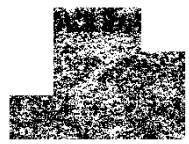
Ju. LURIE

Handbook of Analytical Chemistry

Translated from the Russian by

Nicholas Bobrov



MIR PUBLISHERS

MOSCOW

Table 40

Standard Oxidizing Potentials (E^0) Relative to the Potential of a Standard Hydrogen Electrode* at 25 °C

(↓ = saturated solution in the presence of a solid or liquid substance; ↑ = solution saturated with gas under a pressure of 1 atm)

Symbol of element	Highest degree of oxidation	$+ne$	Lowest degree of oxidation	E^0, V
Ag	Ag^{2+}	$+e$	Ag^+	+2.00
	Ag^+	$+e$	$Ag\downarrow$	+0.7994
	$AgBr\downarrow$	$+e$	$Ag\downarrow + Br^-$	+0.071
	$AgBrO_3\downarrow$	$+e$	$Ag\downarrow + BrO_3^-$	+0.55
	$AgC_2H_3O_2\downarrow$	$+e$	$Ag\downarrow + C_2H_3O_2^-$	+0.64
	$AgCN\downarrow$	$+e$	$Ag\downarrow + CN^-$	−0.04
	$Ag(CN)_2^-$	$+e$	$Ag\downarrow + 2CN^-$	−0.29
	$Ag(CN)_3^{2-}$	$+e$	$Ag\downarrow + 3CN^-$	−0.51
	$AgCNO\downarrow$	$+e$	$Ag\downarrow + CNO^-$	+0.41
	$Ag_2CO_3\downarrow$	$+2e$	$2Ag\downarrow + CO_3^{2-}$	+0.46
	$Ag_2C_2O_4\downarrow$	$+2e$	$2Ag\downarrow + C_2O_4^{2-}$	+0.472
	$AgCl\downarrow$	$+e$	$Ag\downarrow + Cl^-$	+0.224
	$Ag_2CrO_4\downarrow$	$+2e$	$2Ag\downarrow + CrO_4^{2-}$	+0.447
	$Ag_4Fe(CN)_6\downarrow$	$+4e$	$4Ag\downarrow + Fe(CN)_6^{4-}$	+0.194
	$AgI\downarrow$	$+e$	$Ag\downarrow + I^-$	−0.152
	$AgIO_3\downarrow$	$+e$	$Ag\downarrow + IO_3^-$	+0.35
	$Ag_2MoO_4\downarrow$	$+2e$	$2Ag\downarrow + MoO_4^{2-}$	+0.49
	$Ag(NH_3)_2^+$	$+e$	$Ag\downarrow + 2NH_3$	+0.373
	$AgNO_2\downarrow$	$+e$	$Ag\downarrow + NO_2^-$	+0.59
	$AgN_3\downarrow$	$+e$	$Ag\downarrow + N_3^-$	+0.293
	$2AgO\downarrow + H_2O$	$+2e$	$Ag_2O\downarrow + 2OH^-$	+0.60
	$AgO^+ + 2H^+$	$+e$	$Ag^{2+} + H_2O$	~+2.1
	$Ag_2O\downarrow + H_2O$	$+2e$	$2Ag\downarrow + 2OH^-$	+0.344
	$Ag_2O_3\downarrow + H_2O$	$+2e$	$2AgO\downarrow + 2OH^-$	+0.74
	$Ag_2S\downarrow$	$+2e$	$2Ag\downarrow + S^{2-}$	−0.71
	$AgSCN\downarrow$	$+e$	$Ag\downarrow + SCN^-$	+0.09
	$Ag(SO_3)_2^{3-}$	$+e$	$Ag\downarrow + 2SO_3^{2-}$	+0.43
	$Ag(S_2O_3)_2^{3-}$	$+e$	$Ag\downarrow + 2S_2O_3^{2-}$	+0.01
	$Ag_2SO_4\downarrow$	$+2e$	$2Ag\downarrow + SO_4^{2-}$	+0.653
	$Ag_2WO_4\downarrow$	$+2e$	$2Ag\downarrow + WO_4^{2-}$	+0.53
Al	Al^{3+}	$+3e$	$Al\downarrow$	−1.66
	$AlO_2^- + 2H_2O$	$+3e$	$Al\downarrow + 4OH^-$	−2.35
	$Al(OH)_3\downarrow$	$+3e$	$Al\downarrow + 3OH^-$	−2.31
	AlF_6^{3-}	$+3e$	$Al\downarrow + 6F^-$	−2.07

*For the use of the table, see p. 476.

Table 40 (continued)

Symbol of element	Highest degree of oxidation	$+ne$	Lowest degree of oxidation	E^0, V
As	$As\downarrow + 3H^+$	$+3e$	$AsH_3\uparrow$	−0.60
	$As\downarrow + 3H_2O$	$+3e$	$AsH_3\uparrow + 3OH^-$	−1.37
	$HAsO_2 + 3H^+$	$+3e$	$As\downarrow + 2H_2O$	+0.247
	$H_3AsO_4 + 2H^+$	$+2e$	$HAsO_2 + 2H_2O$	+0.56
	$AsO_2^- + 2H_2O$	$+3e$	$As\downarrow + 4OH^-$	−0.68
	$AsO_4^{3-} + 2H_2O$	$+2e$	$AsO_2^- + 4OH^-$	−0.71
Au	Au^{3+}	$+2e$	Au^+	+1.41
	Au^{3+}	$+3e$	$Au\downarrow$	+1.50
	Au^+	$+e$	$Au\downarrow$	+1.68
	$AuBr_2^-$	$+e$	$Au\downarrow + 2Br^-$	+0.96
	$AuBr_4^-$	$+2e$	$AuBr_2^- + 2Br^-$	+0.82
	$AuBr_4^-$	$+3e$	$Au\downarrow + 4Br^-$	+0.87
	$Au(CN)_2^-$	$+e$	$Au\downarrow + 2CN^-$	−0.61
	$AuCl_2^-$	$+e$	$Au\downarrow + 2Cl^-$	+1.11
	$AuCl_4^-$	$+2e$	$AuCl_2^- + 2Cl^-$	+0.93
	$AuCl_4^-$	$+3e$	$Au\downarrow + 4Cl^-$	+0.99
	$H_2AuO_3^- + H_2O$	$+3e$	$Au\downarrow + 4OH^-$	+0.7
	$Au(SCN)_2^-$	$+e$	$Au\downarrow + 2SCN^-$	+0.69
	$Au(SCN)_4^-$	$+2e$	$Au(SCN)_2^- + 2SCN^-$	+0.64
	$Au(SCN)_4^-$	$+3e$	$Au\downarrow + 4SCN^-$	+0.66
B	$H_3BO_3 + 3H^+$	$+3e$	$B\downarrow + 3H_2O$	−0.87
	$H_2BO_3^- + H_2O$	$+3e$	$B\downarrow + 4OH^-$	−1.79
	BF_4^-	$+3e$	$B\downarrow + 4F^-$	−1.04
Ba	Ba^{2+}	$+2e$	$Ba\downarrow$	−2.90
Be	Be^{2+}	$+2e$	$Be\downarrow$	−1.85
	$Be_2O_3^{2-} + 3H_2O$	$+4e$	$2Be\downarrow + 6OH^-$	−2.62
Bi	$BiO^+ + 2H^+$	$+3e$	$Bi\downarrow + H_2O$	+0.32
	$Bi\downarrow + 3H^+$	$+3e$	$BiH_3\uparrow$	<-0.8
	$NaBiO_3\downarrow + 4H^+$	$+2e$	$BiO^+ + Na^+ + 2H_2O$	$>+1.8$
	$BiCl_4^-$	$+3e$	$Bi\downarrow + 4Cl^-$	+0.16
	$Bi_2O_4\downarrow + 4H^+$	$+2e$	$2BiO^+ + 2H_2O$	+1.59
	$Bi_2O_4\downarrow + H_2O$	$+2e$	$Bi_2O_3\downarrow + 2OH^-$	+0.56
	$Bi_2O_3\downarrow + 3H_2O$	$+6e$	$2Bi\downarrow + 6OH^-$	−0.46
	$BiOCl\downarrow + 2H^+$	$+3e$	$Bi\downarrow + H_2O + Cl^-$	+0.16
Br	Br_2	$+2e$	$2Br^-$	+1.087
	Br_3^-	$+2e$	$3Br^-$	+1.05
	$2HBrO + 2H^+$	$+2e$	$Br_2 + 2H_2O$	+1.6
	$2BrO^- + 2H_2O$	$+2e$	$Br_2 + 4OH^-$	+0.45

