

ELECTROCHEMICAL SERIES

Petr Vanýsek

There are three tables for this electrochemical series. Each table lists standard reduction potentials, E° values, at 298.15 K (25°C), and at a pressure of 101.325 kPa (1 atm). Table 1 is an alphabetical listing of the elements, according to the symbol of the elements. Thus, data for silver (Ag) precedes those for aluminum (Al). Table 2 lists only those reduction reactions which have E° values positive in respect to the standard hydrogen electrode. In Table 2, the reactions are listed in the order of increasing positive potential, and they range from 0.0000 V to + 3.4 V. Table 3 lists only those reduction potentials which have E° negative with respect to the standard hydrogen electrode. In Table 3, the reactions are listed in the order of decreasing potential and range from 0.0000 V to -4.10 V. The reliability of the potentials is not the same for all the data. Typically, the values with fewer significant figures have lower reliability. The values of reduction potentials, in particular those of less common reactions, are not definite; they are subject to occasional revisions.

Abbreviations: ac = acetate; bipy = 2,2'-dipyridine, or bipyridine; en = ethylenediamine; phen = 1,10-phenanthroline.

REFERENCES

1. G. Milazzo, S. Caroli, and V. K. Sharma, *Tables of Standard Electrode Potentials*, Wiley, Chichester, 1978.
2. A. J. Bard, R. Parsons, and J. Jordan, *Standard Potentials in Aqueous Solutions*, Marcel Dekker, New York, 1985.
3. S. G. Bratsch, *J. Phys. Chem. Ref. Data*, 18, 1—21, 1989.

TABLE 1
Alphabetical Listing

Reaction	E°/V	Reaction	E°/V
$\text{Ac}^{3+} + 3 \text{ e} \rightarrow 1 \text{ Ac}$	-2.20	$\text{Al}(\text{OH})_4^- + 3 \text{ e} \rightarrow 1 \text{ Al} + 4 \text{ OH}^-$	-2.328
$\text{Ag}^+ + \text{ e} \rightarrow 1 \text{ Ag}$	0.7996	$\text{H}_2\text{AlO}_3^- + \text{H}_2\text{O} + 3 \text{ e} \rightarrow 1 \text{ Al} + 4 \text{ OH}^-$	-2.33
$\text{Ag}^{2+} + \text{ e} \rightarrow 1 \text{ Ag}^+$	1.980	$\text{AlF}_6^{3-} + 3 \text{ e} \rightarrow 1 \text{ Al} + 6 \text{ F}^-$	-2.069
$\text{Ag}(\text{ac}) + \text{ e} \rightarrow 1 \text{ Ag} + (\text{ac})^-$	0.643	$\text{Am}^{4+} + \text{ e} \rightarrow 1 \text{ Am}^{3+}$	2.60
$\text{AgBr} + \text{ e} \rightarrow 1 \text{ Ag} + \text{Br}^-$	0.07133	$\text{Am}^{2+} + 2 \text{ e} \rightarrow 1 \text{ Am}$	-1.9
$\text{AgBrO}_3 + \text{ e} \rightarrow 1 \text{ Ag} + \text{BrO}_3^-$	0.546	$\text{Am}^{3+} + 3 \text{ e} \rightarrow 1 \text{ Am}$	-2.048
$\text{Ag}_2\text{C}_2\text{O}_4 + 2 \text{ e} \rightarrow 1 \text{ 2 Ag} + \text{C}_2\text{O}_4^{2-}$	0.4647	$\text{Am}^{3+} + \text{ e} \rightarrow 1 \text{ Am}^{2+}$	-2.3
$\text{AgCl} + \text{ e} \rightarrow 1 \text{ Ag} + \text{Cl}^-$	0.22233	$\text{As} + 3 \text{ H}^+ + 3 \text{ e} \rightarrow 1 \text{ AsH}_3$	-0.608
$\text{AgCN} + \text{ e} \rightarrow 1 \text{ Ag} + \text{CN}^-$	-0.017	$\text{As}_2\text{O}_3 + 6 \text{ H}^+ + 6 \text{ e} \rightarrow 1 \text{ 2 As} + 3 \text{ H}_2\text{O}$	0.234
$\text{Ag}_2\text{CO}_3 + 2 \text{ e} \rightarrow 1 \text{ 2 Ag} + \text{CO}_3^{2-}$	0.47	$\text{HAsO}_2 + 3 \text{ H}^+ + 3 \text{ e} \rightarrow 1 \text{ As} + 2 \text{ H}_2\text{O}$	0.248
$\text{Ag}_2\text{CrO}_4 + 2 \text{ e} \rightarrow 1 \text{ 2 Ag} + \text{CrO}_4^{2-}$	0.4470	$\text{AsO}_2^- + 2 \text{ H}_2\text{O} + 3 \text{ e} \rightarrow 1 \text{ As} + 4 \text{ OH}^-$	-0.68
$\text{AgF} + \text{ e} \rightarrow 1 \text{ Ag} + \text{F}^-$	0.779	$\text{H}_3\text{AsO}_4 + 2 \text{ H}^+ + 2 \text{ e} \rightarrow 1 \text{ HAsO}_2 + 2 \text{ H}_2\text{O}$	0.560
$\text{Ag}_4[\text{Fe}(\text{CN})_6] + 4 \text{ e} \rightarrow 1 \text{ 4 Ag} + [\text{Fe}(\text{CN})_6]^{4-}$	0.1478	$\text{AsO}_4^{3-} + 2 \text{ H}_2\text{O} + 2 \text{ e} \rightarrow 1 \text{ AsO}_2^- + 4 \text{ OH}^-$	-0.71
$\text{AgI} + \text{ e} \rightarrow 1 \text{ Ag} + \text{I}^-$	-0.15224	$\text{At}_2 + 2 \text{ e} \rightarrow 1 \text{ 2 At}^-$	0.3
$\text{AgIO}_3 + \text{ e} \rightarrow 1 \text{ Ag} + \text{IO}_3^-$	0.354	$\text{Au}^+ + \text{ e} \rightarrow 1 \text{ Au}$	1.692
$\text{Ag}_2\text{MoO}_4 + 2 \text{ e} \rightarrow 1 \text{ 2 Ag} + \text{MoO}_4^{2-}$	0.4573	$\text{Au}^{3+} + 2 \text{ e} \rightarrow 1 \text{ Au}^+$	1.401
$\text{AgNO}_2 + \text{ e} \rightarrow 1 \text{ Ag} + 2 \text{ NO}_2^-$	0.564	$\text{Au}^{3+} + 3 \text{ e} \rightarrow 1 \text{ Au}$	1.498
$\text{Ag}_2\text{O} + \text{H}_2\text{O} + 2 \text{ e} \rightarrow 1 \text{ 2 Ag} + 2 \text{ OH}^-$	0.342	$\text{Au}^{2+} + \text{ e} \rightarrow 1 \text{ Au}^+$	1.8
$\text{Ag}_2\text{O}_3 + \text{H}_2\text{O} + 2 \text{ e} \rightarrow 1 \text{ 2 AgO} + 2 \text{ OH}^-$	0.739	$\text{AuOH}^{2+} + \text{H}^+ + 2 \text{ e} \rightarrow 1 \text{ Au}^+ + \text{H}_2\text{O}$	1.32
$\text{Ag}^{3+} + 2 \text{ e} \rightarrow 1 \text{ Ag}^+$	1.9	$\text{AuBr}_2^- + \text{ e} \rightarrow 1 \text{ Au} + 2 \text{ Br}^-$	0.959
$\text{Ag}^{3+} + \text{ e} \rightarrow 1 \text{ Ag}^{2+}$	1.8	$\text{AuBr}_4^- + 3 \text{ e} \rightarrow 1 \text{ Au} + 4 \text{ Br}^-$	0.854
$\text{Ag}_2\text{O}_2 + 4 \text{ H}^+ + \text{ e} \rightarrow 1 \text{ 2 Ag} + 2 \text{ H}_2\text{O}$	1.802	$\text{AuCl}_4^- + 3 \text{ e} \rightarrow 1 \text{ Au} + 4 \text{ Cl}^-$	1.002
$2 \text{ AgO} + \text{H}_2\text{O} + 2 \text{ e} \rightarrow 1 \text{ Ag}_2\text{O} + 2 \text{ OH}^-$	0.607	$\text{Au}(\text{OH})_3 + 3 \text{ H}^+ + 3 \text{ e} \rightarrow 1 \text{ Au} + 3 \text{ H}_2\text{O}$	1.45
$\text{AgOCN} + \text{ e} \rightarrow 1 \text{ Ag} + \text{OCN}^-$	0.41	$\text{H}_2\text{BO}_3^- + 5 \text{ H}_2\text{O} + 8 \text{ e} \rightarrow 1 \text{ BH}_4^- + 8 \text{ OH}^-$	-1.24
$\text{Ag}_2\text{S} + 2 \text{ e} \rightarrow 1 \text{ 2 Ag} + \text{S}^{2-}$	-0.691	$\text{H}_2\text{BO}_3^- + \text{H}_2\text{O} + 3 \text{ e} \rightarrow 1 \text{ B} + 4 \text{ OH}^-$	-1.79
$\text{Ag}_2\text{S} + 2 \text{ H}^+ + 2 \text{ e} \rightarrow 1 \text{ 2 Ag} + \text{H}_2\text{S}$	-0.0366	$\text{H}_3\text{BO}_3 + 3 \text{ H}^+ + 3 \text{ e} \rightarrow 1 \text{ B} + 3 \text{ H}_2\text{O}$	-0.8698
$\text{AgSCN} + \text{ e} \rightarrow 1 \text{ Ag} + \text{SCN}^-$	0.08951	$\text{B}(\text{OH})_3 + 7 \text{ H}^+ + 8 \text{ e} \rightarrow 1 \text{ BH}_4^- + 3 \text{ H}_2\text{O}$	-0.481
$\text{Ag}_2\text{SeO}_3 + 2 \text{ e} \rightarrow 1 \text{ 2 Ag} + \text{SeO}_4^{2-}$	0.3629	$\text{Ba}^{2+} + 2 \text{ e} \rightarrow 1 \text{ Ba}$	-2.912
$\text{Ag}_2\text{SO}_4 + 2 \text{ e} \rightarrow 1 \text{ 2 Ag} + \text{SO}_4^{2-}$	0.654	$\text{Ba}^{2+} + 2 \text{ e} \rightarrow 1 \text{ Ba}(\text{Hg})$	-1.570
$\text{Ag}_2\text{WO}_4 + 2 \text{ e} \rightarrow 1 \text{ 2 Ag} + \text{WO}_4^{2-}$	0.4660	$\text{Ba}(\text{OH})_2 + 2 \text{ e} \rightarrow 1 \text{ Ba} + 2 \text{ OH}^-$	-2.99
$\text{Al}^{3+} + 3 \text{ e} \rightarrow 1 \text{ Al}$	-1.662	$\text{Be}^{2+} + 2 \text{ e} \rightarrow 1 \text{ Be}$	-1.847
$\text{Al}(\text{OH})_3 + 3 \text{ e} \rightarrow 1 \text{ Al} + 3 \text{ OH}^-$	-2.31	$\text{Be}_2\text{O}_3^{2-} + 3 \text{ H}_2\text{O} + 4 \text{ e} \rightarrow 1 \text{ 2 Be} + 6 \text{ OH}^-$	-2.63

ELECTROCHEMICAL SERIES (continued)

TABLE 1
Alphabetical Listing (continued)

Reaction	E°/V	Reaction	E°/V
p -benzoquinone + 2 H ⁺ + 2 e 1 hydroquinone	0.6992	HClO ₂ + 3 H ⁺ + 4 e 1 Cl ⁻ + 2 H ₂ O	1.570
Bi ⁺ + e 1 Bi	0.5	ClO ₂ ⁻ + H ₂ O + 2 e 1 ClO ⁻ + 2 OH ⁻	0.66
Bi ³⁺ + 3 e 1 Bi	0.308	ClO ₂ ⁻ + 2 H ₂ O + 4 e 1 Cl ⁻ + 4 OH ⁻	0.76
Bi ³⁺ + 2 e 1 Bi ⁺	0.2	ClO ₂ (aq) + e 1 ClO ₂ ⁻	0.954
Bi + 3 H ⁺ + 3 e 1 BiH ₃	-0.8	ClO ₃ ⁻ + 2 H ⁺ + e 1 ClO ₂ + H ₂ O	1.152
BiCl ₄ ⁻ + 3 e 1 Bi + 4 Cl ⁻	0.16	ClO ₃ ⁻ + 3 H ⁺ + 2 e 1 HClO ₂ + H ₂ O	1.214
Bi ₂ O ₃ + 3 H ₂ O + 6 e 1 2 Bi + 6 OH ⁻	-0.46	ClO ₃ ⁻ + 6 H ⁺ + 5 e 1 1/2 Cl ₂ + 3 H ₂ O	1.47
Bi ₂ O ₄ + 4 H ⁺ + 2 e 1 2 BiO ⁺ + 2 H ₂ O	1.593	ClO ₃ ⁻ + 6 H ⁺ + 6 e 1 Cl ⁻ + 3 H ₂ O	1.451
BiO ⁺ + 2 H ⁺ + 3 e 1 Bi + H ₂ O	0.320	ClO ₃ ⁻ + H ₂ O + 2 e 1 ClO ₂ ⁻ + 2 OH ⁻	0.33
BiOCl + 2 H ⁺ + 3 e 1 Bi + Cl ⁻ + H ₂ O	0.1583	ClO ₃ ⁻ + 3 H ₂ O + 6 e 1 Cl ⁻ + 6 OH ⁻	0.62
Bk ⁴⁺ + e 1 Bk ³⁺	1.67	ClO ₄ ⁻ + 2 H ⁺ + 2 e 1 ClO ₃ ⁻ + H ₂ O	1.189
Bk ²⁺ + 2 e 1 Bk	-1.6	ClO ₄ ⁻ + 8 H ⁺ + 7 e 1 1/2 Cl ₂ + 4 H ₂ O	1.39
Bk ³⁺ + e 1 Bk ²⁺	-2.8	ClO ₄ ⁻ + 8 H ⁺ + 8 e 1 Cl ⁻ + 4 H ₂ O	1.389
Br ₂ (aq) + 2 e 1 2 Br ⁻	1.0873	ClO ₄ ⁻ + H ₂ O + 2 e 1 ClO ₃ ⁻ + 2 OH ⁻	0.36
Br ₂ (l) + 2 e 1 2 Br ⁻	1.066	Cm ⁴⁺ + e 1 Cm ³⁺	3.0
HBrO + H ⁺ + 2 e 1 Br ⁻ + H ₂ O	1.331	Cm ³⁺ + 3 e 1 Cm	-2.04
HBrO + H ⁺ + e 1 1/2 Br ₂ (aq) + H ₂ O	1.574	Co ²⁺ + 2 e 1 Co	-0.28
HBrO + H ⁺ + e 1 1/2 Br ₂ (l) + H ₂ O	1.596	Co ³⁺ + e 1 Co ²⁺	1.92
BrO ⁻ + H ₂ O + 2 e 1 Br ⁻ + 2 OH ⁻	0.761	[Co(NH ₃) ₆] ³⁺ + e 1 [Co(NH ₃) ₆] ²⁺	0.108
BrO ₃ ⁻ + 6 H ⁺ + 5 e 1 1/2 Br ₂ + 3 H ₂ O	1.482	Co(OH) ₂ + 2 e 1 Co + 2 OH ⁻	-0.73
BrO ₃ ⁻ + 6 H ⁺ + 6 e 1 Br ⁻ + 3 H ₂ O	1.423	Co(OH) ₃ + e 1 Co(OH) ₂ + OH ⁻	0.17
BrO ₃ ⁻ + 3 H ₂ O + 6 e 1 Br ⁻ + 6 OH ⁻	0.61	Cr ²⁺ + 2 e 1 Cr	-0.913
(CN) ₂ + 2 H ⁺ + 2 e 1 2 HCN	0.373	Cr ³⁺ + e 1 Cr ²⁺	-0.407
2 HCNO + 2 H ⁺ + 2 e 1 (CN) ₂ + 2 H ₂ O	0.330	Cr ³⁺ + 3 e 1 Cr	-0.744
(CNS) ₂ + 2 e 1 2 CNS ⁻	0.77	Cr ₂ O ₇ ²⁻ + 14 H ⁺ + 6 e 1 2 Cr ³⁺ + 7 H ₂ O	1.232
CO ₂ + 2 H ⁺ + 2 e 1 HCOOH	-0.199	CrO ₂ ⁻ + 2 H ₂ O + 3 e 1 Cr + 4 OH ⁻	-1.2
Ca ⁺ + e 1 Ca	-3.80	HCrO ₄ ⁻ + 7 H ⁺ + 3 e 1 Cr ³⁺ + 4 H ₂ O	1.350
Ca ²⁺ + 2 e 1 Ca	-2.868	CrO ₂ + 4 H ⁺ + e 1 Cr ³⁺ + 2H ₂ O	1.48
Ca(OH) ₂ + 2 e 1 Ca + 2 OH ⁻	-3.02	Cr(V) + e 1 Cr(IV)	1.34
Calomel electrode, 1 molal KCl	0.2800	CrO ₄ ²⁻ + 4 H ₂ O + 3 e 1 Cr(OH) ₃ + 5 OH ⁻	-0.13
Calomel electrode, 1 molar KCl (NCE)	0.2801	Cr(OH) ₃ + 3 e 1 Cr + 3 OH ⁻	-1.48
Calomel electrode, 0.1 molar KCl	0.3337	Cs ⁺ + e 1 Cs	-3.026
Calomel electrode, saturated KCl (SCE)	0.2412	Cu ⁺ + e 1 Cu	0.521
Calomel electrode, saturated NaCl (SSCE)	0.2360	Cu ²⁺ + e 1 Cu ⁺	0.153
Cd ²⁺ + 2 e 1 Cd	-0.4030	Cu ²⁺ + 2 e 1 Cu	0.3419
Cd ²⁺ + 2 e 1 Cd(Hg)	-0.3521	Cu ²⁺ + 2 e 1 Cu(Hg)	0.345
Cd(OH) ₂ + 2 e 1 Cd(Hg) + 2 OH ⁻	-0.809	Cu ³⁺ + e 1 Cu ²⁺	2.4
CdSO ₄ + 2 e 1 Cd + SO ₄ ²⁻	-0.246	Cu ₂ O ₃ + 6 H ⁺ + 2 e 1 2Cu ²⁺ + 3 H ₂ O	2.0
Cd(OH) ₄ ²⁻ + 2 e 1 Cd + 4 OH ⁻	-0.658	Cu ²⁺ + 2 CN ⁻ + e 1 [Cu(CN) ₂] ⁻	1.103
CdO + H ₂ O + 2 e 1 Cd + 2 OH ⁻	-0.783	CuI ₂ ⁻ + e 1 Cu + 2 I ⁻	0.00
Ce ³⁺ + 3 e 1 Ce	-2.336	Cu ₂ O + H ₂ O + 2 e 1 2 Cu + 2 OH ⁻	-0.360
Ce ³⁺ + 3 e 1 Ce(Hg)	-1.4373	Cu(OH) ₂ + 2 e 1 Cu + 2 OH ⁻	-0.222
Ce ⁴⁺ + e 1 Ce ³⁺	1.72	2 Cu(OH) ₂ + 2 e 1 Cu ₂ O + 2 OH ⁻ + H ₂ O	-0.080
CeOH ³⁺ + H ⁺ + e 1 Ce ³⁺ + H ₂ O	1.715	2 D ⁺ + 2 e 1 D ₂	-0.013
Cf ⁴⁺ + e 1 Cf ³⁺	3.3	Dy ²⁺ + 2 e 1 Dy	-2.2
Cf ³⁺ + e 1 Cf ²⁺	-1.6	Dy ³⁺ + 3 e 1 Dy	-2.295
Cf ³⁺ + 3 e 1 Cf	-1.94	Dy ³⁺ + e 1 Dy ²⁺	-2.6
Cf ²⁺ + 2 e 1 Cf	-2.12	Er ²⁺ + 2 e 1 Er	-2.0
Cl ₂ (g) + 2 e 1 2 Cl ⁻	1.35827	Er ³⁺ + 3 e 1 Er	-2.331
HClO + H ⁺ + e 1 1/2 Cl ₂ + H ₂ O	1.611	Er ³⁺ + e 1 Er ²⁺	-3.0
HClO + H ⁺ + 2 e 1 Cl ⁻ + H ₂ O	1.482	Es ³⁺ + e 1 Es ²⁺	-1.3
ClO ⁻ + H ₂ O + 2 e 1 Cl ⁻ + 2 OH ⁻	0.81	Es ³⁺ + 3 e 1 Es	-1.91
ClO ₂ + H ⁺ + e 1 HClO ₂	1.277	Es ²⁺ + 2 e 1 Es	-2.23
HClO ₂ + 2 H ⁺ + 2 e 1 HClO + H ₂ O	1.645	Eu ²⁺ + 2 e 1 Eu	-2.812
HClO ₂ + 3 H ⁺ + 3 e 1 1/2 Cl ₂ + 2 H ₂ O	1.628	Eu ³⁺ + 3 e 1 Eu	-1.991

