Standard Reduction Potentials at 25 °C

Half-reaction			E°(volts)
$F_2(g) + 2\ e^-$	$\rightleftharpoons$	$2\ F^-(aq)$	+ 2.87
$H_2O_2(aq) + 2\ H^+(aq) + 2\ e^-$	$\rightleftharpoons$	$2\ H_2O(\ell)$	+ 1.78
$PbO_2(s) + SO_4^{2-}(aq) + 4\ H^+(aq) + 2\ e^-$	$\rightleftharpoons$	$PbSO_4(s) + 2\ H_2O(\ell)$	+ 1.69
$2\ HC\ell O(aq) + 2\ H^+(aq) + 2\ e^-$	$\rightleftharpoons$	$C\ell_2(g) + 2\ H_2O(\ell)$	+ 1.63
$MnO_4^-(aq) + 8\ H^+(aq) + 5\ e^-$	$\rightleftharpoons$	$Mn^{2+}(aq) + 4\ H_2O(\ell)$	+ 1.51
$Au^{3+}(aq) + 3\ e^-$	$\rightleftharpoons$	$Au(s)$	+ 1.50
$HC\ell O(aq) + H^+(aq) + 2\ e^-$	$\rightleftharpoons$	$C\ell^-(aq) + H_2O(\ell)$	+ 1.49
$PbO_2(s) + 4\ H^+(aq) + 2\ e^-$	$\rightleftharpoons$	$Pb^{2+}(aq) + 2\ H_2O(\ell)$	+ 1.46
$C\ell_2(g) + 2\ e^-$	$\rightleftharpoons$	$2\ C\ell^-(aq)$	+ 1.36
$Cr_2O_7^{2-}(aq) + 14\ H^+(aq) + 6\ e^-$	$\rightleftharpoons$	$2\ Cr^{3+}(aq) + 7\ H_2O(\ell)$	+ 1.33
$O_2(g) + 4\ H^+(aq) + 4\ e^-$	$\rightleftharpoons$	$2\ H_2O(\ell)$	+ 1.23
$Br_2(\ell) + 2\ e^-$	$\rightleftharpoons$	$2\ Br^-(aq)$	+ 1.07
$Ag^+(aq) + e^-$	$\rightleftharpoons$	$Ag(s)$	+ 0.80
$NO_3^-(aq) + 2\ H^+(aq) + e^-$	$\rightleftharpoons$	$NO_2(g) + H_2O(\ell)$	+ 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
$I_2(s) + 2\ e^-$	$\rightleftharpoons$	$2\ I^-(aq)$	+ 0.54
$O_2(g) + 2\ H_2O(\ell) + 4\ e^-$	$\rightleftharpoons$	$4\ OH^-(aq)$	+ 0.40
$Cu^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Cu(s)$	+ 0.34
$S(s) + 2\ H^+(aq) + 2\ e^-$	$\rightleftharpoons$	$H_2S(aq)$	+ 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
$Ni^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Ni(s)$	– 0.25
$Co^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Co(s)$	– 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
$2\ CO_2(g) + 2\ H^+(aq) + 2\ e^-$	$\rightleftharpoons$	$HOOCCOOH(aq)$	– 0.43
$Fe^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Fe(s)$	– 0.44
$Cr^{3+}(aq) + 3\ e^-$	$\rightleftharpoons$	$Cr(s)$	– 0.74
$Zn^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Zn(s)$	– 0.76
$2\ H_2O(\ell) + 2\ e^-$	$\rightleftharpoons$	$H_2(g) + 2\ OH^-(aq)$	– 0.83
$Mn^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Mn(s)$	– 1.18
$A\ell^{3+}(aq) + 3\ e^-$	$\rightleftharpoons$	$A\ell(s)$	– 1.66
$Mg^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Mg(s)$	– 2.37
$Na^+(aq) + e^-$	$\rightleftharpoons$	$Na(s)$	– 2.71
$Ca^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Ca(s)$	– 2.87
$Sr^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Sr(s)$	– 2.89
$Ba^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Ba(s)$	– 2.91
$K^+(aq) + e^-$	$\rightleftharpoons$	$K(s)$	– 2.93

Government of **Western Australia**
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CHEMISTRY DATA SHEET

2011

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Periodic Table

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 H 1.008																	2 He 4.003
2	3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
3	11 Na 22.99	12 Mg 24.31											13 Aℓ 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cℓ 35.45	18 Ar 39.95
4	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
5	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
6	55 Cs 132.9	56 Ba 137.3	57 *La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tℓ 204.4	82 Pb 207.2	83 Bi 209.0	84 Po	85 At	86 Rn
7	87 Fr	88 Ra 226.0	89 **Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt									