Table 40 (continued)

Symbol of element	Highest degree of oxidation	$+ne$	Lowest degree of oxidation	$E°$, V
Br	$HBrO + H^+$	$+2e$	$Br^- + H_2O$	+1.34
	$BrO^- + H_2O$	$+2e$	$Br^- + 2OH^-$	+0.76
	$BrO_3^- + 5H^+$	$+4e$	$HBrO + 2H_2O$	+1.45
	$BrO_3^- + 2H_2O$	$+4e$	$BrO^- + 4OH^-$	+0.54
	$2BrO_3^- + 12H^+$	$+10e$	$Br_2 + 6H_2O$	+1.52
	$2BrO_3^- + 6H_2O$	$+10e$	$Br_2 + 12OH^-$	+0.50
	$BrO_3^- + 6H^+$	$+6e$	$Br^- + 3H_2O$	+1.45
	$BrO_3^- + 3H_2O$	$+6e$	$Br^- + 6OH^-$	+0.61
C	$CH_3OH + 2H^+$	$+2e$	$CH_4\uparrow + H_2O$	+0.59
	$C_2H_5OH + 2H^+$	$+2e$	$C_2H_6\uparrow + H_2O$	+0.46
	$C_6H_4O_2 + 2H^+$ (quinone)	$+2e$	$C_6H_4(OH)_2$ (hydroquinone)	+0.6994
	$(CN)_2\uparrow + 2H^+$	$+2e$	$2HCN$	+0.37
	$2HCNO + 2H^+$	$+2e$	$2H_2O + (CN)_2\uparrow$	+0.33
	$HCNO + 2H^+$	$+2e$	$HCN + H_2O$	+0.35
	$CNO^- + H_2O$	$+2e$	$CN^- + 2OH^-$	−0.97
	$HCHO + 2H^+$	$+2e$	CH_3OH	+0.19
	$CH_3CHO + 2H^+$	$+2e$	C_2H_5OH	+0.19
	$HCOOH + 2H^+$	$+2e$	$HCHO$	−0.01
	$CH_3COOH + 2H^+$	$+2e$	CH_3CHO	−0.12
	$HCOO^- + 2H_2O$	$+2e$	$HCHO + 3OH^-$	−1.07
	$CO_2\uparrow + 2H^+$	$+2e$	$CO\uparrow + H_2O$	−0.12
	$CO_2\uparrow + N_2 + 6H^+$	$+6e$	$CO(NH_2)_2 + H_2O$ (urea)	+0.1
	$CO_2\uparrow + 2H^+$	$+2e$	$HCOOH$	−0.20
	$2CO_2\uparrow + 2H^+$	$+2e$	$H_2C_2O_4$	−0.49
Ca	Ca^{2+}	$+2e$	$Ca\downarrow$	−2.87
	$Ca(OH)_2\downarrow$	$+2e$	$Ca\downarrow + 2OH^-$	−3.03
Cd	Cd^{2+}	$+2e$	$Cd\downarrow$	−0.402
	$CdCO_3\downarrow$	$+2e$	$Cd\downarrow + CO_3^{2-}$	−0.74
	$Cd(CN)_4^{2-}$	$+2e$	$Cd\downarrow + 4CN^-$	−1.09
	$Cd(NH_3)_4^{2+}$	$+2e$	$Cd\downarrow + 4NH_3$	−0.61
	$Cd(OH)_2\downarrow$	$+2e$	$Cd\downarrow + 2OH^-$	−0.81
	$CdS\downarrow$	$+2e$	$Cd\downarrow + S^{2-}$	−1.17
Ce	Ce^{3+}	$+3e$	$Ce\downarrow$	−2.33
	$Ce(ClO_4)_6^{2-}$	$+e$	$Ce^{3+} + 6ClO_4^-$	+1.70
	$Ce(NO_3)_6^{2-}$	$+e$	$Ce^{3+} + 6NO_3^-$	+1.60
	$Ce(SO_4)_3^{2-}$	$+e$	$Ce^{3+} + 3SO_4^{2-}$	+1.44
Cl	$Cl_2\uparrow$	$+2e$	$2Cl^-$	+1.359
	$2HOCl + 2H^+$	$+2e$	$Cl_2\uparrow + H_2O$	+1.63

Table 40 (continued)

