



CHEMISTRY DATA SHEET

Revised September 2002

Standard Reduction Potentials at 25°C

			2 He 4.003
7 N 4.01	8 O 16.00	9 F 19.00	10 Ne 20.18
15 P 0.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
33 As 4.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
51 Sb 21.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
83 Bi 09.0	84 Po	85 At	86 Rn

68 Er 67.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
100 Fm	101 Md	102 No	103 Lr

Half-reaction	E°(volts)
$F_2(g) + 2 e^- \rightleftharpoons 2 F^-(aq)$	+ 2.87
$H_2O_2(aq) + 2 H^+(aq) + 2 e^- \rightleftharpoons 2 H_2O(l)$	+ 1.78
$PbO_2(s) + SO_4^{2-}(aq) + 4 H^+(aq) + 2 e^- \rightleftharpoons PbSO_4(s) + 2 H_2O(l)$	+ 1.69
$2 HClO(aq) + 2 H^+(aq) + 2 e^- \rightleftharpoons Cl_2(g) + 2 H_2O(l)$	+ 1.61
$MnO_4^-(aq) + 8 H^+(aq) + 5 e^- \rightleftharpoons Mn^{2+}(aq) + 4 H_2O(l)$	+ 1.51
$Au^{3+}(aq) + 3 e^- \rightleftharpoons Au(s)$	+ 1.50
$HClO(aq) + H^+(aq) + 2 e^- \rightleftharpoons Cl^-(aq) + H_2O(l)$	+ 1.48
$PbO_2(s) + 4 H^+(aq) + 2 e^- \rightleftharpoons Pb^{2+}(aq) + 2 H_2O(l)$	+ 1.46
$Cl_2(g) + 2 e^- \rightleftharpoons 2 Cl^-(aq)$	+ 1.36
$Cr_2O_7^{2-}(aq) + 14 H^+(aq) + 6 e^- \rightleftharpoons 2 Cr^{3+}(aq) + 7 H_2O(l)$	+ 1.23
$O_2(g) + 4 H^+(aq) + 4 e^- \rightleftharpoons 2 H_2O(l)$	+ 1.23
$MnO_2(s) + 4 H^+(aq) + 2 e^- \rightleftharpoons Mn^{2+}(aq) + 2 H_2O(l)$	+ 1.22
$Br_2(l) + 2 e^- \rightleftharpoons 2 Br^-(aq)$	+ 1.07
$NO_3^-(aq) + 4 H^+(aq) + 3 e^- \rightleftharpoons NO(g) + 2 H_2O(l)$	+ 0.96
$2 Hg^{2+}(aq) + 2 e^- \rightleftharpoons Hg_2^{2+}(aq)$	+ 0.91
$Hg^{2+}(aq) + 2 e^- \rightleftharpoons Hg(l)$	+ 0.85
$O_2(g) + 4 H^+(aq)[1.00 \times 10^{-7} mol L^{-1}] + 4 e^- \rightleftharpoons 2 H_2O(l)$	+ 0.82
$NO_3^-(aq) + 2 H^+(aq) + e^- \rightleftharpoons NO_2(g) + H_2O(l)$	+ 0.80
$Ag^+(aq) + e^- \rightleftharpoons Ag(s)$	+ 0.80
$Hg_2^{2+}(aq) + 2 e^- \rightleftharpoons 2 Hg(l)$	+ 0.80
$Fe^{3+}(aq) + e^- \rightleftharpoons Fe^{2+}(aq)$	+ 0.77
$O_2(g) + 2 H^+(aq) + 2 e^- \rightleftharpoons H_2O_2(aq)$	+ 0.68
$MnO_4^-(aq) + 2 H_2O(l) + 3 e^- \rightleftharpoons MnO_2(s) + 4 OH^-(aq)$	+ 0.59
$I_2(s) + 2 e^- \rightleftharpoons 2 I^-(aq)$	+ 0.54
$Cu^+(aq) + e^- \rightleftharpoons Cu(s)$	+ 0.52
$O_2(g) + 2 H_2O(l) + 4 e^- \rightleftharpoons 4 OH^-(aq)$	+ 0.40
$Cu^{2+}(aq) + 2 e^- \rightleftharpoons Cu(s)$	+ 0.34
$Cu^{2+}(aq) + e^- \rightleftharpoons Cu^+(aq)$	+ 0.16
$Sn^{4+}(aq) + 2 e^- \rightleftharpoons Sn^{2+}(aq)$	+ 0.15
$S(s) + 2 H^+(aq) + 2 e^- \rightleftharpoons H_2S(aq)$	+ 0.14
$2 H^+(aq) + 2 e^- \rightleftharpoons H_2(g)$	0 exactly
$Pb^{2+}(aq) + 2 e^- \rightleftharpoons Pb(s)$	- 0.13
$Sn^{2+}(aq) + 2 e^- \rightleftharpoons Sn(s)$	- 0.14
$Ni^{2+}(aq) + 2 e^- \rightleftharpoons Ni(s)$	- 0.26
$Co^{2+}(aq) + 2 e^- \rightleftharpoons Co(s)$	- 0.28
$PbSO_4(s) + 2 e^- \rightleftharpoons Pb(s) + SO_4^{2-}(aq)$	- 0.36
$Cd^{2+}(aq) + 2 e^- \rightleftharpoons Cd(s)$	- 0.40
$2 H_2O(l) + 2 e^- \rightleftharpoons H_2(g) + 2 OH^-(aq)[1.00 \times 10^{-7} mol L^{-1}]$	- 0.41
$2 CO_2(g) + 2 H^+(aq) + 2 e^- \rightleftharpoons HOCCOOH(aq)$	- 0.43
$Fe^{2+}(aq) + 2 e^- \rightleftharpoons Fe(s)$	- 0.44
$Au(CN)_2^-(aq) + e^- \rightleftharpoons Au(s) + 2 CN^-(aq)$	- 0.60
$Cr^{3+}(aq) + 3 e^- \rightleftharpoons Cr(s)$	- 0.73
$Zn^{2+}(aq) + 2 e^- \rightleftharpoons Zn(s)$	- 0.76
$2 H_2O(l) + 2 e^- \rightleftharpoons H_2(g) + 2 OH^-(aq)$	- 0.83
$Mn^{2+}(aq) + 2 e^- \rightleftharpoons Mn(s)$	- 1.18
$Al^{3+}(aq) + 3 e^- \rightleftharpoons Al(s)$	- 1.66
$Mg^{2+}(aq) + 2 e^- \rightleftharpoons Mg(s)$	- 2.37
$Na^+(aq) + e^- \rightleftharpoons Na(s)$	- 2.71
$Ca^{2+}(aq) + 2 e^- \rightleftharpoons Ca(s)$	- 2.76
$Sr^{2+}(aq) + 2 e^- \rightleftharpoons Sr(s)$	- 2.89
$Ba^{2+}(aq) + 2 e^- \rightleftharpoons Ba(s)$	- 2.91
$K^+(aq) + e^- \rightleftharpoons K(s)$	- 2.93

