Solubility rules for ionic solids in water

Soluble in water

Soluble	Exceptions	
	Insoluble	Slightly soluble
Most chlorides	AgCl, Hg_2Cl_2	$PbCl_2$
Most bromides	AgBr, Hg_2Br_2, $HgBr_2$	$PbBr_2$
Most iodides	AgI, Hg_2I_2, HgI_2, PbI_2	
All nitrates	No exceptions	
Most sulfates	$SrSO_4$, $BaSO_4$, $HgSO_4$, $PbSO_4$	$CaSO_4$, Ag_2SO_4

Insoluble in water

Insoluble	Exceptions	
	Soluble	Slightly soluble
Most hydroxides	NaOH, KOH, $Ba(OH)_2$ (NH_4OH does 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 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	$Cr_2O_7^{2-}$	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	-	-

CHEMISTRY DATA SHEET

Revised February 2000

West Australian Test Papers

Periodic Table

1 H 1.008																	2 He 4.003
	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
	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
	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
	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
	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
	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 ← Atomic Number
C ← Symbol
12.01 ← Atomic Weight

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), in atmospheres (atm), or in millimetres of mercury (mmHg)

1.000 atm = 101.3 kPa = 760.0 mmHg

Solution concentrations are given in the unit moles per litre (mol L^{-1})

Relating commonly used symbolism, 1 mol L^{-1} = 1 M

Universal Gas Constant, R = 8.315 J K^{-1} mol^{-1} or 0.08206 L atm K^{-1} mol^{-1}

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

Magnitude of the electronic charge, q_e = 1.602 x 10^{-19} coulomb (C)

Magnitude of the charge carried by one mole of electrons = 1 faraday (F) = 9.649 x 10^4 C