Symbol of element	Highest degree of oxidation	$+ne$	Lowest degree of oxidation	E^0, V
Cl	$2ClO^- + 2H_2O$	$+2e$	$Cl_2\uparrow + 4OH^-$	+0.40
	$HClO + H^+$	$+2e$	$Cl^- + H_2O$	+1.50
	$ClO^- + H_2O$	$+2e$	$Cl^- + 2OH^-$	+0.88
	$HClO_2 + 2H^+$	$+2e$	$HClO + H_2O$	+1.64
	$2HClO_2 + 6H^+$	$+6e$	$Cl_2\uparrow + 4H_2O$	+1.63
	$HClO_2 + 3H^+$	$+4e$	$Cl^- + 2H_2O$	+1.56
	$ClO_2^- + H_2O$	$+2e$	$ClO^- + 2OH^-$	+0.66
	$ClO_2^- + 2H_2O$	$+4e$	$Cl^- + 4OH^-$	+0.77
	$ClO_3^- + 3H^+$	$+2e$	$HClO_2 + H_2O$	+1.21
	$ClO_3^- + H_2O$	$+2e$	$ClO_2^- + 2OH^-$	+0.33
	$ClO_3^- + 2H^+$	$+e$	$ClO_2\uparrow + H_2O$	+1.15
	$ClO_2\uparrow + H^+$	$+e$	$HClO_2$	+1.27
	$ClO_3^- + 6H^+$	$+6e$	$Cl^- + 3H_2O$	+1.45
	$2ClO_3^- + 12H^+$	$+10e$	$Cl_2\uparrow + 6H_2O$	+1.47
	$ClO_3^- + 3H_2O$	$+6e$	$Cl^- + 6OH^-$	+0.63
	$ClO_2\uparrow + 4H^+$	$+5e$	$Cl^- + 2H_2O$	+1.50
	$ClO_2\uparrow + 2H_2O$	$+5e$	$Cl^- + 4OH^-$	+0.85
	$ClO_4^- + 2H^+$	$+2e$	$ClO_3^- + H_2O$	+1.19
	$ClO_4^- + H_2O$	$+2e$	$ClO_3^- + 2OH^-$	+0.36
	$2ClO_4^- + 16H^+$	$+14e$	$Cl_2\uparrow + 8H_2O$	+1.39
	$ClO_4^- + 8H^+$	$+8e$	$Cl^- + 4H_2O$	+1.38
	$ClO_4^- + 4H_2O$	$+8e$	$Cl^- + 8OH^-$	+0.56
Co	Co^{3+}	$+e$	Co^{2+}	+1.84
	Co^{3+}	$+3e$	$Co\downarrow$	+0.33
	Co^{2+}	$+2e$	$Co\downarrow$	−0.28
	$CoCO_3\downarrow$	$+2e$	$Co\downarrow + CO_3^{2-}$	−0.64
	$Co(NH_3)_6^{3+}$	$+e$	$Co(NH_3)_6^{2+}$	+0.1
	$Co(NH_3)_6^{2+}$	$+2e$	$Co\downarrow + 6NH_3$	−0.42
	$Co(OH)_2\downarrow$	$+2e$	$Co\downarrow + 2OH^-$	−0.73
	$Co(OH)_3\downarrow$	$+e$	$Co(OH)_2\downarrow + OH^-$	+0.17
	$CoS\ \alpha\downarrow$	$+2e$	$Co\downarrow + S^{2-}$	−0.88
	$CoS\ \beta\downarrow$	$+2e$	$Co\downarrow + S^{2-}$	−1.01
Cr	Cr^{3+}	$+e$	Cr^{2+}	−0.41
	Cr^{3+}	$+3e$	$Cr\downarrow$	−0.74
	Cr^{2+}	$+2e$	$Cr\downarrow$	−0.91
	$Cr(OH)_3\downarrow$	$+3e$	$Cr\downarrow + 3OH^-$	−1.3
	$Cr(OH)_2\downarrow$	$+2e$	$Cr\downarrow + 2OH^-$	−1.4
	$CrO_2^- + 2H_2O$	$+3e$	$Cr\downarrow + 4OH^-$	−1.2
	$Cr_2O_7^{2-} + 14H^+$	$+6e$	$2Cr^{3+} + 7H_2O$	+1.33
	$CrO_4^{2-} + 4H_2O$	$+3e$	$Cr(OH)_3\downarrow + 5OH^-$	−0.13

Table 40 (continued)

Symbol of element	Highest degree of oxidation	$+ne$	Lowest degree of oxidation	E^0, V
Cs	Cs^+	$+e$	$Cs\downarrow$	−2.914
Cu	Cu^{2+}	$+2e$	$Cu\downarrow$	+0.337
	Cu^+	$+e$	$Cu\downarrow$	+0.521
	Cu^{2+}	$+e$	Cu^+	+0.153
	$Cu^{2+} + Br^-$	$+e$	$CuBr\downarrow$	+0.64
	$Cu^{2+} + Cl^-$	$+e$	$CuCl\downarrow$	+0.54
	$Cu^{2+} + I^-$	$+e$	$CuI\downarrow$	+0.86
	$CuBr\downarrow$	$+e$	$Cu\downarrow + Br^-$	+0.033
	$Cu(CN)_2^-$	$+e$	$Cu\downarrow + 2CN^-$	−0.43
	$CuCl\downarrow$	$+e$	$Cu\downarrow + Cl^-$	+0.137
	$CuI\downarrow$	$+e$	$Cu\downarrow + I^-$	−0.185
	$Cu(NH_3)_4^{2+}$	$+e$	$Cu(NH_3)_2^+ + 2NH_3$	−0.01
	$Cu(NH_3)_2^+$	$+e$	$Cu\downarrow + 2NH_3$	−0.12
	$Cu(NH_3)_4^{2+}$	$+2e$	$Cu\downarrow + 4NH_3$	−0.07
	$2Cu(OH)_2\downarrow$	$+2e$	$Cu_2O\downarrow + 2OH^- + H_2O$	−0.08
	$Cu_2O\downarrow + H_2O$	$+2e$	$2Cu\downarrow + 2OH^-$	−0.36
	$Cu(OH)_2\downarrow$	$+2e$	$Cu\downarrow + 2OH^-$	−0.22
	$CuS\downarrow$	$+2e$	$Cu\downarrow + S^{2-}$	−0.70
	$Cu_2S\downarrow$	$+2e$	$2Cu\downarrow + S^{2-}$	−0.88
	$CuSCN\downarrow$	$+e$	$Cu\downarrow + SCN^-$	−0.27
F	$F_2\uparrow$	$+2e$	$2F^-$	+2.87
Fe	Fe^{3+}	$+e$	Fe^{2+}	+0.771
	Fe^{3+}	$+3e$	$Fe\downarrow$	−0.036
	Fe^{2+}	$+2e$	$Fe\downarrow$	−0.440
	$Fe(CN)_6^{3-}$	$+e$	$Fe(CN)_6^{4-}$	+0.356
	$FeCO_3\downarrow$	$+2e$	$Fe\downarrow + CO_3^{2-}$	−0.756
	$Fe(C_{12}H_8N_2)_3^{3+}$ (1,10-phenanthroline)	$+e$	$Fe(C_{12}H_8N_2)_3^{2+}$	+1.06
	$Fe(OH)_3\downarrow$	$+e$	$Fe(OH)_2\downarrow + OH^-$	−0.56
	$Fe(OH)_2\downarrow$	$+2e$	$Fe\downarrow + 2OH^-$	−0.877
	$FeO_4^{2-} + 8H^+$	$+3e$	$Fe^{3+} + 4H_2O$	>+1.9
	$Fe_3O_4\downarrow + 8H^+$	$+8e$	$3Fe\downarrow + 4H_2O$	−0.085
	$FeS\downarrow$	$+2e$	$Fe\downarrow + S^{2-}$	−0.95
Ga	Ga^{3+}	$+3e$	$Ga\downarrow$	−0.56
	$H_2GaO_3^- + H_2O$	$+3e$	$Ga\downarrow + 4OH^-$	−1.22
Ge	$Ge\downarrow + 4H^+$	$+4e$	$GeH_4\uparrow$	<−0.3
	Ge^{2+}	$+2e$	$Ge\downarrow$	0.0
	$GeO\downarrow + 2H^+$	$+2e$	$Ge\downarrow + H_2O$	−0.29

Table 40 (continued)