ELECTROCHEMICAL SERIES (continued)

TABLE 1
Alphabetical Listing (continued)

Reaction	E°/V	Reaction	E°/V
Eu ³⁺ + e 1 Eu ²⁺	-0.36	Ho ³⁺ + 3 e 1 Ho	-2.33
F ₂ + 2 H ⁺ + 2 e 1 2 HF	3.053	Ho ³⁺ + e 1 Ho ²⁺	-2.8
F ₂ + 2 e 1 2 F ⁻	2.866	I ₂ + 2 e 1 2 I ⁻	0.5355
F ₂ O + 2 H ⁺ + 4 e 1 H ₂ O + 2 F ⁻	2.153	I ₃ ⁻ + 2 e 1 3 I ⁻	0.536
Fe ²⁺ + 2 e 1 Fe	-0.447	H ₃ IO ₆ ²⁻ + 2 e 1 IO ₃ ⁻ + 3 OH ⁻	0.7
Fe ³⁺ + 3 e 1 Fe	-0.037	H ₃ IO ₆ + H ⁺ + 2 e 1 IO ₃ ⁻ + 3 H ₂ O	1.601
Fe ³⁺ + e 1 Fe ²⁺	0.771	2 HIO + 2 H ⁺ + 2 e 1 I ₂ + 2 H ₂ O	1.439
2 HFeO ₄ ⁻ + 8 H ⁺ + 6 e 1 Fe ₂ O ₃ + 5 H ₂ O	2.09	HIO + H ⁺ + 2 e 1 I ⁻ + H ₂ O	0.987
HFeO ₄ ⁻ + 4 H ⁺ + 3 e 1 FeOOH + 2 H ₂ O	2.08	IO ⁻ + H ₂ O + 2 e 1 I ⁻ + 2 OH ⁻	0.485
HFeO ₄ ⁻ + 7 H ⁺ + 3 e 1 Fe ³⁺ + 4 H ₂ O	2.07	2 IO ₃ ⁻ + 12 H ⁺ + 10 e 1 I ₂ + 6 H ₂ O	1.195
Fe ₂ O ₃ + 4 H ⁺ + 2 e 1 2 FeOH ⁺ + H ₂ O	0.16	IO ₃ ⁻ + 6 H ⁺ + 6 e 1 I ⁻ + 3 H ₂ O	1.085
[Fe(CN) ₆] ³⁻ + e 1 [Fe(CN) ₆] ⁴⁻	0.358	IO ₃ ⁻ + 2 H ₂ O + 4 e 1 IO ⁻ + 4 OH ⁻	0.15
FeO ₄ ²⁻ + 8 H ⁺ + 3 e 1 Fe ³⁺ + 4 H ₂ O	2.20	IO ₃ ⁻ + 3 H ₂ O + 6 e 1 IO ⁻ + 6 OH ⁻	0.26
[Fe(bipy) ₂] ³⁺ + e 1 Fe(bipy) ₂ ²⁺	0.78	In ⁺ + e 1 In	-0.14
[Fe(bipy) ₃] ³⁺ + e 1 Fe(bipy) ₃ ²⁺	1.03	In ²⁺ + e 1 In ⁺	-0.40
Fe(OH) ₃ + e 1 Fe(OH) ₂ + OH ⁻	-0.56	In ³⁺ + e 1 In ²⁺	-0.49
[Fe(phen) ₃] ³⁺ + e 1 [Fe(phen) ₃] ²⁺	1.147	In ³⁺ + 2 e 1 In ⁺	-0.443
[Fe(phen) ₃] ³⁺ + e 1 [Fe(phen) ₃] ²⁺ (1 molar H ₂ SO ₄)	1.06	In ³⁺ + 3 e 1 In	-0.3382
[Ferricinium] ⁺ + e 1 ferrocene	0.400	In(OH) ₃ + 3 e 1 In + 3 OH ⁻	-0.99
Fm ³⁺ + e 1 Fm ²⁺	-1.1	In(OH) ₄ ⁻ + 3 e 1 In + 4 OH ⁻	-1.007
Fm ³⁺ + 3 e 1 Fm	-1.89	In ₂ O ₃ + 3 H ₂ O + 6 e 1 2 In + 6 OH ⁻	-1.034
Fm ²⁺ + 2 e 1 Fm	-2.30	Ir ³⁺ + 3 e 1 Ir	1.156
Fr ⁺ + e 1 Fr	-2.9	[IrCl ₆] ²⁻ + e 1 [IrCl ₆] ³⁻	0.8665
Ga ³⁺ + 3 e 1 Ga	-0.549	[IrCl ₆] ³⁻ + 3 e 1 Ir + 6 Cl ⁻	0.77
Ga ⁺ + e 1 Ga	-0.2	Ir ₂ O ₃ + 3 H ₂ O + 6 e 1 2 Ir + 6 OH ⁻	0.098
GaOH ²⁺ + H ⁺ + 3 e 1 Ga + H ₂ O	-0.498	K ⁺ + e 1 K	-2.931
H ₂ GaO ₃ + H ₂ O + 3 e 1 Ga + 4 OH ⁻	-1.219	La ³⁺ + 3 e 1 La	-2.379
Gd ³⁺ + 3 e 1 Gd	-2.279	La(OH) ₃ + 3 e 1 La + 3 OH ⁻	-2.90
Ge ²⁺ + 2 e 1 Ge	0.24	Li ⁺ + e 1 Li	-3.0401
Ge ⁴⁺ + 4 e 1 Ge	0.124	Lr ³⁺ + 3 e 1 Lr	-1.96
Ge ⁴⁺ + 2 e 1 Ge ²⁺	0.00	Lu ³⁺ + 3 e 1 Lu	-2.28
GeO ₂ + 2 H ⁺ + 2 e 1 GeO + H ₂ O	-0.118	Md ³⁺ + e 1 Md ²⁺	-0.1
H ₂ GeO ₃ + 4 H ⁺ + 4 e 1 Ge + 3 H ₂ O	-0.182	Md ³⁺ + 3 e 1 Md	-1.65
2 H ⁺ + 2 e 1 H ₂	0.00000	Md ²⁺ + 2 e 1 Md	-2.40
H ₂ + 2 e 1 2 H ⁻	-2.23	Mg ⁺ + e 1 Mg	-2.70
HO ₂ + H ⁺ + e 1 H ₂ O ₂	1.495	Mg ²⁺ + 2 e 1 Mg	-2.372
2 H ₂ O + 2 e 1 H ₂ + 2 OH ⁻	-0.8277	Mg(OH) ₂ + 2 e 1 Mg + 2 OH ⁻	-2.690
H ₂ O ₂ + 2 H ⁺ + 2 e 1 2 H ₂ O	1.776	Mn ²⁺ + 2 e 1 Mn	-1.185
Hf ⁴⁺ + 4 e 1 Hf	-1.55	Mn ³⁺ + 3 e 1 Mn ²⁺	1.5415
HfO ²⁺ + 2 H ⁺ + 4 e 1 Hf + H ₂ O	-1.724	MnO ₂ + 4 H ⁺ + 2 e 1 Mn ²⁺ + 2 H ₂ O	1.224
HfO ₂ + 4 H ⁺ + 4 e 1 Hf + 2 H ₂ O	-1.505	MnO ₄ ⁻ + e 1 MnO ₄ ²⁻	0.558
HfO(OH) ₂ + H ₂ O + 4 e 1 Hf + 4 OH ⁻	-2.50	MnO ₄ ⁻ + 4 H ⁺ + 3 e 1 MnO ₂ + 2 H ₂ O	1.679
Hg ²⁺ + 2 e 1 Hg	0.851	MnO ₄ ⁻ + 8 H ⁺ + 5 e 1 Mn ²⁺ + 4 H ₂ O	1.507
2 Hg ²⁺ + 2 e 1 Hg ₂ ²⁺	0.920	MnO ₄ ⁻ + 2 H ₂ O + 3 e 1 MnO ₂ + 4 OH ⁻	0.595
Hg ₂ ²⁺ + 2 e 1 2 Hg	0.7973	MnO ₄ ²⁻ + 2 H ₂ O + 2 e 1 MnO ₂ + 4 OH ⁻	0.60
Hg ₂ (ac) ₂ + 2 e 1 2 Hg + 2(ac) ⁻	0.51163	Mn(OH) ₂ + 2 e 1 Mn + 2 OH ⁻	-1.56
Hg ₂ Br ₂ + 2 e 1 2 Hg + 2 Br ⁻	0.13923	Mn(OH) ₃ + e 1 Mn(OH) ₂ + OH ⁻	0.15
Hg ₂ Cl ₂ + 2 e 1 2 Hg + 2 Cl ⁻	0.26808	Mn ₂ O ₃ + 6 H ⁺ + e 1 2 Mn ²⁺ + 3 H ₂ O	1.485
Hg ₂ HPO ₄ + 2 e 1 2 Hg + HPO ₄ ²⁻	0.6359	Mo ³⁺ + 3 e 1 Mo	-0.200
Hg ₂ I ₂ + 2 e 1 2 Hg + 2 I ⁻	-0.0405	MoO ₂ + 4 H ⁺ + 4 e 1 Mo + 4 H ₂ O	-0.152
Hg ₂ O + H ₂ O + 2 e 1 2 Hg + 2 OH ⁻	0.123	H ₃ Mo ₇ O ₂₄ ³⁻ + 45 H ⁺ + 42 e 1 7 Mo + 24 H ₂ O	0.082
HgO + H ₂ O + 2 e 1 Hg + 2 OH ⁻	0.0977	MoO ₃ + 6 H ⁺ + 6 e 1 Mo + 3 H ₂ O	0.075
Hg(OH) ₂ + 2 H ⁺ + 2 e 1 Hg + 2 H ₂ O	1.034	N ₂ + 2 H ₂ O + 6 H ⁺ + 6 e 1 2 NH ₄ OH	0.092
Hg ₂ SO ₄ + 2 e 1 2 Hg + SO ₄ ²⁻	0.6125	3 N ₂ + 2 H ⁺ + 2 e 1 2 NH ₃	-3.09
Ho ²⁺ + 2 e 1 Ho	-2.1	N ₅ ⁺ + 3 H ⁺ + 2 e 1 2 NH ₄ ⁺	1.275

ELECTROCHEMICAL SERIES (continued)

TABLE 1
Alphabetical Listing (continued)

