CHEMISTRY DATA SHEET

Revised February 2008

FORMULA

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.

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

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 Kw = $1x10^{-14}$

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, $Ba(OH)_2$ (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

Colour of species in aqueous solution

Cation	Colour	Cation	Colour
Al^{3+}	colourless	Mn^{2+}	very pale pink
NH_4^+	colourless	Ni^{2+}	green
Ba^{2+}	colourless	Ag^+	colourless
Ca^{2+}	colourless	Na^+	colourless
Cr^{3+}	deep green	Sr^{2+}	colourless
Co^{2+}	pink	Sn^{2+}	colourless
Cu^{2+}	blue	Zn^{2+}	colourless
Fe^{2+}	pale green		
Fe^{3+}	brown		
K^+	colourless		
Pb^{2+}	colourless		
Mg^{2+}	colourless		

Anion	Colour
Br^-	colourless
$C\ell^-$	colourless
CrO_4^{2-}	yellow
$Cr_2O_7^{2-}$	orange
I^-	colourless
MnO_4^-	deep purple
PO_4^{3-}	colourless
S^{2-}	colourless
-	

Halogen	Colour
$C\ell_{2(aq)}$	pale yellow
$Br_{2\ (aq)}$	orange
$I_{2(aq)}$	brown

Halogen in organic solvent

Halogen	Colour
Br_2	red
I_2	purple

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
$2\ HC\ell O(aq) + 2\ H^+(aq) + 2\ e^-$	$\rightleftharpoons$	$C\ell_2(g) + 2\ H_2O(\ell)$	+ 1.61
$MnO_4^-(aq) + 8\ H^+(aq) + 5\ e^-$	$\rightleftharpoons$	$Mn^{2+}(aq) + 4\ H_2O(\ell)$	+ 1.51
$Au^{3+}(aq) + 3\ e^-$	$\rightleftharpoons$	$Au(s)$	+ 1.50
$HC\ell O(aq) + H^+(aq) + 2\ e^-$	$\rightleftharpoons$	$C\ell^-(aq) + H_2O(\ell)$	+ 1.48
$PbO_2(s) + 4\ H^+(aq) + 2\ e^-$	$\rightleftharpoons$	$Pb^{2+}(aq) + 2\ H_2O(\ell)$	+ 1.46
$Cl_2(g) + 2\ e^-$	$\rightleftharpoons$	$2\ C\ell^-(aq)$	+ 1.36
$Cr_2O_7^{2-}(aq) + 14\ H^+(aq) + 6\ e^-$	$\rightleftharpoons$	$2\ Cr^{3+}(aq) + 7\ H_2O(\ell)$	+ 1.23
$O_2(g) + 4\ H^+(aq) + 4\ e^-$	$\rightleftharpoons$	$2\ H_2O(\ell)$	+ 1.23
$Br_2(\ell) + 2\ e^-$	$\rightleftharpoons$	$2\ Br^-(aq)$	+ 1.07
$NO_3^-(aq) + 4\ H^+(aq) + 3\ e^-$	$\rightleftharpoons$	$NO(g) + 2\ H_2O(\ell)$	+ 0.96
$Ag^+(aq) + e^-$	$\rightleftharpoons$	$Ag(s)$	+ 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
$S(s) + 2H^+(aq) + 2e^-$	$\rightleftharpoons$	$H_2S(aq)$	+ 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
$2\ CO_2(g) + 2\ H^+(aq) + 2\ e^-$	$\rightleftharpoons$	$HOOCCOOH(aq)$	– 0.43
$Fe^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Fe(s)$	– 0.44
$Cr^{3+}(aq) + 3\ e^-$	$\rightleftharpoons$	$Cr(s)$	– 0.73
$Zn^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Zn(s)$	– 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
$Ca^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Ca(s)$	– 2.76
$Sr^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Sr(s)$	– 2.89
$Ba^{2+}(aq) + 2\ e^-$	$\rightleftharpoons$	$Ba(s)$	– 2.91
$K^+(aq) + e^-$	$\rightleftharpoons$	$K(s)$	– 2.93

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 ← Atomic Number
C ← Symbol
12.01 ← Atomic Mass