Symbol of element	Highest degree of oxidation	$+ne$	Lowest degree of oxidation	E^0, V
Ge	$GeO_2\downarrow + 4H^+$	$+4e$	$Ge\downarrow + 2H_2O$	−0.15
	$H_2GeO_3 + 4H^+$	$+4e$	$Ge\downarrow + 3H_2O$	−0.13
	$GeO_2\downarrow + 2H^+$	$+2e$	$GeO\downarrow$ (brown) $+ H_2O$	−0.12
	$HGeO_3^- + 2H_2O$	$+4e$	$Ge\downarrow + 5OH^-$	−1.0
H	$2H^+$	$+2e$	$H_2\uparrow$	±0.0000
	$2H^+(10^{-7}M)$	$+2e$	$H_2\uparrow$	−0.414
	$H_2\uparrow$	$+2e$	$2H^-$	−2.25
	$2H_2O$	$+2e$	$H_2\uparrow + 2OH^-$	−0.828
	$H_2O_2 + 2H^+$	$+2e$	$2H_2O$	+1.77
	$HO_2^- + H_2O$	$+2e$	$3OH^-$	+0.88
Hf	$HfO^{2+} + 2H^+$	$+4e$	$Hf\downarrow + H_2O$	−1.70
	$HfO_2\downarrow + 4H^+$	$+4e$	$Hf\downarrow + 2H_2O$	−1.57
	$HfO(OH)_2\downarrow + H_2O$	$+4e$	$Hf\downarrow + 4OH^-$	−2.50
Hg	$2Hg^{2+}$	$+2e$	Hg_2^{2+}	+0.907
	Hg^{2+}	$+2e$	$Hg\downarrow$	+0.850
	Hg_2^{2+}	$+2e$	$Hg\downarrow$	+0.792
	$Hg_2Br_2\downarrow$	$+2e$	$2Hg\downarrow + 2Br^-$	+0.1392
	$Hg(CN)_4^{2-}$	$+2e$	$Hg\downarrow + 4CN^-$	−0.37
	$Hg_2(CH_3COO)_2\downarrow$	$+2e$	$2Hg\downarrow + 2CH_3COO^-$	+0.510
	$Hg_2C_2O_4\downarrow$	$+2e$	$2Hg\downarrow + C_2O_4^{2-}$	+0.415
	$Hg_2Cl_2\downarrow$	$+2e$	$2Hg\downarrow + 2Cl^-$	+0.2680
	$Hg_2I_2\downarrow$	$+2e$	$2Hg\downarrow + 2I^-$	−0.040
	$Hg_2(IO_3)_2\downarrow$	$+2e$	$2Hg\downarrow + 2IO_3^-$	+0.394
	$HgO\downarrow$ (red) $+ H_2O$	$+2e$	$Hg\downarrow + 2OH^-$	+0.098
	$HgS\downarrow$ (black)	$+2e$	$Hg\downarrow + S^{2-}$	−0.67
	$HgS\downarrow$ (red)	$+2e$	$Hg\downarrow + S^{2-}$	−0.70
	$Hg_2SO_4\downarrow$	$+2e$	$Hg\downarrow + SO_4^{2-}$	+0.614
I	$I_2\downarrow$	$+2e$	$2I^-$	+0.536
	I_2	$+2e$	$2I^-$	+0.621
	I_3^-	$+2e$	$3I^-$	+0.545
	$2IBr$	$+2e$	$I_2\downarrow + 2Br^-$	+1.02
	$2IBr_2^-$	$+2e$	$I_2\downarrow + 4Br^-$	+0.87
	ICN	$+2e$	$I^- + CN^-$	+0.30
	$2ICN + 2H^+$	$+2e$	$I_2\downarrow + 2HCN$	+0.63
	$2ICl$	$+2e$	$I_2\downarrow + 2Cl^-$	+1.19
	$2ICl_2^-$	$+2e$	$I_2\downarrow + 4Cl$	+1.06
	$2ICl_3$	$+6e$	$I_2\downarrow + 6Cl^-$	+1.28
	$2HIO + 2H^+$	$+2e$	$I_2\downarrow + 2H_2O$	+1.45
	$2IO^- + H_2O$	$+2e$	$I_2\downarrow + 4OH^-$	+0.45

Table 40 (continued)

Symbol of element	Highest degree of oxidation	$+ne$	Lowest degree of oxidation	E^0, V
I	$HIO + H^+$	$+2e$	$I^- + H_2O$	+0.99
	$IO^- + H_2O$	$+2e$	$I^- + 2OH^-$	+0.49
	$IO_3^- + 5H^+$	$+4e$	$HIO + 2H_2O$	+1.14
	$IO_3^- + 2H_2O$	$+4e$	$IO^- + 4OH^-$	+0.14
	$2IO_3^- + 12H^+$	$+10e$	$I_2\downarrow + 6H_2O$	+1.19
	$2IO_3^- + 6H_2O$	$+10e$	$I_2\downarrow + 12OH^-$	+0.21
	$IO_3^- + 6H^+$	$+6e$	$I^- + 3H_2O$	+1.08
	$IO_3^- + 3H_2O$	$+6e$	$I^- + 6OH^-$	+0.26
	$H_5IO_6 + H^+$	$+2e$	$IO_3^- + 3H_2O$	~+1.6
	$H_3IO_6^{2-}$	$+2e$	$IO_3^- + 3OH^-$	~+0.7
	$H_5IO_6 + 7H^+$	$+8e$	$I^- + 6H_2O$	~+1.24
	$H_3IO_6^{2-} + 3H_2O$	$+8e$	$I^- + 9OH^-$	~+0.37
In	In^{3+}	$+3e$	$In\downarrow$	−0.33
	In^{3+}	$+2e$	In^+	−0.40
	$In(OH)_3\downarrow$	$+3e$	$In\downarrow + 3OH^-$	−1.0
Ir	Ir^{3+}	$+3e$	$Ir\downarrow$	~+1.15
	$IrCl_6^{3-}$	$+3e$	$Ir\downarrow + 6Cl^-$	+0.77
	$IrCl_6^{2-}$	$+e$	$IrCl_6^{3-}$	+1.02
	$IrCl_6^{2-}$	$+4e$	$Ir\downarrow + 6Cl^-$	+0.83
	$IrO_2\downarrow + 4H^+$	$+4e$	$Ir\downarrow + 2H_2O$	+0.93
	$IrO_2\downarrow + 2H_2O$	$+4e$	$Ir\downarrow + 4OH^-$	+0.1
	$Ir_2O_3\downarrow + 3H_2O$	$+6e$	$2Ir\downarrow + 6OH^-$	+0.1
K	K^+	$+e$	$K\downarrow$	−2.925
La	La^{3+}	$+3e$	$La\downarrow$	−2.52
	$La(OH)_3\downarrow$	$+3e$	$La\downarrow + 3OH^-$	−2.90
Li	Li^+	$+e$	$Li\downarrow$	−3.03
Mg	Mg^{2+}	$+2e$	$Mg\downarrow$	−2.37
	$Mg(OH)_2\downarrow$	$+2e$	$Mg\downarrow + 2OH^-$	−2.69
Mn	Mn^{3+}	$+e$	Mn^{2+}	+1.51
	Mn^{2+}	$+2e$	$Mn\downarrow$	−1.19
	$Mn(CN)_6^{3-}$	$+e$	$Mn(CN)_6^{4-}$	−0.244
	$MnCO_3\downarrow$	$+2e$	$Mn\downarrow + CO_3^{2-}$	−1.48
	$Mn(OH)_2\downarrow$	$+2e$	$Mn\downarrow + 2OH^-$	−1.18
	$Mn(OH)_3\downarrow$	$+e$	$Mn(OH)_2\downarrow + OH^-$	+0.1
	$MnO_2 + 4H^+$	$+2e$	$Mn^{2+} + 2H_2O$	+1.23

Table 40 (continued)