Reaction	E°/V	Reaction	E°/V
$N_2O + 2 H^+ + 2 e \rightarrow 1 N_2 + H_2O$	1.766	$H_2P_2^- + e \rightarrow 1 P + 2 OH^-$	-1.82
$H_2N_2O_2 + 2 H^+ + 2 e \rightarrow 1 N_2 + 2 H_2O$	2.65	$H_3PO_2 + H^+ + e \rightarrow 1 P + 2 H_2O$	-0.508
$N_2O_4 + 2 e \rightarrow 1 2 NO_2^-$	0.867	$H_3PO_3 + 2 H^+ + 2 e \rightarrow 1 H_3PO_2 + H_2O$	-0.499
$N_2O_4 + 2 H^+ + 2 e \rightarrow 1 2 NHO_2$	1.065	$H_3PO_3 + 3 H^+ + 3 e \rightarrow 1 P + 3 H_2O$	-0.454
$N_2O_4 + 4 H^+ + 4 e \rightarrow 1 2 NO + 2 H_2O$	1.035	$HPO_3^{2-} + 2 H_2O + 2 e \rightarrow 1 H_2PO_2^- + 3 OH^-$	-1.65
$2 NH_3OH^+ + H^+ + 2 e \rightarrow 1 N_2H_5^+ + 2 H_2O$	1.42	$HPO_3^{2-} + 2 H_2O + 3 e \rightarrow 1 P + 5 OH^-$	-1.71
$2 NO + 2 H^+ + 2 e \rightarrow 1 N_2O + H_2O$	1.591	$H_3PO_4 + 2 H^+ + 2 e \rightarrow 1 H_3PO_3 + H_2O$	-0.276
$2 NO + H_2O + 2 e \rightarrow 1 N_2O + 2 OH^-$	0.76	$PO_4^{3-} + 2 H_2O + 2 e \rightarrow 1 HPO_3^{2-} + 3 OH^-$	-1.05
$HNO_2 + H^+ + e \rightarrow 1 NO + H_2O$	0.983	$Pa^{3+} + 3 e \rightarrow 1 Pa$	-1.34
$2 HNO_2 + 4 H^+ + 4 e \rightarrow 1 H_2N_2O_2 + 2 H_2O$	0.86	$Pa^{4+} + 4 e \rightarrow 1 Pa$	-1.49
$2 HNO_2 + 4 H^+ + 4 e \rightarrow 1 N_2O + 3 H_2O$	1.297	$Pa^{4+} + e \rightarrow 1 Pa^{3+}$	-1.9
$NO_2^- + H_2O + e \rightarrow 1 NO + 2 OH^-$	-0.46	$Pb^{2+} + 2 e \rightarrow 1 Pb$	-0.1262
$2 NO_2^- + 2 H_2O + 4 e \rightarrow 1 N_2O_2^{2-} + 4 OH^-$	-0.18	$Pb^{2+} + 2 e \rightarrow 1 Pb(Hg)$	-0.1205
$2 NO_2^- + 3 H_2O + 4 e \rightarrow 1 N_2O + 6 OH^-$	0.15	$PbBr_2 + 2 e \rightarrow 1 Pb + 2 Br^-$	-0.284
$NO_3^- + 3 H^+ + 2 e \rightarrow 1 HNO_2 + H_2O$	0.934	$PbCl_2 + 2 e \rightarrow 1 Pb + 2 Cl^-$	-0.2675
$NO_3^- + 4 H^+ + 3 e \rightarrow 1 NO + 2 H_2O$	0.957	$PbF_2 + 2 e \rightarrow 1 Pb + 2 F^-$	-0.3444
$2 NO_3^- + 4 H^+ + 2 e \rightarrow 1 N_2O_4 + 2 H_2O$	0.803	$PbHPO_4 + 2 e \rightarrow 1 Pb + HPO_4^{2-}$	-0.465
$NO_3^- + H_2O + 2 e \rightarrow 1 NO_2^- + 2 OH^-$	0.01	$PbI_2 + 2 e \rightarrow 1 Pb + 2 I^-$	-0.365
$2 NO_3^- + 2 H_2O + 2 e \rightarrow 1 N_2O_4 + 4 OH^-$	-0.85	$PbO + H_2O + 2 e \rightarrow 1 Pb + 2 OH^-$	-0.580
$Na^+ + e \rightarrow 1 Na$	-2.71	$PbO_2 + 4 H^+ + 2 e \rightarrow 1 Pb^{2+} + 2 H_2O$	1.455
$Nb^{3+} + 3 e \rightarrow 1 Nb$	-1.099	$HPbO_2^- + H_2O + 2 e \rightarrow 1 Pb + 3 OH^-$	-0.537
$NbO_2 + 2 H^+ + 2 e \rightarrow 1 NbO + H_2O$	-0.646	$PbO_2 + H_2O + 2 e \rightarrow 1 PbO + 2 OH^-$	0.247
$NbO_2 + 4 H^+ + 4 e \rightarrow 1 Nb + 2 H_2O$	-0.690	$PbO_2 + SO_4^{2-} + 4 H^+ + 2 e \rightarrow 1 PbSO_4 + 2 H_2O$	1.6913
$NbO + 2 H^+ + 2 e \rightarrow 1 Nb + H_2O$	-0.733	$PbSO_4 + 2 e \rightarrow 1 Pb + SO_4^{2-}$	-0.3588
$Nb_2O_5 + 10 H^+ + 10 e \rightarrow 1 2 Nb + 5 H_2O$	-0.644	$PbSO_4 + 2 e \rightarrow 1 Pb(Hg) + SO_4^{2-}$	-0.3505
$Nd^{3+} + 3 e \rightarrow 1 Nd$	-2.323	$Pd^{2+} + 2 e \rightarrow 1 Pd$	0.951
$Nd^{2+} + 2 e \rightarrow 1 Nd$	-2.1	$[PdCl_4]^{2-} + 2 e \rightarrow 1 Pd + 4 Cl^-$	0.591
$Nd^{3+} + e \rightarrow 1 Nd^{2+}$	-2.7	$[PdCl_6]^{2-} + 2 e \rightarrow 1 [PdCl_4]^{2-} + 2 Cl^-$	1.288
$Ni^{2+} + 2 e \rightarrow 1 Ni$	-0.257	$Pd(OH)_2 + 2 e \rightarrow 1 Pd + 2 OH^-$	0.07
$Ni(OH)_2 + 2 e \rightarrow 1 Ni + 2 OH^-$	-0.72	$Pm^{2+} + 2 e \rightarrow 1 Pm$	-2.2
$NiO_2 + 4 H^+ + 2 e \rightarrow 1 Ni^{2+} + 2 H_2O$	1.678	$Pm^{3+} + 3 e \rightarrow 1 Pm$	-2.30
$NiO_2 + 2 H_2O + 2 e \rightarrow 1 Ni(OH)_2 + 2 OH^-$	-0.490	$Pm^{3+} + e \rightarrow 1 Pm^{2+}$	-2.6
$No^{3+} + e \rightarrow 1 No^{2+}$	1.4	$Po^{4+} + 2 e \rightarrow 1 Po^{2+}$	0.9
$No^{3+} + 3 e \rightarrow 1 No$	-1.20	$Po^{4+} + 4 e \rightarrow 1 Po$	0.76
$No^{2+} + 2 e \rightarrow 1 No$	-2.50	$Pr^{4+} + e \rightarrow 1 Pr^{3+}$	3.2
$Np^{3+} + 3 e \rightarrow 1 Np$	-1.856	$Pr^{2+} + 2 e \rightarrow 1 Pr$	-2.0
$Np^{4+} + e \rightarrow 1 Np^{3+}$	0.147	$Pr^{3+} + 3 e \rightarrow 1 Pr$	-2.353
$NpO_2 + H_2O + H^+ + e \rightarrow 1 Np(OH)_3$	-0.962	$Pr^{3+} + e \rightarrow 1 Pr^{2+}$	-3.1
$O_2 + 2 H^+ + 2 e \rightarrow 1 H_2O_2$	0.695	$Pt^{2+} + 2 e \rightarrow 1 Pt$	1.18
$O_2 + 4 H^+ + 4 e \rightarrow 1 2 H_2O$	1.229	$[PtCl_4]^{2-} + 2 e \rightarrow 1 Pt + 4 Cl^-$	0.755
$O_2 + H_2O + 2 e \rightarrow 1 HO_2^- + OH^-$	-0.076	$[PtCl_6]^{2-} + 2 e \rightarrow 1 [PtCl_4]^{2-} + 2 Cl^-$	0.68
$O_2 + 2 H_2O + 2 e \rightarrow 1 H_2O_2 + 2 OH^-$	-0.146	$Pt(OH)_2 + 2 e \rightarrow 1 Pt + 2 OH^-$	0.14
$O_2 + 2 H_2O + 4 e \rightarrow 1 4 OH^-$	0.401	$PtO_3 + 2 H^+ + 2 e \rightarrow 1 PtO_2 + H_2O$	1.7
$O_3 + 2 H^+ + 2 e \rightarrow 1 O_2 + H_2O$	2.076	$PtO_3 + 4 H^+ + 2 e \rightarrow 1 Pt(OH)_2^{2+} + H_2O$	1.5
$O_3 + H_2O + 2 e \rightarrow 1 O_2 + 2 OH^-$	1.24	$PtOH^+ + H^+ + 2 e \rightarrow 1 Pt + H_2O$	1.2
$O(g) + 2 H^+ + 2 e \rightarrow 1 H_2O$	2.421	$PtO_2 + 2 H^+ + 2 e \rightarrow 1 PtO + H_2O$	1.01
$OH^- + e \rightarrow 1 OH^-$	2.02	$PtO_2 + 4 H^+ + 4 e \rightarrow 1 Pt + 2 H_2O$	1.00
$HO_2^- + H_2O + 2 e \rightarrow 1 3 OH^-$	0.878	$Pu^{3+} + 3 e \rightarrow 1 Pu$	-2.031
$OsO_4 + 8 H^+ + 8 e \rightarrow 1 Os + 4 H_2O$	0.838	$Pu^{4+} + e \rightarrow 1 Pu^{3+}$	1.006
$OsO_4 + 4 H^+ + 4 e \rightarrow 1 OsO_2 + 2 H_2O$	1.02	$Pu^{5+} + e \rightarrow 1 Pu^{4+}$	1.099
$[Os(bipy)_2]^{3+} + e \rightarrow 1 [Os(bipy)_2]^{2+}$	0.81	$PuO_2(OH)_2 + 2 H^+ + 2 e \rightarrow 1 Pu(OH)_4$	1.325
$[Os(bipy)_3]^{3+} + e \rightarrow 1 [Os(bipy)_3]^{2+}$	0.80	$PuO_2(OH)_2 + H^+ + e \rightarrow 1 PuO_2OH + H_2O$	1.062
$P(\text{red}) + 3 H^+ + 3 e \rightarrow 1 PH_3(g)$	-0.111	$Ra^{2+} + 2 e \rightarrow 1 Ra$	-2.8
$P(\text{white}) + 3 H^+ + 3 e \rightarrow 1 PH_3(g)$	-0.063	$Rb^+ + e \rightarrow 1 Rb$	-2.98
$P + 3 H_2O + 3 e \rightarrow 1 PH_3(g) + 3 OH^-$	-0.87	$Re^{3+} + 3 e \rightarrow 1 Re$	0.300

ELECTROCHEMICAL SERIES (continued)

TABLE 1
Alphabetical Listing (continued)