at 0.0°C = 273.1 K

mercury (mmHg)

Solubility rules for ionic solids in water

Soluble in water

Soluble	Exceptions	
	Insoluble	Slightly soluble
Most chlorides	AgCl, Hg ₂ Cl ₂	PbCl ₂
Most bromides	AgBr, Hg ₂ Br ₂ , HgBr ₂	PbBr ₂
Most iodides	AgI, Hg ₂ I ₂ , HgI ₂ , PbI ₂	
All nitrates	No exceptions	
Most sulfates	SrSO ₄ , BaSO ₄ , HgSO ₄ , PbSO ₄	CaSO ₄ , Ag ₂ SO ₄

Insoluble in water

Insoluble	Exceptions	
	Soluble	Slightly soluble
Most hydroxides	NaOH, KOH, Ba(OH) ₂ (NH ₄ OH does not exist)	Ca(OH) ₂ , Sr(OH) ₂
Most carbonates	Na ₂ CO ₃ , K ₂ CO ₃ , (NH ₄) ₂ CO ₃	
Most phosphates	Na ₃ PO ₄ , K ₃ PO ₄ , (NH ₄) ₃ PO ₄	
Most sulfides	Na ₂ S, K ₂ S, (NH ₄) ₂ S	

Soluble	=	more than 0.1 mole dissolves per litre
Slightly soluble	=	between 0.01 and 0.1 mole dissolves per litre
Insoluble	=	less than 0.01 mole dissolves per litre

Colours of Ions in Aqueous Solution

Cation	Colour	Cation	Colour	Anion	Colour
Al ³⁺	colourless	Hg ₂ ²⁺	colourless	CrO ₄ ²⁻	yellow
NH ₄ ⁺	colourless	Hg ²⁺	colourless	Cr ₂ O ₇ ²⁻	orange
Ba ²⁺	colourless	Ni ²⁺	green	MnO ₄ ⁻	deep purple
Cd ²⁺	colourless	K ⁺	colourless	PO ₄ ³⁻	colourless
Ca ²⁺	colourless	Ag ⁺	colourless	S ²⁻	colourless
Cr ³⁺	deep green	Na ⁺	colourless	-	-
Co ²⁺	pink	Sr ²⁺	colourless	[Al(OH) ₄] ⁻	colourless
Cu ²⁺	blue	Sn ²⁺	colourless	[Cr(OH) ₄] ⁻	deep green
Fe ²⁺	pale green	Zn ²⁺	colourless	[Pb(OH) ₄] ²⁻	colourless
Fe ³⁺	brown	[Ag(NH ₃) ₂] ⁺	colourless	[Zn(OH) ₄] ²⁻	colourless
Pb ²⁺	colourless	[Cu(NH ₃) ₄] ²⁺	deep blue	-	-
Mg ²⁺	colourless	[Cd(NH ₃) ₄] ²⁺	colourless	-	-
Mn ²⁺	very pale pink	[Zn(NH ₃) ₄] ²⁺	colourless	-	-