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

and at 25.0°C and 101.3 kPa is 24.47 L

S.T.P. is 0.0°C and 101.3 kPa

Standard Reduction Potentials at 25°C

Half-reaction			E°(volts)
$F_2(g) + 2\ e^-$	⇌	$2\ F^-(aq)$	+ 2.87
$H_2O_2(aq) + 2\ H^+(aq) + 2\ e^-$	⇌	$2\ H_2O(\ell)$	+ 1.78
$PbO_2(s) + SO_4^{2-}(aq) + 4\ H^+(aq) + 2\ e^-$	⇌	$PbSO_4(s) + 2\ H_2O(\ell)$	+ 1.69
$2\ HClO(aq) + 2\ H^+(aq) + 2\ e^-$	⇌	$Cl_2(g) + 2\ H_2O(\ell)$	+ 1.61
$MnO_4^-(aq) + 8\ H^+(aq) + 5\ e^-$	⇌	$Mn^{2+}(aq) + 4\ H_2O(\ell)$	+ 1.51
$Au^{3+}(aq) + 3\ e^-$	⇌	$Au(s)$	+ 1.50
$HClO(aq) + H^+(aq) + 2\ e^-$	⇌	$Cl^-(aq) + H_2O(\ell)$	+ 1.48
$PbO_2(s) + 4\ H^+(aq) + 2\ e^-$	⇌	$Pb^{2+}(aq) + 2\ H_2O(\ell)$	+ 1.46
$Cl_2(g) + 2\ e^-$	⇌	$2\ Cl^-(aq)$	+ 1.36
$Cr_2O_7^{2-}(aq) + 14\ H^+(aq) + 6\ e^-$	⇌	$2\ Cr^{3+}(aq) + 7\ H_2O(\ell)$	+ 1.23
$O_2(g) + 4\ H^+(aq) + 4\ e^-$	⇌	$2\ H_2O(\ell)$	+ 1.23
$MnO_2(s) + 4\ H^+(aq) + 2\ e^-$	⇌	$Mn^{2+}(aq) + 2\ H_2O(\ell)$	+ 1.22
$Br_2(\ell) + 2\ e^-$	⇌	$2\ Br^-(aq)$	+ 1.07
$NO_3^-(aq) + 4\ H^+(aq) + 3\ e^-$	⇌	$NO(g) + 2\ H_2O(\ell)$	+ 0.96
$2\ Hg^{2+}(aq) + 2\ e^-$	⇌	$Hg_2^{2+}(aq)$	+ 0.91
$Hg^{2+}(aq) + 2\ e^-$	⇌	$Hg(\ell)$	+ 0.85
$O_2(g) + 4\ H^+(aq)$[1.00 x10^{-7} mol L^{-1}] + 4 e^-	⇌	*2 $H_2O(\ell)$*	*+ 0.82*
$NO_3^-(aq) + 2\ H^+(aq) + e^-$	⇌	$NO_2(g) + H_2O(\ell)$	+ 0.80
$Ag^+(aq) + e^-$	⇌	$Ag(s)$	+ 0.80
$Hg_2^{2+}(aq) + 2\ e^-$	⇌	$2\ Hg(\ell)$	+ 0.80
$Fe^{3+}(aq) + e^-$	⇌	$Fe^{2+}(aq)$	+ 0.77
$O_2(g) + 2\ H^+(aq) + 2\ e^-$	⇌	$H_2O_2(aq)$	+ 0.68
$MnO_4^-(aq) + 2\ H_2O(\ell) + 3\ e^-$	⇌	$MnO_2(s) + 4\ OH^-(aq)$	+ 0.59
$I_2(s) + 2\ e^-$	⇌	$2\ I^-(aq)$	+ 0.54
$Cu^+(aq) + e^-$	⇌	$Cu(s)$	+ 0.52
$O_2(g) + 2\ H_2O(\ell) + 4\ e^-$	⇌	$4\ OH^-(aq)$	+ 0.40
$Cu^{2+}(aq) + 2\ e^-$	⇌	$Cu(s)$	+ 0.34
$Cu^{2+}(aq) + e^-$	⇌	$Cu^+(aq)$	+ 0.16
$Sn^{4+}(aq) + 2\ e^-$	⇌	$Sn^{2+}(aq)$	+ 0.15
$S(s) + 2\ H^+(aq) + 2\ e^-$	⇌	$H_2S(aq)$	+ 0.14
$2\ H^+(aq) + 2\ e^-$	⇌	$H_2(g)$	0 exactly
$Pb^{2+}(aq) + 2\ e^-$	⇌	$Pb(s)$	– 0.13
$Sn^{2+}(aq) + 2\ e^-$	⇌	$Sn(s)$	– 0.14
$Ni^{2+}(aq) + 2\ e^-$	⇌	$Ni(s)$	– 0.26
$Co^{2+}(aq) + 2\ e^-$	⇌	$Co(s)$	– 0.28
$PbSO_4(s) + 2\ e^-$	⇌	$Pb(s) + SO_4^{2-}(aq)$	– 0.36
$Cd^{2+}(aq) + 2\ e^-$	⇌	$Cd(s)$	– 0.40
2 $H_2O(\ell)$ + 2 e^-	⇌	*$H_2(g)$ + 2 $OH^-(aq)$*[1.00 x10^{-7} mol L^{-1}]	*– 0.41*
$2\ CO_2(g) + 2\ H^+(aq) + 2\ e^-$	⇌	$HOOCCOOH(aq)$	– 0.43
$Fe^{2+}(aq) + 2\ e^-$	⇌	$Fe(s)$	– 0.44
$Au(CN)_2^-(aq) + e^-$	⇌	$Au(s) + 2\ CN^-(aq)$	– 0.60
$Cr^{3+}(aq) + 3\ e^-$	⇌	$Cr(s)$	– 0.73
$Zn^{2+}(aq) + 2\ e^-$	⇌	$Zn(s)$	– 0.76
$2\ H_2O(\ell) + 2\ e^-$	⇌	$H_2(g) + 2\ OH^-(aq)$	– 0.83
$Mn^{2+}(aq) + 2\ e^-$	⇌	$Mn(s)$	– 1.18
$Al^{3+}(aq) + 3\ e^-$	⇌	$Al(s)$	– 1.66
$Mg^{2+}(aq) + 2\ e^-$	⇌	$Mg(s)$	– 2.37
$Na^+(aq) + e^-$	⇌	$Na(s)$	– 2.71
$Ca^{2+}(aq) + 2\ e^-$	⇌	$Ca(s)$	– 2.76
$Sr^{2+}(aq) + 2\ e^-$	⇌	$Sr(s)$	– 2.89
$Ba^{2+}(aq) + 2\ e^-$	⇌	$Ba(s)$	– 2.91