Reaction	E°/V	Reaction	E°/V
$\text{ReO}_4^- + 4 \text{H}^+ + 3 \text{e} \rightarrow \text{ReO}_2 + 2 \text{H}_2\text{O}$	0.510	$\text{SiO}_2 \text{ (quartz)} + 4 \text{H}^+ + 4 \text{e} \rightarrow \text{Si} + 2 \text{H}_2\text{O}$	0.857
$\text{ReO}_2 + 4 \text{H}^+ + 4 \text{e} \rightarrow \text{Re} + 2 \text{H}_2\text{O}$	0.2513	$\text{SiO}_3^{2-} + 3 \text{H}_2\text{O} + 4 \text{e} \rightarrow \text{Si} + 6 \text{OH}^-$	-1.697
$\text{ReO}_4^- + 2 \text{H}^+ + \text{e} \rightarrow \text{ReO}_3 + \text{H}_2\text{O}$	0.768	$\text{Sm}^{3+} + \text{e} \rightarrow \text{Sm}^{2+}$	-1.55
$\text{ReO}_4^- + 4 \text{H}_2\text{O} + 7 \text{e} \rightarrow \text{Re} + 8 \text{OH}^-$	-0.584	$\text{Sm}^{3+} + 3 \text{e} \rightarrow \text{Sm}$	-2.304
$\text{ReO}_4^- + 8 \text{H}^+ + 7 \text{e} \rightarrow \text{Re} + 4 \text{H}_2\text{O}$	0.368	$\text{Sm}^{2+} + 2 \text{e} \rightarrow \text{Sm}$	-2.68
$\text{Rh}^+ + \text{e} \rightarrow \text{Rh}$	0.600	$\text{Sn}^{2+} + 2 \text{e} \rightarrow \text{Sn}$	-0.1375
$\text{Rh}^+ + 2 \text{e} \rightarrow \text{Rh}$	0.600	$\text{Sn}^{4+} + 2 \text{e} \rightarrow \text{Sn}^{2+}$	0.151
$\text{Rh}^{3+} + 3 \text{e} \rightarrow \text{Rh}$	0.758	$\text{Sn(OH)}_3^+ + 3 \text{H}^+ + 2 \text{e} \rightarrow \text{Sn}^{2+} + 3 \text{H}_2\text{O}$	0.142
$[\text{RhCl}_6]^{3-} + 3 \text{e} \rightarrow \text{Rh} + 6 \text{Cl}^-$	0.431	$\text{SnO}_2 + 4 \text{H}^+ + 2 \text{e} \rightarrow \text{Sn}^{2+} + 2 \text{H}_2\text{O}$	-0.094
$\text{RhOH}^{2+} + \text{H}^+ + 3 \text{e} \rightarrow \text{Rh} + \text{H}_2\text{O}$	0.83	$\text{SnO}_2 + 4 \text{H}^+ + 4 \text{e} \rightarrow \text{Sn} + 2 \text{H}_2\text{O}$	-0.117
$\text{Ru}^{2+} + 2 \text{e} \rightarrow \text{Ru}$	0.455	$\text{SnO}_2 + 3 \text{H}^+ + 2 \text{e} \rightarrow \text{SnOH}^+ + \text{H}_2\text{O}$	-0.194
$\text{Ru}^{3+} + \text{e} \rightarrow \text{Ru}^{2+}$	0.2487	$\text{SnO}_2 + 2 \text{H}_2\text{O} + 4 \text{e} \rightarrow \text{Sn} + 4 \text{OH}^-$	-0.945
$\text{RuO}_2 + 4 \text{H}^+ + 2 \text{e} \rightarrow \text{Ru}^{2+} + 2 \text{H}_2\text{O}$	1.120	$\text{HSnO}_2^- + \text{H}_2\text{O} + 2 \text{e} \rightarrow \text{Sn} + 3 \text{OH}^-$	-0.909
$\text{RuO}_4^- + \text{e} \rightarrow \text{RuO}_4^{2-}$	0.59	$\text{Sn(OH)}_6^{2-} + 2 \text{e} \rightarrow \text{HSnO}_2^- + 3 \text{OH}^- + \text{H}_2\text{O}$	-0.93
$\text{RuO}_4 + \text{e} \rightarrow \text{RuO}_4^-$	1.00	$\text{Sr}^+ + \text{e} \rightarrow \text{Sr}$	-4.10
$\text{RuO}_4 + 6 \text{H}^+ + 4 \text{e} \rightarrow \text{Ru(OH)}_2^{2+} + 2 \text{H}_2\text{O}$	1.40	$\text{Sr}^{2+} + 2 \text{e} \rightarrow \text{Sr}$	-2.899
$\text{RuO}_4 + 8 \text{H}^+ + 8 \text{e} \rightarrow \text{Ru} + 4 \text{H}_2\text{O}$	1.038	$\text{Sr}^{2+} + 2 \text{e} \rightarrow \text{Sr(Hg)}$	-1.793
$[\text{Ru(bipy)}_3]^{3+} + \text{e} \rightarrow [\text{Ru(bipy)}_3]^{2+}$	1.24	$\text{Sr(OH)}_2 + 2 \text{e} \rightarrow \text{Sr} + 2 \text{OH}^-$	-2.88
$[\text{Ru(H}_2\text{O)}_6]^{3+} + \text{e} \rightarrow [\text{Ru(H}_2\text{O)}_6]^{2+}$	0.23	$\text{Ta}_2\text{O}_5 + 10 \text{H}^+ + 10 \text{e} \rightarrow 2 \text{Ta} + 5 \text{H}_2\text{O}$	-0.750
$[\text{Ru(NH}_3)_6]^{3+} + \text{e} \rightarrow [\text{Ru(NH}_3)_6]^{2+}$	0.10	$\text{Ta}^{3+} + 3 \text{e} \rightarrow \text{Ta}$	-0.6
$[\text{Ru(en)}_3]^{3+} + \text{e} \rightarrow [\text{Ru(en)}_3]^{2+}$	0.210	$\text{Tc}^{2+} + 2 \text{e} \rightarrow \text{Tc}$	0.400
$[\text{Ru(CN)}_6]^{3-} + \text{e} \rightarrow [\text{Ru(CN)}_6]^{4-}$	0.86	$\text{TcO}_4^- + 4 \text{H}^+ + 3 \text{e} \rightarrow \text{TcO}_2 + 2 \text{H}_2\text{O}$	0.782
$\text{S} + 2 \text{e} \rightarrow \text{S}^{2-}$	-0.47627	$\text{Tc}^{3+} + \text{e} \rightarrow \text{Tc}^{2+}$	0.3
$\text{S} + 2 \text{H}^+ + 2 \text{e} \rightarrow \text{H}_2\text{S(aq)}$	0.142	$\text{TcO}_4^- + 8 \text{H}^+ + 7 \text{e} \rightarrow \text{Tc} + 4 \text{H}_2\text{O}$	0.472
$\text{S} + \text{H}_2\text{O} + 2 \text{e} \rightarrow \text{SH}^- + \text{OH}^-$	-0.478	$\text{Tb}^{4+} + \text{e} \rightarrow \text{Tb}^{3+}$	3.1
$2 \text{S} + 2 \text{e} \rightarrow \text{S}_2^{2-}$	-0.42836	$\text{Tb}^{3+} + 3 \text{e} \rightarrow \text{Tb}$	-2.28
$\text{S}_2\text{O}_6^{2-} + 4 \text{H}^+ + 2 \text{e} \rightarrow 2 \text{H}_2\text{SO}_3$	0.564	$\text{Te} + 2 \text{e} \rightarrow \text{Te}^{2-}$	-1.143
$\text{S}_2\text{O}_8^{2-} + 2 \text{e} \rightarrow 2 \text{SO}_4^{2-}$	2.010	$\text{Te} + 2 \text{H}^+ + 2 \text{e} \rightarrow \text{H}_2\text{Te}$	-0.793
$\text{S}_2\text{O}_8^{2-} + 2 \text{H}^+ + 2 \text{e} \rightarrow 2 \text{HSO}_4^-$	2.123	$\text{Te}^{4+} + 4 \text{e} \rightarrow \text{Te}$	0.568
$\text{S}_2\text{O}_6^{2-} + 2 \text{e} \rightarrow 2 \text{S}_2\text{O}_3^{2-}$	0.08	$\text{TeO}_2 + 4 \text{H}^+ + 4 \text{e} \rightarrow \text{Te} + 2 \text{H}_2\text{O}$	0.593
$2 \text{H}_2\text{SO}_3 + \text{H}^+ + 2 \text{e} \rightarrow \text{HS}_2\text{O}_4^- + 2 \text{H}_2\text{O}$	-0.056	$\text{TeO}_3^{2-} + 3 \text{H}_2\text{O} + 4 \text{e} \rightarrow \text{Te} + 6 \text{OH}^-$	-0.57
$\text{H}_2\text{SO}_3 + 4 \text{H}^+ + 4 \text{e} \rightarrow \text{S} + 3 \text{H}_2\text{O}$	0.449	$\text{TeO}_4^- + 8 \text{H}^+ + 7 \text{e} \rightarrow \text{Te} + 4 \text{H}_2\text{O}$	0.472
$2 \text{SO}_3^{2-} + 2 \text{H}_2\text{O} + 2 \text{e} \rightarrow \text{S}_2\text{O}_4^{2-} + 4 \text{OH}^-$	-1.12	$\text{H}_6\text{TeO}_6 + 2 \text{H}^+ + 2 \text{e} \rightarrow \text{TeO}_2 + 4 \text{H}_2\text{O}$	1.02
$2 \text{SO}_3^{2-} + 3 \text{H}_2\text{O} + 4 \text{e} \rightarrow \text{S}_2\text{O}_3^{2-} + 6 \text{OH}^-$	-0.571	$\text{Th}^{4+} + 4 \text{e} \rightarrow \text{Th}$	-1.899
$\text{SO}_4^{2-} + 4 \text{H}^+ + 2 \text{e} \rightarrow \text{H}_2\text{SO}_3 + \text{H}_2\text{O}$	-0.172	$\text{ThO}_2 + 4 \text{H}^+ + 4 \text{e} \rightarrow \text{Th} + 2 \text{H}_2\text{O}$	-1.789
$2 \text{SO}_4^{2-} + 4 \text{H}^+ + 2 \text{e} \rightarrow \text{S}_2\text{O}_6^{2-} + \text{H}_2\text{O}$	-0.22	$\text{Th(OH)}_4 + 4 \text{e} \rightarrow \text{Th} + 4 \text{OH}^-$	-2.48
$\text{SO}_4^{2-} + \text{H}_2\text{O} + 2 \text{e} \rightarrow \text{SO}_3^{2-} + 2 \text{OH}^-$	-0.93	$\text{Ti}^{2+} + 2 \text{e} \rightarrow \text{Ti}$	-1.630
$\text{Sb} + 3 \text{H}^+ + 3 \text{e} \rightarrow \text{SbH}_3$	-0.510	$\text{Ti}^{3+} + \text{e} \rightarrow \text{Ti}^{2+}$	-0.9
$\text{Sb}_2\text{O}_3 + 6 \text{H}^+ + 6 \text{e} \rightarrow 2 \text{Sb} + 3 \text{H}_2\text{O}$	0.152	$\text{TiO}_2 + 4 \text{H}^+ + 2 \text{e} \rightarrow \text{Ti}^{2+} + 2 \text{H}_2\text{O}$	-0.502
$\text{Sb}_2\text{O}_5 \text{ (senarmonite)} + 4 \text{H}^+ + 4 \text{e} \rightarrow \text{Sb}_2\text{O}_3 + 2 \text{H}_2\text{O}$	0.671	$\text{Ti}^{3+} + 3 \text{e} \rightarrow \text{Ti}$	-1.37
$\text{Sb}_2\text{O}_5 \text{ (valentinite)} + 4 \text{H}^+ + 4 \text{e} \rightarrow \text{Sb}_2\text{O}_3 + 2 \text{H}_2\text{O}$	0.649	$\text{TiOH}^{3+} + \text{H}^+ + \text{e} \rightarrow \text{Ti}^{3+} + \text{H}_2\text{O}$	-0.055
$\text{Sb}_2\text{O}_5 + 6 \text{H}^+ + 4 \text{e} \rightarrow 2 \text{SbO}^+ + 3 \text{H}_2\text{O}$	0.581	$\text{Ti}^+ + \text{e} \rightarrow \text{Ti}$	-0.336
$\text{SbO}^+ + 2 \text{H}^+ + 3 \text{e} \rightarrow \text{Sb} + 2 \text{H}_2\text{O}$	0.212	$\text{Ti}^+ + \text{e} \rightarrow \text{Ti(Hg)}$	-0.3338
$\text{SbO}_2^- + 2 \text{H}_2\text{O} + 3 \text{e} \rightarrow \text{Sb} + 4 \text{OH}^-$	-0.66	$\text{Ti}^{3+} + 2 \text{e} \rightarrow \text{Ti}^+$	1.252
$\text{SbO}_3^- + \text{H}_2\text{O} + 2 \text{e} \rightarrow \text{SbO}_2^- + 2 \text{OH}^-$	-0.59	$\text{Ti}^{3+} + 3 \text{e} \rightarrow \text{Ti}$	0.741
$\text{Sc}^{3+} + 3 \text{e} \rightarrow \text{Sc}$	-2.077	$\text{TlBr} + \text{e} \rightarrow \text{Tl} + \text{Br}^-$	-0.658
$\text{Se} + 2 \text{e} \rightarrow \text{Se}^{2-}$	-0.924	$\text{TlCl} + \text{e} \rightarrow \text{Tl} + \text{Cl}^-$	-0.5568
$\text{Se} + 2 \text{H}^+ + 2 \text{e} \rightarrow \text{H}_2\text{Se(aq)}$	-0.399	$\text{TlI} + \text{e} \rightarrow \text{Tl} + \text{I}^-$	-0.752
$\text{H}_2\text{SeO}_3 + 4 \text{H}^+ + 4 \text{e} \rightarrow \text{Se} + 3 \text{H}_2\text{O}$	0.74	$\text{Tl}_2\text{O}_3 + 3 \text{H}_2\text{O} + 4 \text{e} \rightarrow 2 \text{Tl}^+ + 6 \text{OH}^-$	0.02
$\text{Se} + 2 \text{H}^+ + 2 \text{e} \rightarrow \text{H}_2\text{Se}$	-0.082	$\text{TlOH} + \text{e} \rightarrow \text{Tl} + \text{OH}^-$	-0.34
$\text{SeO}_3^{2-} + 3 \text{H}_2\text{O} + 4 \text{e} \rightarrow \text{Se} + 6 \text{OH}^-$	-0.366	$\text{Ti(OH)}_3 + 2 \text{e} \rightarrow \text{TlOH} + 2 \text{OH}^-$	-0.05
$\text{SeO}_4^{2-} + 4 \text{H}^+ + 2 \text{e} \rightarrow \text{H}_2\text{SeO}_3 + \text{H}_2\text{O}$	1.151	$\text{Ti}_2\text{SO}_4 + 2 \text{e} \rightarrow \text{Ti} + \text{SO}_4^{2-}$	-0.4360
$\text{SeO}_4^{2-} + \text{H}_2\text{O} + 2 \text{e} \rightarrow \text{SeO}_3^{2-} + 2 \text{OH}^-$	0.05	$\text{Tm}^{3+} + \text{e} \rightarrow \text{Tm}^{2+}$	-2.2
$\text{SiF}_6^{2-} + 4 \text{e} \rightarrow \text{Si} + 6 \text{F}^-$	-1.24	$\text{Tm}^{3+} + 3 \text{e} \rightarrow \text{Tm}$	-2.319
$\text{SiO} + 2 \text{H}^+ + 2 \text{e} \rightarrow \text{Si} + \text{H}_2\text{O}$	-0.8	$\text{Tm}^{2+} + 2 \text{e} \rightarrow \text{Tm}$	-2.4

ELECTROCHEMICAL SERIES (continued)

TABLE 1
Alphabetical Listing (continued)

Reaction	E°/V	Reaction	E°/V
$U^{3+} + 3 e \rightarrow 1 U$	-1.798	$2 WO_3 + 2 H^+ + 2 e \rightarrow 1 W_2O_5 + H_2O$	-0.029
$U^{4+} + e \rightarrow 1 U^{3+}$	-0.607	$H_4XeO_6 + 2 H^+ + 2 e \rightarrow 1 XeO_3 + 3 H_2O$	2.42
$UO_2^+ + 4 H^+ + e \rightarrow 1 U^{4+} + 2 H_2O$	0.612	$XeO_3 + 6 H^+ + 6 e \rightarrow 1 Xe + 3 H_2O$	2.10
$UO_2^{2+} + e \rightarrow 1 UO^{+2}$	0.062	$XeF + e \rightarrow 1 Xe + F^-$	3.4
$UO_2^{2+} + 4 H^+ + 2 e \rightarrow 1 U^{4+} + 2 H_2O$	0.327	$Y^{3+} + 3 e \rightarrow 1 Y$	-2.372
$UO_2^{2+} + 4 H^+ + 6 e \rightarrow 1 U + 2 H_2O$	-1.444	$Yb^{3+} + e \rightarrow 1 Yb^{2+}$	-1.05
$V^{2+} + 2 e \rightarrow 1 V$	-1.175	$Yb^{3+} + 3 e \rightarrow 1 Yb$	-2.19
$V^{3+} + e \rightarrow 1 V^{2+}$	-0.255	$Yb^{2+} + 2 e \rightarrow 1 Yb$	-2.76
$VO^{2+} + 2 H^+ + e \rightarrow 1 V^{3+} + H_2O$	0.337	$Zn^{2+} + 2 e \rightarrow 1 Zn$	-0.7618
$VO^{+} + 2 H^+ + e \rightarrow 1 VO^{2+} + H_2O$	0.991	$Zn^{2+} + 2 e \rightarrow 1 Zn(Hg)$	-0.7628
$V_2O_5 + 6 H^+ + 2 e \rightarrow 1 2 VO^{2+} + 3 H_2O$	0.957	$ZnO^{2-} + 2 H_2O + 2 e \rightarrow 1 Zn + 4 OH^-$	-1.215
$V_2O_5 + 10 H^+ + 10 e \rightarrow 1 2 V + 5 H_2O$	-0.242	$ZnSO_4 \cdot 7 H_2O + 2 e \rightarrow 1 Zn(Hg) + SO_4^{2-} + 7 H_2O$	-0.7993
$V(OH)_4^+ + 2 H^+ + e \rightarrow 1 VO^{2+} + 3 H_2O$	1.00	(Saturated $ZnSO_4$)	
$V(OH)_4^+ + 4 H^+ + 5 e \rightarrow 1 V + 4 H_2O$	-0.254	$ZnOH^+ + H^+ + 2 e \rightarrow 1 Zn + H_2O$	-0.497
$[V(phen)_3]^{3+} + e \rightarrow 1 [V(phen)_3]^{2+}$	0.14	$Zn(OH)_4^{2-} + 2 e \rightarrow 1 Zn + 4 OH^-$	-1.199
$W^{3+} + 3 e \rightarrow 1 W$	0.1	$Zn(OH)_2 + 2 e \rightarrow 1 Zn + 2 OH^-$	-1.249
$W_2O_5 + 2 H^+ + 2 e \rightarrow 1 2 WO_2 + H_2O$	-0.031	$ZnO + H_2O + 2 e \rightarrow 1 Zn + 2 OH^-$	-1.260
$WO_2 + 4 H^+ + 4 e \rightarrow 1 W + 2 H_2O$	-0.119	$ZrO_2 + 4 H^+ + 4 e \rightarrow 1 Zr + 2 H_2O$	-1.553
$WO_3 + 6 H^+ + 6 e \rightarrow 1 W + 3 H_2O$	-0.090	$Zr(OH)_2 + H_2O + 4 e \rightarrow 1 Zr + 4 OH^-$	-2.36
$WO_3 + 2 H^+ + 2 e \rightarrow 1 WO_2 + H_2O$	0.036	$Zr^{4+} + 4 e \rightarrow 1 Zr$	-1.45

TABLE 2
Reduction Reactions Having E° Values More Positive than that of the Standard Hydrogen Electrode

Reaction	E°/V	Reaction	E°/V
$2 H^+ + 2 e \rightarrow 1 H_2$	0.00000	$Sn(OH)_3^+ + 3 H^+ + 2 e \rightarrow 1 Sn^{2+} + 3 H_2O$	0.142
$CuI_2^- + e \rightarrow 1 Cu + 2 I^-$	0.00	$Np^{4+} + e \rightarrow 1 Np^{3+}$	0.147
$Ge^{4+} + 2 e \rightarrow 1 Ge^{2+}$	0.00	$Ag_4[Fe(CN)_6] + 4 e \rightarrow 1 4 Ag + [Fe(CN)_6]^{4-}$	0.1478
$NO_3^- + H_2O + 2 e \rightarrow 1 NO_2^- + 2 OH^-$	0.01	$IO_3^- + 2 H_2O + 4 e \rightarrow 1 IO^- + 4 OH^-$	0.15
$Tl_2O_3 + 3 H_2O + 4 e \rightarrow 1 2 Tl^+ + 6 OH^-$	0.02	$Mn(OH)_3 + e \rightarrow 1 Mn(OH)_2 + OH^-$	0.15
$SeO_4^{2-} + H_2O + 2 e \rightarrow 1 SeO_3^{2-} + 2 OH^-$	0.05	$2 NO_2^- + 3 H_2O + 4 e \rightarrow 1 N_2O + 6 OH^-$	0.15
$WO_3 + 2 H^+ + 2 e \rightarrow 1 WO_2 + H_2O$	0.036	$Sn^{4+} + 2 e \rightarrow 1 Sn^{2+}$	0.151
$UO_2^{2+} + e \rightarrow 1 UO_2^+$	0.062	$Sb_2O_3 + 6 H^+ + 6 e \rightarrow 1 2 Sb + 3 H_2O$	0.152
$Pd(OH)_2 + 2 e \rightarrow 1 Pd + 2 OH^-$	0.07	$Cu^{2+} + e \rightarrow 1 Cu^+$	0.153
$AgBr + e \rightarrow 1 Ag + Br^-$	0.07133	$BiOCl + 2 H^+ + 3 e \rightarrow 1 Bi + Cl^- + H_2O$	0.1583
$MoO_3 + 6 H^+ + 6 e \rightarrow 1 Mo + 3 H_2O$	0.075	$BiCl_4^- + 3 e \rightarrow 1 Bi + 4 Cl^-$	0.16
$S_2O_6^{2-} + 2 e \rightarrow 1 2 S_2O_3^{2-}$	0.08	$Fe_2O_3 + 4 H^+ + 2 e \rightarrow 1 2 FeOH^+ + H_2O$	0.16
$H_3Mo_7O_{24}^{3-} + 45 H^+ + 42 e \rightarrow 1 7 Mo + 24 H_2O$	0.082	$Co(OH)_3 + e \rightarrow 1 Co(OH)_2 + OH^-$	0.17
$AgSCN + e \rightarrow 1 Ag + SCN^-$	0.8951	$SO_4^{2-} + 4 H^+ + 2 e \rightarrow 1 H_2SO_3 + H_2O$	0.172
$N_2 + 2 H_2O + 6 H^+ + 6 e \rightarrow 1 2 NH_4OH$	0.092	$Bi^{3+} + 2 e \rightarrow 1 Bi^+$	0.2
$HgO + H_2O + 2 e \rightarrow 1 Hg + 2 OH^-$	0.0977	$[Ru(en)_3]^{3+} + e \rightarrow 1 [Ru(en)_3]^{2+}$	0.210
$Ir_2O_3 + 3 H_2O + 6 e \rightarrow 1 2 Ir + 6 OH^-$	0.098	$SbO^+ + 2 H^+ + 3 e \rightarrow 1 Sb + 2 H_2O$	0.212
$2 NO + 2 e \rightarrow 1 N_2O_2^{2-}$	0.10	$AgCl + e \rightarrow 1 Ag + Cl^-$	0.22233
$[Ru(NH_3)_6]^{3+} + e \rightarrow 1 [Ru(NH_3)_6]^{2+}$	0.10	$[Ru(H_2O)_6]^{3+} + e \rightarrow 1 [Ru(H_2O)_6]^{2+}$	0.23
$W^{3+} + 3 e \rightarrow 1 W$	0.1	$As_2O_3 + 6 H^+ + 6 e \rightarrow 1 2 As + 3 H_2O$	0.234
$[Co(NH_3)_6]^{3+} + e \rightarrow 1 [Co(NH_3)_6]^{2+}$	0.108	Calomel electrode, saturated NaCl (SSCE)	0.2360
$Hg_2O + H_2O + 2 e \rightarrow 1 2 Hg + 2 OH^-$	0.123	$Ge^{2+} + 2 e \rightarrow 1 Ge$	0.24
$Ge^{4+} + 4 e \rightarrow 1 Ge$	0.124	$Ru^{3+} + e \rightarrow 1 Ru^{2+}$	0.24
$Hg_2Br_2 + 2 e \rightarrow 1 2 Hg + 2 Br^-$	0.13923	Calomel electrode, saturated KCl	0.2412
$Pt(OH)_2 + 2 e \rightarrow 1 Pt + 2 OH^-$	0.14	$PbO + H_2O + 2 e \rightarrow 1 PbO + 2 OH^-$	0.247
$[V(phen)_3]^{3+} + e \rightarrow 1 [V(phen)_3]^{2+}$	0.14	$HAsO_2 + 3 H^+ + 3 e \rightarrow 1 As + 2 H_2O$	0.248
$S + 2 H^+ + 2 e \rightarrow 1 H_2S(aq)$	0.142	$Ru^{3+} + e \rightarrow 1 Ru^{2+}$	0.2487

