
$\text{Fe}(\text{OH})_2 (\text{s}) + 2 \text{e}^- \longrightarrow \text{Fe} (\text{s}) + 2 \text{OH}^- (\text{aq})$	-0.877
$\text{SO}_4^{2-} (\text{aq}) + \text{H}_2\text{O} + 2 \text{e}^- \longrightarrow \text{SO}_3^{2-} (\text{aq}) + 2 \text{OH}^- (\text{aq})$	-0.93
$\text{N}_2 (\text{g}) + 4 \text{H}_2\text{O} + 4 \text{e}^- \longrightarrow \text{N}_2\text{H}_4 (\text{aq}) + 4 \text{OH}^- (\text{aq})$	-1.15
$\text{Zn}(\text{OH})_4^{2-} (\text{aq}) + 2 \text{e}^- \longrightarrow \text{Zn} (\text{s}) + 4 \text{OH}^- (\text{aq})$	-1.22
$\text{Zn}(\text{OH})_2 (\text{s}) + 2 \text{e}^- \longrightarrow \text{Zn} (\text{s}) + 2 \text{OH}^- (\text{aq})$	-1.245
$\text{Zn}(\text{CN})_4^{2-} (\text{aq}) + 2 \text{e}^- \longrightarrow \text{Zn} (\text{s}) + 4 \text{CN}^- (\text{aq})$	-1.26
$\text{Cr}(\text{OH})_3 (\text{s}) + 3 \text{e}^- \longrightarrow \text{Cr} (\text{s}) + 3 \text{OH}^- (\text{aq})$	-1.30
$\text{SiO}_3^{2-} (\text{aq}) + 3 \text{H}_2\text{O} + 4 \text{e}^- \longrightarrow \text{Si} (\text{s}) + 6 \text{OH}^- (\text{aq})$	-1.70