Symbol of element	Highest degree of oxidation	$+ne$	Lowest degree of oxidation	E^0, V
Mn	$MnO_4^{2-} + 4H^+$	$+2e$	$MnO_2\downarrow + 2H_2O$	+2.26
	$MnO_4^{2-} + 2H_2O$	$+2e$	$MnO_2\downarrow + 4OH^-$	+0.6
	MnO_4^-	$+e$	MnO_4^{2-}	+0.56
	$MnO_4^- + 4H^+$	$+3e$	$MnO_2 + 2H_2O$	+1.69
	$MnO_4^- + 2H_2O$	$+3e$	$MnO_2\downarrow + 4OH^-$	+0.60
	$MnO_4^- + 8H^+$	$+5e$	$Mn^{2+} + 4H_2O$	+1.51
Mo	Mo^{3+}	$+3e$	$Mo\downarrow$	−0.2
	$Mo(CN)_8^{3-}$	$+e$	$Mo(CN)_8^{4-}$	+0.73
	$MoO_2^+ + 4H^+$	$+2e$	$Mo^{3+} + 2H_2O$	~0.0
	MoO_2^{2+}	$+e$	MoO_2^+	+0.48
	$H_2MoO_4 + 6H^+$	$+6e$	$Mo\downarrow + 4H_2O$	0.0
	$MoO_4^{2-} + 4H_2O$	$+6e$	$Mo\downarrow + 8OH^-$	−1.05
N	$HN_3 + 11H^+$	$+8e$	$3NH_4^+$	+0.69
	$N_3^- + 7H_2O$	$+6e$	$N_2H_4 + NH_3 + 7OH^-$	−0.62
	$3N_2\uparrow + 2H^+$	$+2e$	$2HN_3$	−3.1
	$3N_2\uparrow$	$+2e$	$2N_3^-$	−3.4
	$N_2\uparrow + 2H_2O + 4H^+$	$+2e$	$(2NH_2OH)H^+$	−1.87
	$N_2\uparrow + 4H_2O$	$+2e$	$2NH_2OH + 2OH^-$	−3.04
	$N_2\uparrow + 5H^+$	$+4e$	$(N_2H_4)H^+$	−0.23
	$N_2\uparrow + 4H_2O$	$+4e$	$N_2H_4 + 4OH^-$	−1.16
	$N_2\uparrow + 8H^+$	$+6e$	$2NH_4^+$	+0.26
	$N_2\uparrow + 8H_2O$	$+6e$	$2NH_4OH + 6OH^-$	−0.74
	$(N_2H_4)H^+ + 3H^+$	$+2e$	$2NH_4^+$	+1.27
	$N_2H_4 + 4H_2O$	$+2e$	$2NH_4OH + 2OH^-$	+0.1
	$(NH_2OH)H^+ + 2H^+$	$+2e$	$NH_4^+ + H_2O$	+1.35
	$NH_2OH + 2H_2O$	$+2e$	$NH_4OH + 2OH^-$	+0.42
	$H_2N_2O_2 + 2H^+$	$+2e$	$N_2\uparrow + 2H_2O$	+2.65
	$H_2N_2O_2 + 6H^+$	$+4e$	$(2NH_2OH)H^+$	+0.50
	$2HNO_2 + 4H^+$	$+4e$	$H_2N_2O_2 + 2H_2O$	+0.83
	$HNO_2 + H^+$	$+e$	$NO\uparrow + H_2O$	+0.99
	$NO_2^- + H_2O$	$+e$	$NO\uparrow + 2OH^-$	−0.46
	$2HNO_2 + 4H^+$	$+4e$	$N_2O\uparrow + 3H_2O$	+1.29
	$2HNO_2 + 6H^+$	$+6e$	$N_2\uparrow + 4H_2O$	+1.44
	$2NO_2^- + 4H_2O$	$+6e$	$N_2\uparrow + 8OH^-$	+0.41
	$HNO_2 + 7H^+$	$+6e$	$NH_4^+ + 2H_2O$	+0.86
	$NO_2^- + 6H_2O$	$+6e$	$NH_4OH + 7OH^-$	−0.15
	$N_2O\uparrow + 2H^+$	$+2e$	$N_2\uparrow + H_2O$	+1.77
	$N_2O\uparrow + H_2O$	$+2e$	$N_2\uparrow + 2OH^-$	+0.94
	$2NO\uparrow + 4H^+$	$+4e$	$N_2\uparrow + 2H_2O$	+1.68
	$2NO\uparrow + 2H_2O$	$+4e$	$N_2\uparrow + 4OH^-$	+0.85

Table 40 (continued)

Symbol of element	Highest degree of oxidation	$+ne$	Lowest degree of oxidation	E^0, V
N	$N_2O_4\uparrow + 2H^+$	$+2e$	$2HNO_2$	+1.07
	$N_2O_4\uparrow$	$+2e$	$2NO_2^-$	+0.88
	$N_2O_4\uparrow + 8H^+$	$+8e$	$N_2\uparrow + 4H_2O$	+1.35
	$N_2O_4\uparrow + 4H_2O$	$+8e$	$N_2\uparrow + 8OH^-$	+0.53
	$NO_3^- + 3H^+$	$+2e$	$HNO_2 + H_2O$	+0.94
	$NO_3^- + H_2O$	$+2e$	$NO_2^- + 2OH^-$	+0.01
	$NO_3^- + 2H^+$	$+e$	$NO_2\uparrow + H_2O$	+0.80
	$NO_3^- + H_2O$	$+e$	$NO_2\uparrow + 2OH^-$	−0.86
	$NO_3^- + 4H^+$	$+3e$	$NO\uparrow + 2H_2O$	+0.96
	$NO_3^- + 2H_2O$	$+3e$	$NO\uparrow + 4OH^-$	−0.14
	$2NO_3^- + 12H^+$	$+10e$	$N_2\uparrow + 6H_2O$	+1.24
	$NO_3^- + 8H^+$	$+6e$	$(NH_2OH)H^+ + 2H_2O$	+0.73
	$2NO_3^- + 17H^+$	$+14e$	$(N_2H_4)H^+ + 6H_2O$	+0.84
	$NO_3^- + 10H^+$	$+8e$	$NH_4^+ + 3H_2O$	+0.87
	$NO_3^- + 7H_2O$	$+8e$	$NH_4OH + 9OH^-$	−0.12
Na	Na^+	$+e$	$Na\downarrow$	−2.713
Nb	Nb^{3+}	$+3e$	$Nb\downarrow$	−1.1
	$Nb_2O_5\downarrow + 10H^+$	$+10e$	$Nb\downarrow + 5H_2O$	−0.65
	$NbO^{3+} + 2H^+$	$+2e$	$Nb^{3+} + H_2O$	−0.34
	$NbO(SO_4)_2^- + 2H^+$	$+2e$	$Nb^{3+} + H_2O + 2SO_4^{2-}$	−0.1
	$NbO(SO_4)_2^- + 2H^+$	$+5e$	$Nb\downarrow + H_2O + 2SO_4^{2-}$	−0.63
Ni	Ni^{2+}	$+2e$	$Ni\downarrow$	−0.23
	$Ni(CN)_4^{2-}$	$+e$	$Ni(CN)_3^- + CN^-$	<-0.4
	$NiCO_3\downarrow$	$+2e$	$Ni\downarrow + CO_3^{2-}$	−0.45
	$Ni(OH)_2\downarrow$	$+2e$	$Ni\downarrow + 2OH^-$	−0.72
	$Ni(NH_3)_6^{2+}$	$+2e$	$Ni\downarrow + 6NH_3$	−0.49
	$NiO_2\downarrow + 4H^+$	$+2e$	$Ni^{2+} + 2H_2O$	+1.68
	$NiO_2\downarrow + 2H_2O$	$+2e$	$Ni(OH)_2\downarrow + 2OH^-$	+0.49
	$NiO_4^{2-} + 8H^+$	$+4e$	$Ni^{2+} + 4H_2O$	$>+1.8$
	$NiS\ \alpha\downarrow$	$+2e$	$Ni + S^{2-}$	+0.76
	$NiS\ \gamma\downarrow$	$+2e$	$Ni\downarrow + S^{2-}$	−0.99
O	$O_2\uparrow + 4H^+$	$+4e$	$2H_2O$	+1.229
	$O_2\uparrow + 4H^+(10^{-7}M)$	$+4e$	$2H_2O$	+0.815
	$O_2\uparrow + 2H_2O$	$+4e$	$4OH^-$	+0.401
	$O_2\uparrow + 2H^+$	$+2e$	H_2O_2	+0.682
	$O_2\uparrow + H_2O$	$+2e$	$HO_2^- + OH^-$	−0.076
	$H_2O_2 + 2H^+$	$+2e$	$2H_2O$	+1.77
	$HO_2^- + H_2O$	$+2e$	$3OH^-$	+0.88
	$O_3\uparrow + 2H^+$	$+2e$	$O_2\uparrow + H_2O$	+2.07
	$O_3\uparrow + H_2O$	$+2e$	$O_2\uparrow + 2OH^-$	+1.24