ELECTROCHEMICAL SERIES (continued)

TABLE 2
Reduction Reactions Having E° Values More Positive than that of the Standard Hydrogen Electrode
(continued)

Reaction	E°/V	Reaction	E°/V
ReO ₂ + 4 H ⁺ + 4 e 1 Re + 2 H ₂ O	0.2513	[PdCl ₄] ²⁻ + 2 e 1 Pd + 4 Cl ⁻	0.591
IO ₃ ⁻ + 3 H ₂ O + 6 e 1 I ⁻ + OH ⁻	0.26	TeO ₂ + 4 H ⁺ + 4 e 1 Te + 2 H ₂ O	0.593
Hg ₂ Cl ₂ + 2 e 1 2 Hg + 2 Cl ⁻	0.26808	MnO ₄ ⁻ + 2 H ₂ O + 3 e 1 MnO ₂ + 4 OH ⁻	0.595
Calomel electrode, 1 molal KCl	0.2800	Rh ²⁺ + 2 e 1 Rh	0.600
Calomel electrode, 1 molar KCl (NCE)	0.2801	Rh ⁺ + e 1 Rh	0.600
At ₂ + 2 e 1 2 At ⁻	0.3	MnO ₄ ²⁻ + 2 H ₂ O + 2 e 1 MnO ₂ + 4 OH ⁻	0.60
Re ³⁺ + 3 e 1 Re	0.300	2 AgO + H ₂ O + 2 e 1 Ag ₂ O + 2 OH ⁻	0.607
Tc ³⁺ + e 1 Tc ²⁺	0.3	BrO ₃ ⁻ + 3 H ₂ O + 6 e 1 Br ⁻ + 6 OH ⁻	0.61
Bi ³⁺ + 3 e 1 Bi	0.308	UO ₂ ⁺ + 4 H ⁺ + e 1 U ⁴⁺ + 2 H ₂ O	0.612
BiO ⁺ + 2 H ⁺ + 3 e 1 Bi + H ₂ O	0.320	Hg ₂ SO ₄ + 2 e 1 2 Hg + SO ₄ ²⁻	0.6125
UO ₂ ²⁺ + 4 H ⁺ + 2 e 1 U ⁴⁺ + 2 H ₂ O	0.327	ClO ₃ ⁻ + 3 H ₂ O + 6 e 1 Cl ⁻ + 6 OH ⁻	0.62
ClO ₃ ⁻ + H ₂ O + 2 e 1 ClO ₂ ⁻ + 2 OH ⁻	0.33	Hg ₂ HPO ₄ + 2 e 1 2 Hg + HPO ₄ ²⁻	0.6359
2 HCNO + 2 H ⁺ + 2 e 1 (CN) ₂ + 2 H ₂ O	0.330	Ag(ac) + e 1 Ag + (ac) ⁻	0.643
Calomel electrode, 0.1 molar KCl	0.3337	Sb ₂ O ₃ (valentinite) + 4 H ⁺ + 4 e 1 Sb ₂ O ₃ + 2 H ₂ O	0.649
VO ²⁺ + 2 H ⁺ + e 1 V ³⁺ + H ₂ O	0.337	Ag ₂ SO ₄ + 2 e 1 2 Ag + SO ₄ ²⁻	0.654
Cu ²⁺ + 2 e 1 Cu	0.3419	ClO ₂ ⁻ + H ₂ O + 2 e 1 ClO ⁻ + 2 OH ⁻	0.66
Ag ₂ O + H ₂ O + 2 e 1 2 Ag + 2 OH ⁻	0.342	Sb ₂ O ₃ (senarmontite) + 4 H ⁺ + 4 e 1 Sb ₂ O ₅ + 2 H ₂ O	0.671
Cu ²⁺ + 2 e 1 Cu(Hg)	0.345	[PtCl ₆] ²⁻ + 2 e 1 [PtCl ₄] ²⁻ + 2 Cl ⁻	0.68
AgIO ₃ + e 1 Ag + IO ₃ ⁻	0.354	O ₂ + 2 H ⁺ + 2 e 1 H ₂ O ₂	0.695
[Fe(CN) ₆] ³⁻ + e 1 [Fe(CN) ₆] ⁴⁻	0.358	<i>p</i> -benzoquinone + 2 H ⁺ + 2 e 1 hydroquinone	0.6992
ClO ₄ ⁻ + H ₂ O + 2 e 1 ClO ₃ ⁻ + 2 OH ⁻	0.36	H ₃ IO ₆ ²⁻ + 2 e 1 IO ₃ ⁻ + 3 OH ⁻	0.7
Ag ₂ SeO ₃ + 2 e 1 2 Ag + SeO ₃ ²⁻	0.3629	Ag ₂ O ₃ + H ₂ O + 2 e 1 2 AgO + 2 OH ⁻	0.739
ReO ₄ ⁻ + 8 H ⁺ + 7 e 1 Re + 4 H ₂ O	0.368	Tl ³⁺ + 3 e 1 Tl	0.741
(CN) ₂ + 2 H ⁺ + 2 e 1 2 HCN	0.373	[PtCl ₄] ²⁻ + 2 e 1 Pt + 4 Cl ⁻	0.755
[Ferricinium] ⁺ + e 1 ferrocene	0.400	Rh ³⁺ + 3 e 1 Rh	0.758
Tc ²⁺ + 2 e 1 Tc	0.400	ClO ₂ + 2 H ₂ O + 4 e 1 Cl ⁻ + 4 OH ⁻	0.76
O ₂ + 2 H ₂ O + 4 e 1 4 OH ⁻	0.401	2 NO + H ₂ O + 2 e 1 N ₂ O + 2 OH ⁻	0.76
AgOCN + e 1 Ag + OCN ⁻	0.41	Po ⁴⁺ + 4 e 1 Po	0.76
[RhCl ₆] ³⁻ + 3 e 1 Rh + 6 Cl ⁻	0.431	BrO ⁻ + H ₂ O + 2 e 1 Br ⁻ + 2 OH ⁻	0.761
Ag ₂ CrO ₄ + 2 e 1 2 Ag + CrO ₄ ²⁻	0.4470	ReO ₄ ⁻ + 2 H ⁺ + e 1 ReO ₃ + H ₂ O	0.768
H ₂ SO ₃ + 4 H ⁺ + 4 e 1 S + 3 H ₂ O	0.449	(CNS) ⁻ + 2 e 1 2 CNS ⁻	0.77
Ru ²⁺ + 2 e 1 Ru	0.455	[IrCl ₆] ³⁻ + 3 e 1 Ir + 6 Cl ⁻	0.77
Ag ₂ MoO ₄ + 2 e 1 2 Ag + MoO ₄ ²⁻	0.4573	Fe ³⁺ + e 1 Fe ²⁺	0.771
Ag ₂ C ₂ O ₄ + 2 e 1 2 Ag + C ₂ O ₄ ²⁻	0.4647	AgF + e 1 Ag + F ⁻	0.779
Ag ₂ WO ₄ + 2 e 1 2 Ag + WO ₄ ²⁻	0.4660	[Fe(bipy) ₂] ³⁺ + e 1 [Fe(bipy) ₂] ²⁺	0.78
Ag ₂ CO ₃ + 2 e 1 2 Ag + CO ₃ ²⁻	0.47	TcO ₄ ⁻ + 4 H ⁺ + 3 e 1 TcO ₂ + 2 H ₂ O	0.782
TcO ₄ ⁻ + 8 H ⁺ + 7 e 1 Tc + 4 H ₂ O	0.472	Hg ₂ ²⁺ + 2 e 1 2 Hg	0.7973
TeO ₄ ⁻ + 8 H ⁺ + 7 e 1 Te + 4 H ₂ O	0.472	Ag ⁺ + e 1 Ag	0.7996
IO ⁻ + H ₂ O + 2 e 1 I ⁻ + 2 OH ⁻	0.485	[Os(bipy) ₃] ³⁺ + e 1 [Os(bipy) ₃] ²⁺	0.80
NiO ₂ + 2 H ₂ O + 2 e 1 Ni(OH) ₂ + 2 OH ⁻	0.490	2 NO ₃ ⁻ + 4 H ⁺ + 2 e 1 N ₂ O ₄ + 2 H ₂ O	0.803
Bi ⁺ + e 1 Bi	0.5	[Os(bipy) ₂] ³⁺ + e 1 [Os(bipy) ₂] ²⁺	0.81
ReO ₄ ⁻ + 4 H ⁺ + 3 e 1 ReO ₂ + 2 H ₂ O	0.510	RhOH ²⁺ + H + 3 e 1 Rh + H ₂ O	0.83
Hg ₂ (ac) ₂ + 2 e 1 2 Hg + 2(ac) ⁻	0.51163	OsO ₄ + 8 H ⁺ + 8 e 1 Os + 4 H ₂ O	0.838
Cu ⁺ + e 1 Cu	0.521	ClO ⁻ + H ₂ O + 2 e 1 Cl ⁻ + 2 OH ⁻	0.841
I ₂ + 2 e 1 2 I ⁻	0.5355	Hg ²⁺ + 2 e 1 Hg	0.851
I ₃ ⁻ + 2 e 1 3 I ⁻	0.536	AuBr ₄ ⁻ + 3 e 1 Au + 4 Br ⁻	0.854
AgBrO ₃ + e 1 Ag + BrO ₃ ⁻	0.546	SiO ₂ (quartz) + 4 H ⁺ + 4 e 1 Si + 2 H ₂ O	0.857
MnO ₄ ⁻ + e 1 MnO ₂ ⁻	0.558	2 HNO ₂ + 4 H ⁺ + 4 e 1 H ₂ N ₂ O ₂ + H ₂ O	0.86
H ₃ AsO ₄ + 2 H ⁺ + 2 e 1 HAsO ₂ + 2 H ₂ O	0.560	[Ru(CN) ₆] ³⁻ + e 1 [Ru(CN) ₆] ⁴⁻	0.86
S ₂ O ₆ ²⁻ + 4 H ⁺ + 2 e 1 2 H ₂ SO ₃	0.564	[IrCl ₆] ²⁻ + e 1 [IrCl ₆] ³⁻	0.8665
AgNO ₂ + e 1 Ag + NO ₂ ⁻	0.564	N ₂ O ₄ + 2 e 1 2 NO ₂ ⁻	0.867
Te ⁴⁺ + 4 e 1 Te	0.568	HO ₂ ⁻ + H ₂ O + 2 e 1 3 OH ⁻	0.878
Sb ₂ O ₅ + 6 H ⁺ + 4 e 1 2 SbO ⁺ + 3 H ₂ O	0.581	Po ⁴⁺ + 2 e 1 Po ²⁺	0.9
RuO ₄ ⁻ + e 1 RuO ₄ ²⁻	0.59	2 Hg ⁺ + 2 e 1 Hg ₂ ²⁺	0.920

ELECTROCHEMICAL SERIES (continued)

TABLE 2

Reduction Reactions Having E° Values More Positive than that of the Standard Hydrogen Electrode (continued)