* Lanthanide Series	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
** Actinide Series	90 Th 232.0	91 Pa	92 U 238.0	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

6 C 12.01 ← Atomic Number ← Symbol ← Atomic Mass

Formulae

Number of moles	n	$=$	$\frac{m}{M} = \frac{\text{mass}}{\text{molar mass}}$
Number of moles of solute	n	$=$	cV
Number of moles of a gas at STP	n	$=$	$\frac{V}{22.41}$
Ideal gas law	PV	$=$	nRT
Parts per million	ppm	$=$	$\frac{\text{mass of solute (mg)}}{\text{mass of solution (kg)}}$
pH of a solution	pH	$=$	$-\log [H^+]$
Density	ρ	$=$	$\frac{\text{mass of sample}}{\text{volume of sample}}$

Units

Volumes are given in the units of litres (L), or millilitres (mL)

Temperatures are given in the units of degrees Celsius (°C) or Kelvin (K).
It may be assumed that 0.0°C = 273.1 K

Energy changes are given in the SI unit kilojoule (kJ)

Pressures are given in the SI unit kilopascal (kPa) and in atmospheres (atm).
1.00 atm = 101.3 kPa

Solution concentrations are given in the units moles per litre (mol L^{-1}), grams per litre (g L^{-1}) and parts per million.

Constants

Universal gas constant, R = 8.315 J K^{-1} mol^{-1}

Avogadro constant, N = 6.022 x 10^{23} mol^{-1}

Volume of 1.000 mol of an ideal gas at 0.0°C and 101.3 kPa is 22.41 L

S.T.P. is 0.0°C and 101.3 kPa

Equilibrium constant for water at 25°C, K_w = 1.00 x 10^{-14}

Solubility rules for ionic solids in water

Soluble in water

Soluble	Exceptions	
	Insoluble	Slightly soluble
Most chlorides	AgCℓ	PbCℓ_2
Most bromides	AgBr	$PbBr_2$
Most iodides	AgI, PbI_2	
All nitrates	No exceptions	
All ethanoates		
Most sulfates	$SrSO_4$, $BaSO_4$, $PbSO_4$	$CaSO_4$, Ag_2SO_4

Insoluble in water

Insoluble	Exceptions	
	Soluble	Slightly soluble
Most hydroxides	NaOH, KOH, $Ba(OH)_2$ (note: NH_4OH and AgOH do not exist)	$Ca(OH)_2$, $Sr(OH)_2$
Most carbonates	Na_2CO_3, K_2CO_3, $(NH_4)_2CO_3$	
Most phosphates	Na_3PO_4, K_3PO_4, $(NH_4)_3PO_4$	
Most sulfides	Na_2S, K_2S, $(NH_4)_2S$	

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 selected ionic substances

In general, ionic solids have the same colour as that of any coloured ion they contain. Two colourless ions in general produce a white solid. Selected exceptions to these two basic rules are noted below.

Ionic Solid	Colour
calcium iodide	pale yellow
copper(II) carbonate	green
copper(II) chloride	green
copper(II) oxide	black
copper(II) sulfide	black
iron(III) sulfide	black
lead(II) iodide	yellow
lead(II) sulfide	black
manganese(II) sulfide	black
silver carbonate	yellow
silver iodide	yellow
silver oxide	brown/black
silver sulfide	black

Other coloured substances

Most gases and liquids are colourless, and most metals are silvery or grey. Selected exceptions to these basic rules are noted below.

Substance	State	Colour
copper	solid	salmon pink
gold	solid	yellow
nitrogen dioxide	gas	brown
phosphorus	solid	yellow
sulfur	liquid, solid	yellow

Coloured ions in aqueous solution

Cation	Colour
Cr^{3+}	deep green
Co^{2+}	pink
Cu^{2+}	blue
Fe^{2+}	pale green
Fe^{3+}	brown
Mn^{2+}	very pale pink
Ni^{2+}	green

Anion	Colour
CrO_4^{2-}	yellow
$Cr_2O_7^{2-}$	orange
MnO_4^-	purple

Coloured halogens

Halogen	Colour of free element
F_2(g)	yellow
Cℓ_2(g)	green
Br_2(ℓ)	red
I_2(s)	dark grey

Halogen	Colour of halogen in aqueous solution
Cℓ_2(aq)	pale yellow
Br_2(aq)	orange
I_2(aq)	brown

Halogen	Colour of halogen in organic solvent
Br_2	red
I_2	purple