Table 40 (continued)

Symbol of element	Highest degree of oxidation	$+ne$	Lowest degree of oxidation	E^0, V
Os	Os^{2+}	$+2e$	$Os\downarrow$	+0.85
	$OsCl_6^{2-}$	$+e$	$OsCl_6^{3-}$	+0.85
	$OsCl_6^{3-}$	$+3e$	$Os\downarrow + 6Cl^-$	+0.71
	$OsCl_6^{3-}$	$+e$	$Os^{2+} + 6Cl^-$	+0.4
	$OsO_4\downarrow + 6Cl^- + 8H^+$	$+4e$	$OsCl_6^{2-} + 4H_2O$	+1.0
	$OsO_4\downarrow + 8H^+$	$+8e$	$Os\downarrow + 4H_2O$	+0.85
	$HOsO_5^- + 4H_2O$	$+8e$	$Os\downarrow + 9OH^-$	+0.02
P	$P\downarrow + 3H^+$	$+3e$	$PH_3\uparrow$	+0.06
	$P\downarrow + 3H_2O$	$+3e$	$PH_3\uparrow + 3OH^-$	−0.89
	$H_3PO_2 + H^+$	$+e$	$P\downarrow + 2H_2O$	−0.51
	$H_2PO_2^-$	$+e$	$P\downarrow + 2OH^-$	−2.05
	$H_3PO_3 + 3H^+$	$+3e$	$P\downarrow + 3H_2O$	−0.50
	$H_3PO_3 + 2H^+$	$+2e$	$H_3PO_2 + H_2O$	−0.50
	$HPO_3^{2-} + 2H_2O$	$+2e$	$H_2PO_2^- + 3OH^-$	−1.57
	$H_4P_2O_6 + 2H^+$	$+2e$	$2H_3PO_3$	+0.38
	$H_3PO_4 + 5H^+$	$+5e$	$P\downarrow + 4H_2O$	−0.41
	$H_3PO_4 + 4H^+$	$+4e$	$H_3PO_2 + 2H_2O$	−0.39
	$2H_3PO_4 + 2H^+$	$+2e$	$H_4P_2O_6 + 2H_2O$	−0.94
	$H_3PO_4 + 2H^+$	$+2e$	$H_3PO_3 + H_2O$	−0.276
	$PO_4^{3-} + 2H_2O$	$+2e$	$HPO_3^{2-} + 3OH^-$	−1.12
Pb	Pb^{2+}	$+2e$	$Pb\downarrow$	−0.126
	Pb^{4+}	$+2e$	Pb^{2+}	+1.8
	Pb^{4+}	$+4e$	$Pb\downarrow$	+0.84
	$PbBr_2\downarrow$	$+2e$	$Pb\downarrow + 2Br^-$	−0.274
	$PbCO_3\downarrow$	$+2e$	$Pb\downarrow + CO_3^{2-}$	−0.506
	$PbCl_2\downarrow$	$+2e$	$Pb\downarrow + 2Cl^-$	−0.266
	$PbF_2\downarrow$	$+2e$	$Pb\downarrow + 2F^-$	−0.350
	$PbI_2\downarrow$	$+2e$	$Pb\downarrow + 2I^-$	−0.364
	$PbO\downarrow + H_2O$	$+2e$	$Pb\downarrow + 2OH^-$	−0.58
	$HPbO_2^- + H_2O$	$+2e$	$Pb\downarrow + 3OH^-$	−0.54
	$PbO_2\downarrow + H_2O$	$+2e$	$PbO\downarrow + 2OH^-$	+0.28
	$PbO_2\downarrow + 4H^+$	$+2e$	$Pb^{2+} + 2H_2O$	+1.455
	$PbO_2\downarrow + 4H^+ + SO_4^{2-}$	$+2e$	$PbSO_4\downarrow + 2H_2O$	+1.68
	$PbO_3^{2-} + H_2O$	$+2e$	$PbO_2^{2-} + 2OH^-$	+0.2
	$PbS\downarrow$	$+2e$	$Pb\downarrow + S^{2-}$	−0.91
	$PbSO_4\downarrow$	$+2e$	$Pb\downarrow + SO_4^{2-}$	−0.356
Pd	Pd^{2+}	$+2e$	$Pd\downarrow$	+0.987
	$PdCl_4^{2-}$	$+2e$	$Pd\downarrow + 4Cl^-$	+0.623
	$PdCl_6^{2-}$	$+2e$	$PdCl_4^{2-} + 2Cl^-$	+1.29
	$PdCl_6^{2-}$	$+4e$	$Pd\downarrow + 6Cl^-$	+0.96
	$Pd(OH)_2\downarrow$	$+2e$	$Pd\downarrow + 2OH^-$	+0.07

Table 40 (continued)