Reaction	E°/V	Reaction	E°/V
$\text{NO}_3^- + 3 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{HNO}_2 + \text{H}_2\text{O}$	0.934	$\text{Cl}_2(\text{g}) + 2 \text{e} \rightarrow 1 \text{2Cl}^-$	1.35827
$\text{Pd}^{2+} + 2 \text{e} \rightarrow 1 \text{Pd}$	0.951	$\text{ClO}_4^- + 8 \text{H}^+ + 8 \text{e} \rightarrow 1 \text{Cl}^- + 4 \text{H}_2\text{O}$	1.389
$\text{ClO}_2(\text{aq}) + \text{e} \rightarrow 1 \text{ClO}_2^-$	0.954	$\text{ClO}_4^- + 8 \text{H}^+ + 7 \text{e} \rightarrow 1 \text{1/2 Cl}_2 + 4 \text{H}_2\text{O}$	1.39
$\text{NO}_3^- + 4 \text{H}^+ + 3 \text{e} \rightarrow 1 \text{NO} + 2 \text{H}_2\text{O}$	0.957	$\text{No}^{3+} + \text{e} \rightarrow 1 \text{No}^{2+}$	1.4
$\text{V}_2\text{O}_5 + 6 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{2 VO}^{2+} + 3 \text{H}_2\text{O}$	0.957	$\text{RuO}_4 + 6 \text{H}^+ + 4 \text{e} \rightarrow 1 \text{Ru}(\text{OH})_2^{2+} + 2 \text{H}_2\text{O}$	1.40
$\text{AuBr}_2^- + \text{e} \rightarrow 1 \text{Au} + 2 \text{Br}^-$	0.959	$\text{Au}^{3+} + 2 \text{e} \rightarrow 1 \text{Au}^+$	1.401
$\text{HNO}_2 + \text{H}^+ + \text{e} \rightarrow 1 \text{NO} + \text{H}_2\text{O}$	0.983	$2 \text{NH}_3\text{OH}^+ + \text{H}^+ + 2 \text{e} \rightarrow 1 \text{N}_2\text{H}_5^+ + 2 \text{H}_2\text{O}$	1.42
$\text{HIO} + \text{H}^+ + 2 \text{e} \rightarrow 1 \text{I}^- + \text{H}_2\text{O}$	0.987	$\text{BrO}_3^- + 6 \text{H}^+ + 6 \text{e} \rightarrow 1 \text{Br}^- + 3 \text{H}_2\text{O}$	1.423
$\text{VO}_2^+ + 2 \text{H}^+ + \text{e} \rightarrow 1 \text{VO}^{2+} + \text{H}_2\text{O}$	0.991	$2 \text{HIO} + 2 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{I}_2 + 2 \text{H}_2\text{O}$	1.439
$\text{PtO}_2 + 4 \text{H}^+ + 4 \text{e} \rightarrow 1 \text{Pt} + 2 \text{H}_2\text{O}$	1.00	$\text{Au}(\text{OH})_3 + 3 \text{H}^+ + 3 \text{e} \rightarrow 1 \text{Au}^- + 3 \text{H}_2\text{O}$	1.45
$\text{RuO}_4 + \text{e} \rightarrow 1 \text{RuO}_4^-$	1.00	$3\text{IO}_3^- + 6 \text{H}^+ + 6 \text{e} \rightarrow 1 \text{Cl}^- + 3 \text{H}_2\text{O}$	1.451
$\text{V}(\text{OH})_4^{2+} + 2 \text{H}^+ + \text{e} \rightarrow 1 \text{VO}^{2+} + 3 \text{H}_2\text{O}$	1.00	$\text{PbO}_2 + 4 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{Pb}^{2+} + 2 \text{H}_2\text{O}$	1.455
$\text{AuCl}_4^- + 3 \text{e} \rightarrow 1 \text{Au} + 4 \text{Cl}^-$	1.002	$\text{ClO}_3^- + 6 \text{H}^+ + 5 \text{e} \rightarrow 1 \text{1/2 Cl}_2 + 3 \text{H}_2\text{O}$	1.47
$\text{Pu}^{4+} + \text{e} \rightarrow 1 \text{Pu}^{3+}$	1.006	$\text{CrO}_2 + 4 \text{H}^+ + \text{e} \rightarrow 1 \text{Cr}^{3+} + 2 \text{H}_2\text{O}$	1.48
$\text{PtO}_2 + 2 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{PtO} + \text{H}_2\text{O}$	1.01	$\text{BrO}_3^- + 6 \text{H}^+ + 5 \text{e} \rightarrow 1 \text{1/2 Br}_2 + 3 \text{H}_2\text{O}$	1.482
$\text{OsO}_4 + 4 \text{H}^+ + 4 \text{e} \rightarrow 1 \text{OsO}_2 + 2 \text{H}_2\text{O}$	1.02	$\text{HClO} + \text{H}^+ + 2 \text{e} \rightarrow 1 \text{Cl}^- + \text{H}_2\text{O}$	1.482
$\text{H}_6\text{TeO}_6 + 2 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{TeO}_2 + 4 \text{H}_2\text{O}$	1.02	$\text{Mn}_2\text{O}_3 + 6 \text{H}^+ + \text{e} \rightarrow 1 \text{2 Mn}^{2+} + 3 \text{H}_2\text{O}$	1.485
$[\text{Fe}(\text{bipy})_3]^{3+} + \text{e} \rightarrow 1 [\text{Fe}(\text{bipy})_3]^{2+}$	1.03	$\text{HO}_2 + \text{H}^+ + \text{e} \rightarrow 1 \text{H}_2\text{O}_2$	1.495
$\text{Hg}(\text{OH})_2 + 2 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{Hg} + 2 \text{H}_2\text{O}$	1.034	$\text{Au}^{3+} + 3 \text{e} \rightarrow 1 \text{Au}$	1.498
$\text{N}_2\text{O}_4 + 4 \text{H}^+ + 4 \text{e} \rightarrow 1 \text{2 NO} + 2 \text{H}_2\text{O}$	1.035	$\text{PtO}_3 + 4 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{Pt}(\text{OH})_2^{2+} + \text{H}_2\text{O}$	1.5
$\text{RuO}_4 + 8 \text{H}^+ + 8 \text{e} \rightarrow 1 \text{Ru} + 4\text{H}_2\text{O}$	1.038	$\text{MnO}_4^- + 8 \text{H}^+ + 5 \text{e} \rightarrow 1 \text{Mn}^{2+} + 4 \text{H}_2\text{O}$	1.507
$[\text{Fe}(\text{phen})_3]^{3+} + \text{e} \rightarrow 1 [\text{Fe}(\text{phen})_3]^{2+} \text{ (1 molar } \text{H}_2\text{SO}_4\text{)}$	1.06	$\text{Mn}^{3+} + \text{e} \rightarrow 1 \text{Mn}^{2+}$	1.5415
$\text{PuO}_2(\text{OH})_2 + \text{H}^+ + \text{e} \rightarrow 1 \text{PuO}_2\text{OH} + \text{H}_2\text{O}$	1.062	$\text{HClO}_2 + 3 \text{H}^+ + 4 \text{e} \rightarrow 1 \text{Cl}^- + 2 \text{H}_2\text{O}$	1.570
$\text{N}_2\text{O}_4 + 2 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{2 HNO}_2$	1.065	$\text{HBrO} + \text{H}^+ + \text{e} \rightarrow 1 \text{1/2 Br}_2(\text{aq}) + \text{H}_2\text{O}$	1.574
$\text{Br}_2(\text{l}) + 2 \text{e} \rightarrow 1 \text{2Br}^-$	1.066	$2 \text{NO} + 2 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{N}_2\text{O} + \text{H}_2\text{O}$	1.591
$\text{IO}_3^- + 6 \text{H}^+ + 6 \text{e} \rightarrow 1 \text{I}^- + 3 \text{H}_2\text{O}$	1.085	$\text{Bi}_2\text{O}_4 + 4 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{2 BiO}^+ + 2 \text{H}_2\text{O}$	1.593
$\text{Br}_2(\text{aq}) + 2 \text{e} \rightarrow 1 \text{2Br}^-$	1.0873	$\text{HBrO} + \text{H}^+ + \text{e} \rightarrow 1 \text{1/2 Br}_2(\text{l}) + \text{H}_2\text{O}$	1.596
$\text{Pu}^{5+} + \text{e} \rightarrow 1 \text{Pu}^{4+}$	1.099	$\text{H}_5\text{IO}_6 + \text{H}^+ + 2 \text{e} \rightarrow 1 \text{IO}_3^- + 3 \text{H}_2\text{O}$	1.601
$\text{Cu}^{2+} + 2 \text{CN}^- + \text{e} \rightarrow 1 [\text{Cu}(\text{CN})_2]^-$	1.103	$\text{HClO} + \text{H}^+ + \text{e} \rightarrow 1 \text{1/2 Cl}_2 + \text{H}_2\text{O}$	1.611
$\text{RuO}_2 + 4 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{Ru}^{2+} + 2 \text{H}_2\text{O}$	1.120	$\text{HClO}_2 + 3 \text{H}^+ + 3 \text{e} \rightarrow 1 \text{1/2 Cl}_2 + 2 \text{H}_2\text{O}$	1.628
$[\text{Fe}(\text{phen})_3]^{3+} + \text{e} \rightarrow 1 [\text{Fe}(\text{phen})_3]^{2+}$	1.147	$\text{HClO}_2 + 2 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{HClO} + \text{H}_2\text{O}$	1.645
$\text{SeO}_4^{2-} + 4 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{H}_2\text{SeO}_3 + \text{H}_2\text{O}$	1.151	$\text{Bk}^{4+} + \text{e} \rightarrow 1 \text{Bk}^{3+}$	1.67
$\text{ClO}_3^- + 2 \text{H}^+ + \text{e} \rightarrow 1 \text{ClO}_2 + \text{H}_2\text{O}$	1.152	$\text{NiO}_2 + 4 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{Ni}^{2+} + 2 \text{H}_2\text{O}$	1.678
$\text{Ir}^{3+} + 3 \text{e} \rightarrow 1 \text{Ir}$	1.156	$\text{MnO}_4^- + 4 \text{H}^+ + 3 \text{e} \rightarrow 1 \text{MnO}_2 + 2 \text{H}_2\text{O}$	1.679
$\text{Pt}^{2+} + 2 \text{e} \rightarrow 1 \text{Pt}$	1.18	$\text{PbO}_2 + \text{SO}_4^{2-} + 4 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{PbSO}_4 + 2 \text{H}_2\text{O}$	1.6913
$\text{ClO}_4^- + 2 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{ClO}_3^- + \text{H}_2\text{O}$	1.189	$\text{Au}^+ + \text{e} \rightarrow 1 \text{Au}$	1.692
$2 \text{IO}_3^- + 12 \text{H}^+ + 10 \text{e} \rightarrow 1 \text{I}_2 + 6 \text{H}_2\text{O}$	1.195	$\text{PtO}_3 + 2 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{PtO}_2 + \text{H}_2\text{O}$	1.7
$\text{PtOH}^+ + \text{H}^+ + 2 \text{e} \rightarrow 1 \text{Pt} + \text{H}_2\text{O}$	1.2	$\text{CeOH}^{3+} + \text{H}^+ + \text{e} \rightarrow 1 \text{Ce}^{3+} + \text{H}_2\text{O}$	1.715
$\text{ClO}_3^- + 3 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{HClO}_2 + \text{H}_2\text{O}$	1.214	$\text{Ce}^{4+} + \text{e} \rightarrow 1 \text{Ce}^{3+}$	1.72
$\text{MnO}_2 + 4 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{Mn}^{2+} + 2 \text{H}_2\text{O}$	1.224	$\text{N}_2\text{O} + 2 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{N}_2 + \text{H}_2\text{O}$	1.766
$\text{O}_2 + 4 \text{H}^+ + 4 \text{e} \rightarrow 1 \text{2 H}_2\text{O}$	1.229	$\text{H}_2\text{O}_2 + 2 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{2 H}_2\text{O}$	1.776
$\text{Cr}_2\text{O}_7^{2-} + 14 \text{H}^+ + 6 \text{e} \rightarrow 1 \text{2 Cr}^{3+} + 7 \text{H}_2\text{O}$	1.232	$\text{Ag}^{3+} + \text{e} \rightarrow 1 \text{Ag}^{2+}$	1.8
$\text{O}_3 + \text{H}_2\text{O} + 2 \text{e} \rightarrow 1 \text{O}_2 + 2 \text{OH}^-$	1.24	$\text{Au}^{2+} + \text{e}^- \rightarrow 1 \text{Au}^+$	1.8
$[\text{Ru}(\text{bipy})_3]^{3+} + \text{e} \rightarrow 1 [\text{Ru}(\text{bipy})_3]^{2+}$	1.24	$\text{Ag}_2\text{O}_2 + 4 \text{H}^+ + \text{e} \rightarrow 1 \text{2 Ag} + 2 \text{H}_2\text{O}$	1.802
$\text{Ti}^{3+} + 2 \text{e} \rightarrow 1 \text{Ti}^+$	1.252	$\text{Co}^{3+} + \text{e} \rightarrow 1 \text{Co}^{2-} \text{ (2 molar } \text{H}_2\text{SO}_4\text{)}$	1.83
$\text{N}_2\text{H}_5^+ + 3 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{2 NH}_4^+$	1.275	$\text{Ag}^{3+} + 2 \text{e} \rightarrow 1 \text{Ag}^+$	1.9
$\text{ClO}_2 + \text{H}^+ + \text{e} \rightarrow 1 \text{HClO}_2$	1.277	$\text{Co}^{3+} + \text{e} \rightarrow 1 \text{Co}^{2+}$	1.92
$[\text{PdCl}_6]^{2-} + 2 \text{e} \rightarrow 1 [\text{PdCl}_4]^{2-} + 2 \text{Cl}^-$	1.288	$\text{Ag}^{2+} + \text{e} \rightarrow 1 \text{Ag}^+$	1.980
$2 \text{HNO}_2 + 4 \text{H}^+ + 4 \text{e} \rightarrow 1 \text{N}_2\text{O} + 3 \text{H}_2\text{O}$	1.297	$\text{Cu}_2\text{O}_3 + 6 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{2 Cu}^{2+} + 3 \text{H}_2\text{O}$	2.0
$\text{AuOH}^{2+} + \text{H}^+ + 2 \text{e} \rightarrow 1 \text{Au}^+ + \text{H}_2\text{O}$	1.32	$\text{S}_2\text{O}_8^{2-} + 2 \text{e} \rightarrow 1 \text{2 SO}_4^{2-}$	2.010
$\text{PuO}_2(\text{OH})_2 + 2 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{Pu}(\text{OH})_4$	1.325	$\text{OH}^- + \text{e} \rightarrow 1 \text{OH}^-$	2.02
$\text{HBrO} + \text{H}^+ + 2 \text{e} \rightarrow 1 \text{Br}^- + \text{H}_2\text{O}$	1.331	$\text{HFeO}_4^- + 7 \text{H}^+ + 3 \text{e} \rightarrow 1 \text{Fe}^{3+} + 4 \text{H}_2\text{O}$	2.07
$\text{Cr}(\text{V}) + \text{e} \rightarrow 1 \text{Cr}(\text{IV})$	1.34	$\text{O}_3 + 2 \text{H}^+ + 2 \text{e} \rightarrow 1 \text{O}_2 + \text{H}_2\text{O}$	2.076
$\text{HCrO}_4^- + 7 \text{H}^+ + 3 \text{e} \rightarrow 1 \text{Cr}^{3+} + 4 \text{H}_2\text{O}$	1.350	$\text{HFeO}_4^- + 4 \text{H}^+ + 3 \text{e} \rightarrow 1 \text{FeOOH} + 2 \text{H}_2\text{O}$	2.08

ELECTROCHEMICAL SERIES (continued)

TABLE 2
Reduction Reactions Having E° Values More Positive than that of the Standard Hydrogen Electrode (continued)

Reaction	E°/V	Reaction	E°/V
$2 \text{HFeO}_4^- + 8 \text{H}^+ + 6 \text{e}^- \rightarrow \text{Fe}_2\text{O}_3 + 5 \text{H}_2\text{O}$	2.09	$\text{H}_2\text{N}_2\text{O}_2 + 2 \text{H}^+ + 2 \text{e}^- \rightarrow \text{N}_2 + 2 \text{H}_2\text{O}$	2.65
$\text{XeO}_3 + 6 \text{H}^+ + 6 \text{e}^- \rightarrow \text{Xe} + 3 \text{H}_2\text{O}$	2.10	$\text{F}_2 + 2 \text{e}^- \rightarrow 2 \text{F}^-$	2.866
$\text{S}_2\text{O}_8^{2-} + 2 \text{H}^+ + 2 \text{e}^- \rightarrow 2 \text{HSO}_4^-$	2.123	$\text{Cm}^{4+} + \text{e}^- \rightarrow \text{Cm}^{3+}$	3.0
$\text{F}_2\text{O} + 2 \text{H}^+ + 4 \text{e}^- \rightarrow \text{H}_2\text{O} + 2 \text{F}^-$	2.153	$\text{F}_2 + 2 \text{H}^+ + 2 \text{e}^- \rightarrow 2 \text{HF}$	3.053
$\text{FeO}_4^{2-} + 8 \text{H}^+ + 3 \text{e}^- \rightarrow \text{Fe}^{3+} + 4 \text{H}_2\text{O}$	2.20	$\text{Tb}^{4+} + \text{e}^- \rightarrow \text{Tb}^{3+}$	3.1
$\text{Cu}^{3+} + \text{e}^- \rightarrow \text{Cu}^{2+}$	2.4	$\text{Pr}^{4+} + \text{e}^- \rightarrow \text{Pr}^{3+}$	3.2
$\text{H}_4\text{XeO}_6 + 2 \text{H}^+ + 2 \text{e}^- \rightarrow \text{XeO}_3 + 3 \text{H}_2\text{O}$	2.42	$\text{Cf}^{4+} + \text{e}^- \rightarrow \text{Cf}^{3+}$	3.3
$\text{O}(\text{g}) + 2 \text{H}^+ + 2 \text{e}^- \rightarrow \text{H}_2\text{O}$	2.421	$\text{XeF} + \text{e}^- \rightarrow \text{Xe} + \text{F}^-$	3.4
$\text{Am}^{4+} + \text{e}^- \rightarrow \text{Am}^{3+}$	2.60		

TABLE 3
Reduction Reactions Having E° Values More Negative than that of the Standard Hydrogen Electrode

