

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	-	-

CHEMISTRY DATA SHEET

Revised February 2002

Reproduced by kind permission of Curriculum Council



West Australian Test Papers

1 H 1.008	PERIODIC TABLE																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 98.91	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 (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.0	89 **Ac 227.0	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)									

* Lanthanide Series

** Actinide Series

58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	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
90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np 237.0	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

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 10²³ 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 10⁴ 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

E°(volts)	Half-reaction	
	F ₂ (g) + 2 e ⁻ ⇌ 2 F ⁻ (aq)	+ 2.87
	H ₂ O ₂ (aq) + 2 H ⁺ (aq) + 2 e ⁻ ⇌ 2 H ₂ O(l)	+ 1.78
	PbO ₂ (s) + SO ₄ ²⁻ (aq) + 4 H ⁺ (aq) + 2 e ⁻ ⇌ PbSO ₄ (s) + 2 H ₂ O(l)	+ 1.69
	2 HClO(aq) + 2 H ⁺ (aq) + 2 e ⁻ ⇌ Cl ₂ (g) + 2 H ₂ O(l)	+ 1.61
	MnO ₄ ⁻ (aq) + 8 H ⁺ (aq) + 5 e ⁻ ⇌ Mn ²⁺ (aq) + 4 H ₂ O(l)	+ 1.51
	Au ³⁺ (aq) + 3 e ⁻ ⇌ Au(s)	+ 1.50
	HClO(aq) + H ⁺ (aq) + 2 e ⁻ ⇌ Cl ⁻ (aq) + H ₂ O(l)	+ 1.48
	PbO ₂ (s) + 4 H ⁺ (aq) + 2 e ⁻ ⇌ Pb ²⁺ (aq) + 2 H ₂ O(l)	+ 1.46
	Cl ₂ (g) + 2 e ⁻ ⇌ 2 Cl ⁻ (aq)	+ 1.36
	Cr ₂ O ₇ ²⁻ (aq) + 14 H ⁺ (aq) + 6 e ⁻ ⇌ 2 Cr ³⁺ (aq) + 7 H ₂ O(l)	+ 1.23
	O ₂ (g) + 4 H ⁺ (aq) + 4 e ⁻ ⇌ 2 H ₂ O(l)	+ 1.23
	MnO ₂ (s) + 4 H ⁺ (aq) + 2 e ⁻ ⇌ Mn ²⁺ (aq) + 2 H ₂ O(l)	+ 1.22
	Br ₂ (l) + 2 e ⁻ ⇌ 2 Br ⁻ (aq)	+ 1.07
	NO ₃ ⁻ (aq) + 4 H ⁺ (aq) + 3 e ⁻ ⇌ NO(g) + 2 H ₂ O(l)	+ 0.96
	2 Hg ₂ ²⁺ (aq) + 2 e ⁻ ⇌ Hg ₂ ²⁺ (aq)	+ 0.91
	Hg ₂ ²⁺ (aq) + 2 e ⁻ ⇌ Hg(l)	+ 0.85
	O ₂ (g) + 4 H ⁺ (aq)[1.00 x 10 ⁻⁷ mol L ⁻¹] + 4 e ⁻ ⇌ 2 H ₂ O(l)	+ 0.82
	NO ₃ ⁻ (aq) + 2 H ⁺ (aq) + e ⁻ ⇌ NO ₂ (g) + H ₂ O(l)	+ 0.80
	Ag ⁺ (aq) + e ⁻ ⇌ Ag(s)	+ 0.80
	Hg ₂ ²⁺ (aq) + 2 e ⁻ ⇌ 2 Hg(l)	+ 0.80
	Fe ³⁺ (aq) + e ⁻ ⇌ Fe ²⁺ (aq)	+ 0.77
	O ₂ (g) + 2 H ⁺ (aq) + 2 e ⁻ ⇌ H ₂ O ₂ (aq)	+ 0.68
	MnO ₄ ⁻ (aq) + 2 H ₂ O(l) + 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 ₂ O(l) + 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 ₂ S(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 ₂ O(l) + 2 e ⁻ ⇌ H ₂ (g) + 2 OH ⁻ (aq)[1.00 x 10 ⁻⁷ mol L ⁻¹]	- 0.41
	2 CO ₂ (g) + 2 H ⁺ (aq) + 2 e ⁻ ⇌ HOCCOOH(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 ₂ O(l) + 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
	K ⁺ (aq) + e ⁻ ⇌ K(s)	- 2.93