Symbol of element	Highest degree of oxidation	$+ne$	Lowest degree of oxidation	E^0, V
Pd	$Pd(OH)_4\downarrow$	$+2e$	$Pd(OH)_2\downarrow + 2OH^-$	$\sim+0.73$
Pt	Pt^{2+}	$+2e$	$Pt\downarrow$	$\sim+1.2$
	$PtCl_4^{2-}$	$+2e$	$Pt\downarrow + 4Cl^-$	$+0.73$
	$PtCl_6^{2-}$	$+2e$	$PtCl_4^{2-} + 2Cl^-$	$+0.720$
	$Pt(OH)_2\downarrow$	$+2e$	$Pt\downarrow + 2OH^-$	$+0.15$
	$Pt(OH)_2\downarrow + 2H^+$	$+2e$	$Pt\downarrow + 2H_2O$	$+0.98$
Pu	Pu^{3+}	$+3e$	$Pu\downarrow$	-2.03
	Pu^{4+}	$+e$	Pu^{3+}	$+0.970$
	PuO_2^{2+}	$+e$	PuO_2^+	$+0.916$
	$PuO_2^{2+} + 4H^+$	$+2e$	$Pu^{4+} + 2H_2O$	$+1.04$
	$Pu(OH)_3\downarrow$	$+3e$	$Pu\downarrow + 3OH^-$	-2.42
	$Pu(OH)_4\downarrow$	$+e$	$Pu(OH)_3\downarrow + OH^-$	-0.95
Ra	Ra^{2+}	$+2e$	$Ra\downarrow$	-2.92
Rb	Rb^+	$+e$	$Rb\downarrow$	-2.93
Re	$Re\downarrow$	$+e$	Re^-	-0.4
	Re^+	$+2e$	Re^-	-0.23
	Re^{3+}	$+3e$	$Re\downarrow$	$\sim+0.3$
	$ReO_2\downarrow + 4H^+$	$+4e$	$Re\downarrow + 2H_2O$	$+0.26$
	$ReO_3\downarrow + 2H^+$	$+2e$	$ReO_2\downarrow + H_2O$	$+0.4$
	$ReO_4^- + 8H^+$	$+7e$	$Re\downarrow + 4H_2O$	$+0.37$
	$ReO_4^- + 4H^+$	$+3e$	$ReO_2\downarrow + 2H_2O$	$+0.51$
	$ReO_4^- + 2H^+$	$+e$	$ReO_3\downarrow + 2H_2O$	$+0.77$
	$ReO_4^- + 4H_2O$	$+7e$	$Re\downarrow + 8OH^-$	-0.584
	$ReO_4^- + 2H_2O$	$+3e$	$ReO_2\downarrow + 4OH^-$	-0.595
Rh	Rh^{3+}	$+3e$	$Rh\downarrow$	$\sim+0.8$
	$RhCl_6^{3-}$	$+3e$	$Rh\downarrow + 6Cl^-$	$+0.44$
	$Rh_2O_3\downarrow + 6H^+$	$+6e$	$2Rh\downarrow + 3H_2O$	$+0.87$
	$RhO_2 + 4H^+ + 6Cl^-$	$+e$	$RhCl_6^{3-} + 2H_2O$	$>+1.4$
	$RhO^{2+} + 2H^+$	$+e$	$Rh^{3+} + H_2O$	$+1.40$
	$RhO_4^{2-} + 6H^+$	$+2e$	$RhO^{2+} + 3H_2O$	$+1.46$
Ru	Ru^{2+}	$+2e$	$Ru\downarrow$	$+0.45$
	$RuCl_3$	$+3e$	$Ru\downarrow + 3Cl^-$	$+0.68$
	$RuCl_5^-$	$+2e$	$Ru^{2+} + 5Cl^-$	$+0.3$
	$RuCl_5OH^{2-} + H^+$	$+e$	$RuCl_5^{2-} + H_2O$	$+1.3$
	RuO_4^-	$+e$	RuO_4^{2-}	$+0.59$
	$RuO_4\downarrow$	$+e$	RuO_4^-	$+1.00$

Table 40 (continued)

Symbol of element	Highest degree of oxidation	$+ne$	Lowest degree of oxidation	E^0, V
S	$S\downarrow$	$+2e$	S^{2-}	−0.48
	$S\downarrow + 2H^+$	$+2e$	$H_2S\uparrow$	+0.14
	$5S\downarrow$	$+2e$	S_5^{2-}	−0.34
	$(SCN)_2\uparrow$	$+2e$	$2SCN^-$	+0.77
	$S_4O_6^{2-}$	$+2e$	$2S_2O_3^{2-}$	+0.09
	$S_2O_3^{2-} + 6H^+$	$+4e$	$2S\uparrow + 3H_2O$	+0.5
	$2H_2SO_3 + 2H^+$	$+4e$	$S_2O_3^{2-} + 3H_2O$	+0.40
	$2SO_3^{2-} + 3H_2O$	$+4e$	$S_2O_3^{2-} + 6OH^-$	−0.58
	$2H_2SO_3 + H^+$	$+2e$	$HS_2O_4^- + 2H_2O$	−0.08
	$2SO_3^{2-} + 2H_2O$	$+2e$	$S_2O_4^{2-} + 4OH^-$	−1.12
	$SO_4^{2-} + 4H^+$	$+2e$	$H_2SO_3 + H_2O$	+0.17
	$SO_4^{2-} + H_2O$	$+2e$	$SO_3^{2-} + 2OH^-$	−0.93
	$2SO_4^{2-} + 10H^+$	$+8e$	$S_2O_3^{2-} + 5H_2O$	+0.29
	$2SO_4^{2-} + 5H_2O$	$+8e$	$S_2O_3^{2-} + 10OH^-$	−0.76
	$SO_4^{2-} + 8H^+$	$+6e$	$S\downarrow + 4H_2O$	+0.36
	$SO_4^{2-} + 4H_2O$	$+6e$	$S\downarrow + 8OH^-$	−0.75
	$SO_4^{2-} + 10H^+$	$+8e$	$H_2S + 4H_2O$	+0.31
	$SO_4^{2-} + 4H_2O$	$+8e$	$S^{2-} + 8OH^-$	−0.68
	$S_2O_8^{2-}$	$+2e$	$2SO_4^{2-}$	+2.0
Sb	$Sb\downarrow + 3H^+$	$+3e$	SbH_3	−0.51
	$SbO^+ + 2H^+$	$+3e$	$Sb\downarrow + H_2O$	+0.212
	$Sb_2O_3\downarrow + 6H^+$	$+6e$	$2Sb\downarrow + 3H_2O$	+0.152
	$SbO_2^- + 2H_2O$	$+3e$	$Sb\downarrow + 4OH^-$	−0.675
	$Sb_2O_4\downarrow + 4H^+$	$+2e$	$2SbO^+ + 2H_2O$	+0.68
	$Sb_2O_5\downarrow + 4H^+$	$+4e$	$Sb_2O_3\downarrow + 2H_2O$	+0.69
	$Sb_2O_5\downarrow + 6H^+$	$+4e$	$2SbO^+ + 3H_2O$	+0.58
	$SbO_3^- + H_2O$	$+2e$	$SbO_2^- + 2OH^-$	−0.43
Sc	Sc^{3+}	$+3e$	$Sc\downarrow$	−2.08
Se	$Se\downarrow + 2H^+$	$+2e$	$H_2Se\uparrow$	−0.40
	$H_2SeO_3 + 4H^+$	$+4e$	$Se\downarrow + 3H_2O$	+0.74
	$SeO_3^{2-} + 3H_2O$	$+4e$	$Se\downarrow + 6OH^-$	−0.366
	$SeO_4^{2-} + 4H^+$	$+2e$	$H_2SeO_3 + H_2O$	+1.15
	$SeO_4^{2-} + H_2O$	$+2e$	$SeO_3^{2-} + 2OH^-$	+0.05
Si	$Si\downarrow + 4H^+$	$+4e$	$SiH_4\uparrow$	+0.10
	$Si\downarrow + 4H_2O$	$+4e$	$SiH_4\uparrow + 4OH^-$	−0.73
	SiF_6^{2-}	$+4e$	$Si\downarrow + 6F^-$	−1.2
	$SiO_2\downarrow + 4H^+$	$+4e$	$Si\downarrow + 2H_2O$	−0.86
	H_2SiO_3(hydrous) $+ 4H^+$	$+4e$	$Si\downarrow + 3H_2O$	−0.79
	$SiO_3^{2-} + 3H_2O$	$+4e$	$Si\downarrow + 6OH^-$	−1.7