Reaction	E°/V	Reaction	E°/V
$2 \text{H}^+ + 2 \text{e}^- \rightarrow \text{H}_2$	0.00000	$\text{Cu}(\text{OH})_2 + 2 \text{e}^- \rightarrow \text{Cu} + 2 \text{OH}^-$	-0.222
$2 \text{D}^+ + 2 \text{e}^- \rightarrow \text{D}_2$	-0.013	$\text{V}_2\text{O}_5 + 10 \text{H}^+ + 10 \text{e}^- \rightarrow 2 \text{V} + 5 \text{H}_2\text{O}$	-0.242
$\text{AgCN} + \text{e}^- \rightarrow \text{Ag} + \text{CN}^-$	-0.017	$\text{CdSO}_4 + 2 \text{e}^- \rightarrow \text{Cd} + \text{SO}_4^{2-}$	-0.246
$2 \text{WO}_3 + 2 \text{H}^+ + 2 \text{e}^- \rightarrow \text{W}_2\text{O}_5 + \text{H}_2\text{O}$	-0.029	$\text{V}(\text{OH})_4^+ + 4 \text{H}^+ + 5 \text{e}^- \rightarrow \text{V} + 4 \text{H}_2\text{O}$	-0.254
$\text{W}_2\text{O}_5 + 2 \text{H}^+ + 2 \text{e}^- \rightarrow 2 \text{WO}_2 + \text{H}_2\text{O}$	-0.031	$\text{V}^{3+} + \text{e}^- \rightarrow \text{V}^{2+}$	-0.255
$\text{Ag}_2\text{S} + 2 \text{H}^+ + 2 \text{e}^- \rightarrow 2 \text{Ag} + \text{H}_2\text{S}$	-0.0366	$\text{Ni}^{2+} + 2 \text{e}^- \rightarrow \text{Ni}$	-0.257
$\text{Fe}^{3+} + 3 \text{e}^- \rightarrow \text{Fe}$	-0.037	$\text{PbCl}_2 + 2 \text{e}^- \rightarrow \text{Pb} + 2 \text{Cl}^-$	-0.2675
$\text{Hg}_2\text{I}_2 + 2 \text{e}^- \rightarrow 2 \text{Hg} + 2 \text{I}^-$	-0.0405	$\text{H}_3\text{PO}_4 + 2 \text{H}^+ + 2 \text{e}^- \rightarrow \text{H}_3\text{PO}_3 + \text{H}_2\text{O}$	-0.276
$\text{Tl}(\text{OH})_3 + 2 \text{e}^- \rightarrow \text{TlOH} + 2 \text{OH}^-$	-0.05	$\text{Co}^{2+} + 2 \text{e}^- \rightarrow \text{Co}$	-0.28
$\text{TiOH}^{3+} + \text{H}^+ + \text{e}^- \rightarrow \text{Ti}^{3+} + \text{H}_2\text{O}$	-0.055	$\text{PbBr}_2 + 2 \text{e}^- \rightarrow \text{Pb} + 2 \text{Br}^-$	-0.284
$2 \text{H}_2\text{SO}_3 + \text{H}^+ + 2 \text{e}^- \rightarrow \text{HS}_2\text{O}_4^- + 2 \text{H}_2\text{O}$	-0.056	$\text{Tl}^+ + \text{e}^- \rightarrow \text{Tl}(\text{Hg})$	-0.3338
$\text{P}(\text{white}) + 3 \text{H}^+ + 3 \text{e}^- \rightarrow \text{PH}_3(\text{g})$	-0.063	$\text{Ti}^+ + \text{e}^- \rightarrow \text{Ti}$	-0.336
$\text{O}_2 + \text{H}_2\text{O} + 2 \text{e}^- \rightarrow \text{HO}_2^- + \text{OH}^-$	-0.076	$\text{In}^{3+} + 3 \text{e}^- \rightarrow \text{In}$	-0.3382
$2 \text{Cu}(\text{OH})_2 + 2 \text{e}^- \rightarrow \text{Cu}_2\text{O} + 2 \text{OH}^- + \text{H}_2\text{O}$	-0.080	$\text{TlOH} + \text{e}^- \rightarrow \text{Tl} + \text{OH}^-$	-0.34
$\text{Se} + 2 \text{H}^+ + 2 \text{e}^- \rightarrow \text{H}_2\text{Se}$	-0.082	$\text{PbF}_2 + 2 \text{e}^- \rightarrow \text{Pb} + 2 \text{F}^-$	-0.3444
$\text{WO}_3 + 6 \text{H}^+ + 6 \text{e}^- \rightarrow \text{W} + 3 \text{H}_2\text{O}$	-0.090	$\text{PbSO}_4 + 2 \text{e}^- \rightarrow \text{Pb}(\text{Hg}) + \text{SO}_4^{2-}$	-0.3505
$\text{SnO}_2 + 4 \text{H}^+ + 2 \text{e}^- \rightarrow \text{Sn}^{2+} + 2 \text{H}_2\text{O}$	-0.094	$\text{Cd}^{2+} + 2 \text{e}^- \rightarrow \text{Cd}(\text{Hg})$	-0.3521
$\text{Md}^{3+} + \text{e}^- \rightarrow \text{Md}^{2+}$	-0.1	$\text{PbSO}_4 + 2 \text{e}^- \rightarrow \text{Pb} + \text{SO}_4^{2-}$	-0.3588
$\text{P}(\text{red}) + 3 \text{H}^+ + 3 \text{e}^- \rightarrow \text{PH}_3(\text{g})$	-0.111	$\text{Cu}_2\text{O} + \text{H}_2\text{O} + 2 \text{e}^- \rightarrow 2 \text{Cu} + 2 \text{OH}^-$	-0.360
$\text{SnO}_2 + 4 \text{H}^+ + 4 \text{e}^- \rightarrow \text{Sn} + 2 \text{H}_2\text{O}$	-0.117	$\text{Eu}^{3+} + \text{e}^- \rightarrow \text{Eu}^{2+}$	-0.36
$\text{GeO}_2 + 2 \text{H}^+ + 2 \text{e}^- \rightarrow \text{GeO} + \text{H}_2\text{O}$	-0.118	$\text{PbI}_2 + 2 \text{e}^- \rightarrow \text{Pb} + 2 \text{I}^-$	-0.365
$\text{WO}_2 + 4 \text{H}^+ + 4 \text{e}^- \rightarrow \text{W} + 2 \text{H}_2\text{O}$	-0.119	$\text{SeO}_3^{2-} + 3 \text{H}_2\text{O} + 4 \text{e}^- \rightarrow \text{Se} + 6 \text{OH}^-$	-0.366
$\text{Pb}^{2+} + 2 \text{e}^- \rightarrow \text{Pb}(\text{Hg})$	-0.1205	$\text{Se} + 2 \text{H}^+ + 2 \text{e}^- \rightarrow \text{H}_2\text{Se}(\text{aq})$	-0.399
$\text{Pb}^{2+} + 2 \text{e}^- \rightarrow \text{Pb}$	-0.1262	$\text{In}^{2+} + \text{e}^- \rightarrow \text{In}^+$	-0.40
$\text{CrO}_4^{2-} + 4 \text{H}_2\text{O} + 3 \text{e}^- \rightarrow \text{Cr}(\text{OH})_3 + 5 \text{OH}^-$	-0.13	$\text{Cd}^{2+} + 2 \text{e}^- \rightarrow \text{Cd}$	-0.4030
$\text{Sn}^{2+} + 2 \text{e}^- \rightarrow \text{Sn}$	-0.1375	$\text{Cr}^{3+} + \text{e}^- \rightarrow \text{Cr}^{2+}$	-0.407
$\text{In}^+ + \text{e}^- \rightarrow \text{In}$	-0.14	$2 \text{S} + 2 \text{e}^- \rightarrow \text{S}_2^{2-}$	-0.42836
$\text{O}_2 + 2 \text{H}_2\text{O} + 2 \text{e}^- \rightarrow \text{H}_2\text{O}_2 + 2 \text{OH}^-$	-0.146	$\text{Tl}_2\text{SO}_4 + 2 \text{e}^- \rightarrow \text{Tl} + \text{SO}_4^{2-}$	-0.4360
$\text{MoO}_2 + 4 \text{H}^+ + 4 \text{e}^- \rightarrow \text{Mo} + 4 \text{H}_2\text{O}$	-0.152	$\text{In}^{3+} + 2 \text{e}^- \rightarrow \text{In}^+$	-0.443
$\text{AgI} + \text{e}^- \rightarrow \text{Ag} + \text{I}^-$	-0.15224	$\text{Fe}^{2+} + 2 \text{e}^- \rightarrow \text{Fe}$	-0.447
$2 \text{NO}_2^- + 2 \text{H}_2\text{O} + 4 \text{e}^- \rightarrow \text{N}_2\text{O}_2^{2-} + 4 \text{OH}^-$	-0.18	$\text{H}_3\text{PO}_3 + 3 \text{H}^+ + 3 \text{e}^- \rightarrow \text{P} + 3 \text{H}_2\text{O}$	-0.454
$\text{H}_2\text{GeO}_3 + 4 \text{H}^+ + 4 \text{e}^- \rightarrow \text{Ge} + 3 \text{H}_2\text{O}$	-0.182	$\text{Bi}_2\text{O}_3 + 3 \text{H}_2\text{O} + 6 \text{e}^- \rightarrow 2 \text{Bi} + 6 \text{OH}^-$	-0.46
$\text{SnO}_2 + 3 \text{H}^+ + 2 \text{e}^- \rightarrow \text{SnOH}^+ + \text{H}_2\text{O}$	-0.194	$\text{NO}_2^- + \text{H}_2\text{O} + \text{e}^- \rightarrow \text{NO} + 2 \text{OH}^-$	-0.46
$\text{CO}_2 + 2 \text{H}^+ + 2 \text{e}^- \rightarrow \text{HCOOH}$	-0.199	$\text{PbHPO}_4 + 2 \text{e}^- \rightarrow \text{Pb} + \text{HPO}_4^{2-}$	-0.465
$\text{Mo}^{3+} + 3 \text{e}^- \rightarrow \text{Mo}$	-0.200	$\text{S} + 2 \text{e}^- \rightarrow \text{S}^{2-}$	-0.47627
$\text{Ga}^+ + \text{e}^- \rightarrow \text{Ga}$	-0.2	$\text{S} + \text{H}_2\text{O} + 2 \text{e}^- \rightarrow \text{HS}^- + \text{OH}^-$	-0.478
$2 \text{SO}_2^{2-} + 4 \text{H}^+ + 2 \text{e}^- \rightarrow \text{S}_2\text{O}_6^{2-} + \text{H}_2\text{O}$	-0.22	$\text{B}(\text{OH})_3 + 7 \text{H}^+ + 8 \text{e}^- \rightarrow \text{BH}_4^- + 3 \text{H}_2\text{O}$	-0.481

ELECTROCHEMICAL SERIES (continued)

TABLE 3
Reduction Reactions Having E° Values More Negative than that of the Standard Hydrogen Electrode
(continued)