Table 40 (continued)

Symbol of element	Highest degree of oxidation	$+ne$	Lowest degree of oxidation	E^0, V
Sn	Sn^{2+}	$+2e$	$Sn\downarrow$	−0.140
	Sn^{4+}	$+2e$	Sn^{2+}	+0.15
	Sn^{4+}	$+4e$	$Sn\downarrow$	+0.01
	$HSnO_2^- + H_2O$	$+2e$	$Sn\downarrow + 3OH^-$	−0.91
	$Sn(OH)_6^{2-}$	$+2e$	$HSnO_2^- + 3OH^- + H_2O$	−0.93
Sr	Sr^{2+}	$+2e$	$Sr\downarrow$	−2.89
Ta	$Ta_2O_5\downarrow + 10H^+$	$+10e$	$2Ta\downarrow + 5H_2O$	−0.81
Te	$Te\downarrow + 2H^+$	$+2e$	$H_2Te\uparrow$	−0.72
	$Te\downarrow$	$+2e$	Te^{2-}	−1.14
	$TeO_2\downarrow + 4H^+$	$+4e$	$Te\downarrow + 2H_2O$	+0.53
	$TeO_3H^+ + 3H^+$	$+4e$	$Te\downarrow + 2H_2O$	+0.56
	$TeO_3^{2-} + 3H_2O$	$+4e$	$Te\downarrow + 6OH^-$	−0.57
	$H_6TeO_6\downarrow + 2H^+$	$+2e$	$TeO_2\downarrow + 4H_2O$	+1.02
	$TeO_4^{2-} + H_2O$	$+2e$	$TeO_3^{2-} + 2OH^-$	$>+0.4$
Th	Th^{4-}	$+4e$	$Th\downarrow$	−1.90
	$Th(OH)_4\downarrow$	$+4e$	$Th\downarrow + 4OH^-$	−2.48
Ti	Ti^{2+}	$+2e$	$Ti\downarrow$	−1.63
	$TiO_2\downarrow + 4H^+$	$+4e$	$Ti\downarrow + 2H_2O$	−0.86
	$TiO^{2+} + 2H^+$	$+4e$	$Ti\downarrow + H_2O$	$\sim$−0.88
	$TiO^{2+} + 2H^+$	$+e$	$Ti^{3+} + H_2O$	$\sim$+0.1
	Ti^{3+}	$+e$	Ti^{2+}	−0.37
	TiF_6^{2-}	$+4e$	$Ti\downarrow + 6F^-$	−1.19
Tl	Tl^+	$+e$	$Tl\downarrow$	−0.336
	$TlBr\downarrow$	$+e$	$Tl\downarrow + Br^-$	−0.656
	$TlCl\downarrow$	$+e$	$Tl\downarrow + Cl^-$	−0.557
	$TlOH$	$+e$	$Tl\downarrow + OH^-$	−0.344
	Tl^{3+}	$+2e$	Tl^+	+1.28
	$Tl_2O_3\downarrow + 3H_2O$	$+4e$	$2Tl^+ + 6OH^-$	+0.02
U	U^{3+}	$+3e$	$U\downarrow$	−1.8
	U^{4+}	$+e$	U^{3+}	−0.64
	$U(OH)_3\downarrow$	$+3e$	$U\downarrow + 3OH^-$	−2.17
	$UO_2\downarrow + 2H_2O$	$+4e$	$U\downarrow + 4OH^-$	−2.39
	$UO_2^{2+} + 4H^+$	$+e$	$U^{4+} + 2H_2O$	+0.55
	UO_2^{2+}	$+2e$	$UO_2\downarrow$	+0.45
	$UO_2^{2+} + 4H^+$	$+2e$	$U^{4+} + 2H_2O$	+0.33

Table 40 (continued)

Symbol of element	Highest degree of oxidation	$+ne$	Lowest degree of oxidation	E^0, V
V	V^{2+}	$+2e$	$V\downarrow$	−1.18
	V^{3+}	$+e$	V^{2+}	−0.255
	$VO^{2+} + 2H^+$	$+e$	$V^{3+} + H_2O$	+0.337
	VO^{2+}	$+e$	VO^+	−0.044
	$VO_2^+ + 2H^+$	$+e$	$VO^{2+} + H_2O$	+0.9994
	$VO_2^+ + 4H^+$	$+2e$	$V^{3+} + 2H_2O$	+0.668
	$VO_2^+ + 4H^+$	$+3e$	$V^{2+} + 2H_2O$	+0.360
	$VO_2^+ + 4H^+$	$+5e$	$V\downarrow + 2H_2O$	−0.25
	$VO_4^{3-} + 6H^+$	$+2e$	$VO^+ + 3H_2O$	+1.26
	$H_2VO_4^- + 4H^+$	$+e$	$VO^{2+} + 3H_2O$	+1.31
W	$WO_2\downarrow + 4H^+$	$+4e$	$W\downarrow + 2H_2O$	−0.12
	$W(CN)_8^{3-}$	$+e$	$W(CN)_8^{4-}$	+0.457
	$W_2O_5\downarrow + 2H^+$	$+2e$	$2WO_2\downarrow + H_2O$	−0.04
	$WO_3\downarrow + 6H^+$	$+6e$	$W\downarrow + 3H_2O$	−0.09
	$2WO_3\downarrow + 2H^+$	$+2e$	$W_2O_5\downarrow + H_2O$	−0.03
	$WO_4^{2-} + 8H^+$	$+6e$	$W\downarrow + 4H_2O$	+0.05
	$WO_4^{2-} + 4H_2O$	$+6e$	$W\downarrow + 8OH^-$	−1.05
Y	Y^{3+}	$+3e$	$Y\downarrow$	−2.37
Zn	Zn^{2+}	$+2e$	$Zn\downarrow$	−0.7628
	$Zn(CN)_4^{2-}$	$+2e$	$Zn\downarrow + 4CN^-$	−1.26
	$Zn(NH_3)_4^{2+}$	$+2e$	$Zn\downarrow + 4NH_3$	−1.04
	$Zn(OH)_2\downarrow$	$+2e$	$Zn\downarrow + 2OH^-$	−1.245
	$ZnO_2^{2-} + 2H_2O$	$+2e$	$Zn\downarrow + 4OH^-$	−1.216
	$ZnS\downarrow$ (wurtzite)	$+2e$	$Zn\downarrow + S^{2-}$	−1.40
Zr	$ZrO^{2+} + 2H^+$	$+4e$	$Zr\downarrow + H_2O$	−1.57
	$ZrO_2\downarrow + 4H^+$	$+4e$	$Zr\downarrow + 2H_2O$	−1.43
	$H_2ZrO_3\downarrow + H_2O$	$+4e$	$Zr\downarrow + 4OH^-$	−2.36