Reaction	E°/V	Reaction	E°/V
$\text{In}^{3+} + e \rightarrow 1 \text{ In}^{2+}$	-0.49	$\text{SnO}_2 + 2 \text{H}_2\text{O} + 4 e \rightarrow 1 \text{ Sn} + 4 \text{OH}^-$	-0.945
$\text{ZnOH}^+ + \text{H}^+ + 2 e \rightarrow 1 \text{ Zn} + \text{H}_2\text{O}$	-0.497	$\text{In}(\text{OH})_3 + 3 e \rightarrow 1 \text{ In} + 3 \text{OH}^-$	-0.99
$\text{GaOH}^{2+} + \text{H}^+ + 3 e \rightarrow 1 \text{ Ga} + \text{H}_2\text{O}$	-0.498	$\text{NpO}_2 + \text{H}_2\text{O} + \text{H}^+ + e \rightarrow 1 \text{ Np}(\text{OH})_3$	-0.962
$\text{H}_3\text{PO}_3 + 2 \text{H}^+ + 2 e \rightarrow 1 \text{ H}_3\text{PO}_2 + \text{H}_2\text{O}$	-0.499	$\text{In}(\text{OH})_4^- + 3 e \rightarrow 1 \text{ In} + 4 \text{OH}^-$	-1.007
$\text{TiO}_2 + 4 \text{H}^+ + 2 e \rightarrow 1 \text{ Ti}^{2+} + 2 \text{H}_2\text{O}$	-0.502	$\text{In}_2\text{O}_3 + 3 \text{H}_2\text{O} + 6 e \rightarrow 1 \text{ 2 In} + 6 \text{OH}^-$	-1.034
$\text{H}_3\text{PO}_2 + \text{H}^+ + e \rightarrow 1 \text{ P} + 2 \text{H}_2\text{O}$	-0.508	$\text{PO}_4^{3-} + 2 \text{H}_2\text{O} + 2 e \rightarrow 1 \text{ HPO}_3^{2-} + 3 \text{OH}^-$	-1.05
$\text{Sb} + 3 \text{H}^+ + 3 e \rightarrow 1 \text{ SbH}_3$	-0.510	$\text{Yb}^{3+} + e \rightarrow 1 \text{ Yb}^{2+}$	-1.05
$\text{HPbO}_2^- + \text{H}_2\text{O} + 2 e \rightarrow 1 \text{ Pb} + 3 \text{OH}^-$	-0.537	$\text{Nb}^{3+} + 3 e \rightarrow 1 \text{ Nb}$	-1.099
$\text{Ga}^{3+} + 3 e \rightarrow 1 \text{ Ga}$	-0.549	$\text{Fm}^{3+} + e \rightarrow 1 \text{ Fm}^{2+}$	-1.1
$\text{TlCl} + e \rightarrow 1 \text{ Tl} + \text{Cl}^-$	-0.5568	$2 \text{SO}_3^{2-} + 2 \text{H}_2\text{O} + 2 e \rightarrow 1 \text{ S}_2\text{O}_4^{2-} + 4 \text{OH}^-$	-1.12
$\text{Fe}(\text{OH})_3 + e \rightarrow 1 \text{ Fe}(\text{OH})_2 + \text{OH}^-$	-0.56	$\text{Te} + 2 e \rightarrow 1 \text{ Te}^{2-}$	-1.143
$\text{TeO}_3^{2-} + 3 \text{H}_2\text{O} + 4 e \rightarrow 1 \text{ Te} + 6 \text{OH}^-$	-0.57	$\text{V}^{2+} + 2 e \rightarrow 1 \text{ V}$	-1.175
$2 \text{SO}_3^{2-} + 3 \text{H}_2\text{O} + 4 e \rightarrow 1 \text{ S}_2\text{O}_3^{2-} + 6 \text{OH}^-$	-0.571	$\text{Mn}^{2+} + 2 e \rightarrow 1 \text{ Mn}$	-1.185
$\text{PbO} + \text{H}_2\text{O} + 2 e \rightarrow 1 \text{ Pb} + 2 \text{OH}^-$	-0.580	$\text{Zn}(\text{OH})_4^{2-} + 2 e \rightarrow 1 \text{ Zn} + 4 \text{OH}^-$	-1.199
$\text{ReO}_2^- + 4 \text{H}_2\text{O} + 7 e \rightarrow 1 \text{ Re} + 8 \text{OH}^-$	-0.584	$\text{CrO}_2 + 2 \text{H}_2\text{O} + 3 e \rightarrow 1 \text{ Cr} + 4 \text{OH}^-$	-1.2
$\text{SbO}_3^- + \text{H}_2\text{O} + 2 e \rightarrow 1 \text{ SbO}_2^- + 2 \text{OH}^-$	-0.59	$\text{No}^{3+} + 3 e \rightarrow 1 \text{ No}$	-1.20
$\text{Ta}^{3+} + 3 e \rightarrow 1 \text{ Ta}$	-0.6	$\text{ZnO}_2^- + 2 \text{H}_2\text{O} + 2 e \rightarrow 1 \text{ Zn} + 4 \text{OH}^-$	-1.215
$\text{U}^{4+} + e \rightarrow 1 \text{ U}^{3+}$	-0.607	$\text{H}_2\text{GaO}_3^- + \text{H}_2\text{O} + 3 e \rightarrow 1 \text{ Ga} + 4 \text{OH}^-$	-1.219
$\text{As} + 3 \text{H}^+ + 3 e \rightarrow 1 \text{ AsH}_3$	-0.608	$\text{H}_2\text{BO}_3^- + 5 \text{H}_2\text{O} + 8 e \rightarrow 1 \text{ BH}_4^- + 8 \text{OH}^-$	-1.24
$\text{Nb}_2\text{O}_5 + 10 \text{H}^+ + 10 e \rightarrow 1 \text{ 2 Nb} + 5 \text{H}_2\text{O}$	-0.644	$\text{SiF}_6^{2-} + 4 e \rightarrow 1 \text{ Si} + 6 \text{F}^-$	-1.24
$\text{NbO}_2 + 2 \text{H}^+ + 2 e \rightarrow 1 \text{ NbO} + \text{H}_2\text{O}$	-0.646	$\text{Zn}(\text{OH})_2 + 2 e \rightarrow 1 \text{ Zn} + 2 \text{OH}^-$	-1.249
$\text{Cd}(\text{OH})_4^{2-} + 2 e \rightarrow 1 \text{ Cd} + 4 \text{OH}^-$	-0.658	$\text{ZnO} + \text{H}_2\text{O} + 2 e \rightarrow 1 \text{ Zn} + 2 \text{OH}^-$	-1.260
$\text{TlBr} + e \rightarrow 1 \text{ Tl} + \text{Br}^-$	-0.658	$\text{Es}^{3+} + e \rightarrow 1 \text{ Es}^{2+}$	-1.3
$\text{SbO}_2^- + 2 \text{H}_2\text{O} + 3 e \rightarrow 1 \text{ Sb} + 4 \text{OH}^-$	-0.66	$\text{Pa}^{3+} + 3 e \rightarrow 1 \text{ Pa}$	-1.34
$\text{AsO}_2^- + 2 \text{H}_2\text{O} + 3 e \rightarrow 1 \text{ As} + 4 \text{OH}^-$	-0.68	$\text{Ti}^{3+} + 3 e \rightarrow 1 \text{ Ti}$	-1.37
$\text{NbO}_2 + 4 \text{H}^+ + 4 e \rightarrow 1 \text{ Nb} + 2 \text{H}_2\text{O}$	-0.690	$\text{Ce}^{3+} + 3 e \rightarrow 1 \text{ Ce}(\text{Hg})$	-1.4373
$\text{Ag}_2\text{S} + 2 e \rightarrow 1 \text{ 2 Ag} + \text{S}^{2-}$	-0.691	$\text{UO}_2^{2+} + 4 \text{H}^+ + 6 e \rightarrow 1 \text{ U} + 2 \text{H}_2\text{O}$	-1.444
$\text{AsO}_4^{3-} + 2 \text{H}_2\text{O} + 2 e \rightarrow 1 \text{ AsO}_2^- + 4 \text{OH}^-$	-0.71	$\text{Zr}^{4+} + 4 e \rightarrow 1 \text{ Zr}$	-1.45
$\text{Ni}(\text{OH})_2 + 2 e \rightarrow 1 \text{ Ni} + 2 \text{OH}^-$	-0.72	$\text{Cr}(\text{OH})_3 + 3 e \rightarrow 1 \text{ Cr} + 3 \text{OH}^-$	-1.48
$\text{Co}(\text{OH})_2 + 2 e \rightarrow 1 \text{ Co} + 2 \text{OH}^-$	-0.73	$\text{Pa}^{4+} + 4 e \rightarrow 1 \text{ Pa}$	-1.49
$\text{NbO} + 2 \text{H}^+ + 2 e \rightarrow 1 \text{ Nb} + \text{H}_2\text{O}$	-0.733	$\text{HfO}_2 + 4 \text{H}^+ + 4 e \rightarrow 1 \text{ Hf} + 2 \text{H}_2\text{O}$	-1.505
$\text{H}_2\text{SeO}_3 + 4 \text{H}^+ + 4 e \rightarrow 1 \text{ Se} + 3 \text{H}_2\text{O}$	-0.74	$\text{Hf}^{4+} + 4 e \rightarrow 1 \text{ Hf}$	-1.55
$\text{Cr}^{3+} + 3 e \rightarrow 1 \text{ Cr}$	-0.744	$\text{Sm}^{3+} + e \rightarrow 1 \text{ Sm}^{2+}$	-1.55
$\text{Ta}_2\text{O}_5 + 10 \text{H}^+ + 10 e \rightarrow 1 \text{ 2 Ta} + 5 \text{H}_2\text{O}$	-0.750	$\text{ZrO}_2 + 4 \text{H}^+ + 4 e \rightarrow 1 \text{ Zr} + 2 \text{H}_2\text{O}$	-1.553
$\text{TlI} + e \rightarrow 1 \text{ Tl} + \text{I}^-$	-0.752	$\text{Mn}(\text{OH})_2 + 2 e \rightarrow 1 \text{ Mn} + 2 \text{OH}^-$	-1.56
$\text{Zn}^{2+} + 2 e \rightarrow 1 \text{ Zn}$	-0.7618	$\text{Ba}^{2+} + 2 e \rightarrow 1 \text{ Ba}(\text{Hg})$	-1.570
$\text{Zn}^{2+} + 2 e \rightarrow 1 \text{ Zn}(\text{Hg})$	-0.7628	$\text{Bk}^{2+} + 2 e \rightarrow 1 \text{ Bk}$	-1.6
$\text{CdO} + \text{H}_2\text{O} + 2 e \rightarrow 1 \text{ Cd} + 2 \text{OH}^-$	-0.783	$\text{Cf}^{3+} + e \rightarrow 1 \text{ Cf}^{2+}$	-1.6
$\text{Te} + 2 \text{H}^+ + 2 e \rightarrow 1 \text{ H}_2\text{Te}$	-0.793	$\text{Ti}^{2+} + 2 e \rightarrow 1 \text{ Ti}$	-1.630
$\text{ZnSO}_4 \cdot 7\text{H}_2\text{O} + 2 e \rightarrow 1 \text{ Zn}(\text{Hg}) + \text{SO}_4^{2-} + 7 \text{H}_2\text{O}$	-0.7993	$\text{Md}^{3+} + 3 e \rightarrow 1 \text{ Md}$	-1.65
(Saturated ZnSO_4)		$\text{HPO}_3^{2-} + 2 \text{H}_2\text{O} + 2 e \rightarrow 1 \text{ H}_2\text{PO}_2^- + 3 \text{OH}^-$	-1.65
$\text{Bi} + 3 \text{H}^+ + 3 e \rightarrow 1 \text{ BiH}_3$	-0.8	$\text{Al}^{3+} + 3 e \rightarrow 1 \text{ Al}$	-1.662
$\text{SiO} + 2 \text{H}^+ + 2 e \rightarrow 1 \text{ Si} + \text{H}_2\text{O}$	-0.8	$\text{SiO}_3^{2-} + \text{H}_2\text{O} + 4 e \rightarrow 1 \text{ Si} + 6 \text{OH}^-$	-1.697
$\text{Cd}(\text{OH})_2 + 2 e \rightarrow 1 \text{ Cd}(\text{Hg}) + 2 \text{OH}^-$	-0.809	$\text{HPO}_3^{2-} + 2 \text{H}_2\text{O} + 3 e \rightarrow 1 \text{ P} + 5 \text{OH}^-$	-1.71
$2 \text{H}_2\text{O} + 2 e \rightarrow 1 \text{ H}_2 + 2 \text{OH}^-$	-0.8277	$\text{HfO}^{2+} + 2 \text{H}^+ + 4 e \rightarrow 1 \text{ Hf} + \text{H}_2\text{O}$	-1.724
$2 \text{NO}_3^- + 2 \text{H}_2\text{O} + 2 e \rightarrow 1 \text{ N}_2\text{O}_4 + 4 \text{OH}^-$	-0.85	$\text{ThO}_2 + 4 \text{H}^+ + 4 e \rightarrow 1 \text{ Th} + 2 \text{H}_2\text{O}$	-1.789
$\text{H}_3\text{BO}_3 + 3 \text{H}^+ + 3 e \rightarrow 1 \text{ B} + 3 \text{H}_2\text{O}$	-0.8698	$\text{H}_2\text{BO}_3^- + \text{H}_2\text{O} + 3 e \rightarrow 1 \text{ B} + 4 \text{OH}^-$	-1.79
$\text{P} + 3 \text{H}_2\text{O} + 3 e \rightarrow 1 \text{ PH}_3(\text{g}) + 3 \text{OH}^-$	-0.87	$\text{Sr}^{2+} + 2 e \rightarrow 1 \text{ Sr}(\text{Hg})$	-1.793
$\text{Ti}^{3+} + e \rightarrow 1 \text{ Ti}^{2+}$	-0.9	$\text{U}^{3+} + 3 e \rightarrow 1 \text{ U}$	-1.798
$\text{HSnO}_2^- + \text{H}_2\text{O} + 2 e \rightarrow 1 \text{ Sn} + 3 \text{OH}^-$	-0.909	$\text{H}_2\text{PO}_2^- + e \rightarrow 1 \text{ P} + 2 \text{OH}^-$	-1.82
$\text{Cr}^{2+} + 2 e \rightarrow 1 \text{ Cr}$	-0.913	$\text{Be}^{2+} + 2 e \rightarrow 1 \text{ Be}$	-1.847
$\text{Se} + 2 e \rightarrow 1 \text{ Se}^{2-}$	-0.924	$\text{Np}^{3+} + 3 e \rightarrow 1 \text{ Np}$	-1.856
$\text{SO}_4^{2-} + \text{H}_2\text{O} + 2 e \rightarrow 1 \text{ SO}_3^{2-} + 2 \text{OH}^-$	-0.93	$\text{Fm}^{3+} + 3 e \rightarrow 1 \text{ Fm}$	-1.89
$\text{Sn}(\text{OH})_6^{2-} + 2 e \rightarrow 1 \text{ HSnO}_2^- + 3 \text{OH}^- + \text{H}_2\text{O}$	-0.93	$\text{Th}^{4+} + 4 e \rightarrow 1 \text{ Th}$	-1.899

ELECTROCHEMICAL SERIES (continued)

TABLE 3
Reduction Reactions Having E° Values More Negative than that of the Standard Hydrogen Electrode
(continued)

Reaction	E°/V	Reaction	E°/V
$\text{Am}^{2+} + 2 e \rightarrow 1 \text{ Am}$	-1.9	$\text{ZrO}(\text{OH})_2 + \text{H}_2\text{O} + 4 e \rightarrow 1 \text{ Zr} + 4 \text{ OH}^-$	-2.36
$\text{Pa}^{4+} + e \rightarrow 1 \text{ Pa}^{3+}$	-1.9	$\text{Mg}^{2+} + 2 e \rightarrow 1 \text{ Mg}$	-2.372
$\text{Es}^{3+} + 3 e \rightarrow 1 \text{ Es}$	-1.91	$\text{Y}^{3+} + 3 e \rightarrow 1 \text{ Y}$	-2.372
$\text{Cf}^{3+} + 3 e \rightarrow 1 \text{ Cf}$	-1.94	$\text{La}^{3+} + 3 e \rightarrow 1 \text{ La}$	-2.379
$\text{Lr}^{3+} + 3 e \rightarrow 1 \text{ Lr}$	-1.96	$\text{Tm}^{2+} + 2 e \rightarrow 1 \text{ Tm}$	-2.4
$\text{Eu}^{3+} + 3 e \rightarrow 1 \text{ Eu}$	-1.991	$\text{Md}^{2+} + 2 e \rightarrow 1 \text{ Md}$	-2.40
$\text{Er}^{2+} + 2 e \rightarrow 1 \text{ Er}$	-2.0	$\text{Th}(\text{OH})_4 + 4 e \rightarrow 1 \text{ Th} + 4 \text{ OH}^-$	-2.48
$\text{Pr}^{2+} + 2 e \rightarrow 1 \text{ Pr}$	-2.0	$\text{HfO}(\text{OH})_2 + \text{H}_2\text{O} + 4 e \rightarrow 1 \text{ Hf} + 4 \text{ OH}^-$	-2.50
$\text{Pu}^{3+} + 3 e \rightarrow 1 \text{ Pu}$	-2.031	$\text{No}^{2+} + 2 e \rightarrow 1 \text{ No}$	-2.50
$\text{Cm}^{3+} + 3 e \rightarrow 1 \text{ Cm}$	-2.04	$\text{Dy}^{3+} + e \rightarrow 1 \text{ Dy}^{2+}$	-2.6
$\text{Am}^{3+} + 3 e \rightarrow 1 \text{ Am}$	-2.048	$\text{Pm}^{3+} + e \rightarrow 1 \text{ Pm}^{2+}$	-2.6
$\text{AlF}_6^{3-} + 3 e \rightarrow 1 \text{ Al} + 6 \text{ F}^-$	-2.069	$\text{Be}_2\text{O}_3^{2-} + 3 \text{ H}_2\text{O} + 4 e \rightarrow 1 \text{ 2 Be} + 6 \text{ OH}^-$	-2.63
$\text{Sc}^{3+} + 3 e \rightarrow 1 \text{ Sc}$	-2.077	$\text{Sm}^{2+} + 2 e \rightarrow 1 \text{ Sm}$	-2.68
$\text{Ho}^{2+} + 2 e \rightarrow 1 \text{ Ho}$	-2.1	$\text{Mg}(\text{OH})_2 + 2 e \rightarrow 1 \text{ Mg} + 2 \text{ OH}^-$	-2.690
$\text{Nd}^{2+} + 2 e \rightarrow 1 \text{ Nd}$	-2.1	$\text{Nd}^{3+} + e \rightarrow 1 \text{ Nd}^{2+}$	-2.7
$\text{Cf}^{2+} + 2 e \rightarrow 1 \text{ Cf}$	-2.12	$\text{Mg}^+ + e \rightarrow 1 \text{ Mg}$	-2.70
$\text{Yb}^{3+} + 3 e \rightarrow 1 \text{ Yb}$	-2.19	$\text{Na}^+ + e \rightarrow 1 \text{ Na}$	-2.71
$\text{Ac}^{3+} + 3 e \rightarrow 1 \text{ Ac}$	-2.20	$\text{Yb}^{2+} + 2 e \rightarrow 1 \text{ Yb}$	-2.76
$\text{Dy}^{2+} + 2 e \rightarrow 1 \text{ Dy}$	-2.2	$\text{Bk}^{3+} + e \rightarrow 1 \text{ Bk}^{2+}$	-2.8
$\text{Tm}^{3+} + e \rightarrow 1 \text{ Tm}^{2+}$	-2.2	$\text{Ho}^{3+} + e \rightarrow 1 \text{ Ho}^{2+}$	-2.8
$\text{Pm}^{2+} + 2 e \rightarrow 1 \text{ Pm}$	-2.2	$\text{Ra}^{2+} + 2 e \rightarrow 1 \text{ Ra}$	-2.8
$\text{Es}^{2+} + 2 e \rightarrow 1 \text{ Es}$	-2.23	$\text{Eu}^{2+} + 2 e \rightarrow 1 \text{ Eu}$	-2.812
$\text{H}_2 + 2 e \rightarrow 1 \text{ 2 H}^-$	-2.23	$\text{Ca}^{2+} + 2 e \rightarrow 1 \text{ Ca}$	-2.868
$\text{Gd}^{3+} + 3 e \rightarrow 1 \text{ Gd}$	-2.279	$\text{Sr}(\text{OH})_2 + 2 e \rightarrow 1 \text{ Sr} + 2 \text{ OH}^-$	-2.88
$\text{Tb}^{3+} + 3 e \rightarrow 1 \text{ Tb}$	-2.28	$\text{Sr}^{2+} + 2 e \rightarrow 1 \text{ Sr}$	-2.89
$\text{Lu}^{3+} + 3 e \rightarrow 1 \text{ Lu}$	-2.28	$\text{Fr}^+ + e \rightarrow 1 \text{ Fr}$	-2.9
$\text{Dy}^{3+} + 3 e \rightarrow 1 \text{ Dy}$	-2.295	$\text{La}(\text{OH})_3 + 3 e \rightarrow 1 \text{ La} + 3 \text{ OH}^-$	-2.90
$\text{Am}^{3+} + e \rightarrow 1 \text{ Am}^{2+}$	-2.3	$\text{Ba}^{2+} + 2 e \rightarrow 1 \text{ Ba}$	-2.912
$\text{Fm}^{2+} + 2 e \rightarrow 1 \text{ Fm}$	-2.30	$\text{K}^+ + e \rightarrow 1 \text{ K}$	-2.931
$\text{Pm}^{3+} + 3 e \rightarrow 1 \text{ Pm}$	-2.30	$\text{Rb}^+ + e \rightarrow 1 \text{ Rb}$	-2.98
$\text{Sm}^{3+} + 3 e \rightarrow 1 \text{ Sm}$	-2.304	$\text{Ba}(\text{OH})_2 + 2 e \rightarrow 1 \text{ Ba} + 2 \text{ OH}^-$	-2.99
$\text{Al}(\text{OH})_3 + 3 e \rightarrow 1 \text{ Al} + 3 \text{ OH}^-$	-2.31	$\text{Er}^{3+} + e \rightarrow 1 \text{ Er}^{2+}$	-3.0
$\text{Tm}^{3+} + 3 e \rightarrow 1 \text{ Tm}$	-2.319	$\text{Ca}(\text{OH})_2 + 2 e \rightarrow 1 \text{ Ca} + 2 \text{ OH}^-$	-3.02
$\text{Nd}^{3+} + 3 e \rightarrow 1 \text{ Nd}$	-2.323	$\text{Cs}^+ + e \rightarrow 1 \text{ Cs}$	-3.026
$\text{Al}(\text{OH})^- + 3 e \rightarrow 1 \text{ Al} + 4 \text{ OH}^-$	-2.328	$\text{Li}^+ + e \rightarrow 1 \text{ Li}$	-3.0401
$\text{H}_2\text{AlO}_3^- + \text{H}_2\text{O} + 3 e \rightarrow 1 \text{ Al} + 4 \text{ OH}^-$	-2.33	$3 \text{ N}_2 + 2 \text{ H}^+ + 2 e \rightarrow 1 \text{ 2 HN}_3$	-3.09
$\text{Ho}^{3+} + 3 e \rightarrow 1 \text{ Ho}$	-2.33	$\text{Pr}^{3+} + e \rightarrow 1 \text{ Pr}^{2+}$	-3.1
$\text{Er}^{3+} + 3 e \rightarrow 1 \text{ Er}$	-2.331	$\text{Ca}^+ + e \rightarrow 1 \text{ Ca}$	-3.80
$\text{Ce}^{3+} + 3 e \rightarrow 1 \text{ Ce}$	-2.336	$\text{Sr}^+ + e \rightarrow 1 \text{ Sr}$	-4.10
$\text{Pr}^{3+} + 3 e \rightarrow 1 \text{ Pr}$	-2.353		