

DATA SHEET

Some Useful Constants and Formulae

Fundamental Constants and Conversion Factors

Atomic mass unit (u)	$1.660\,539 \times 10^{-27}$ kg	Kelvin temperature scale	0 K = -273.15 °C
Avogadro's number (N_A)	$6.022\,141 \times 10^{23}$ mol ⁻¹	K_w (at 25 °C)	10^{-14}
Boltzmann constant (k_B)	$1.380\,649 \times 10^{-23}$ J·K ⁻¹	Planck's constant (h)	$6.626\,070 \times 10^{-34}$ J·Hz ⁻¹
Charge of electron	$-1.602\,176 \times 10^{-19}$ C	Speed of light in vacuum (c)	$2.997\,925 \times 10^8$ m·s ⁻¹
Faraday's constant (F)	96 485 C·mol ⁻¹	Volume conversion	1000 L = 1 m ³
Ideal gas constant (R)	$8.314\,462$ J·mol ⁻¹ ·K ⁻¹	Pressure conversions	1 bar = 100 kPa 1 atm = 1.01325 bar
	$8.314\,462$ m ³ ·Pa·mol ⁻¹ ·K ⁻¹		

Formulae

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$PV = nRT$$

$$S = k_B \ln \Omega$$

$$\Delta S = \frac{q_{rev}}{T}$$

$$\Delta_r G = \Delta_r H - T \Delta_r S$$

$$\Delta_r G = \Delta_r G^\circ + RT \ln Q$$

$$\Delta_r G^\circ = -RT \ln K$$

$$\ln \left(\frac{K_2}{K_1} \right) = \frac{\Delta_r H^\circ}{R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

$$P_A = X_A P_A^\circ$$

$$[A] = k_H P_A$$

$$X = \frac{n}{\sum n}$$

$$\Delta_r G = -\nu_e F E$$

$$E = E^\circ - \frac{RT}{\nu_e F} \ln Q$$

$$pH = -\log a_{H^+}$$

$$pK_a = -\log K_a$$

$$pK_b = -\log K_b$$

$$K_w = K_a \cdot K_b$$

$$pH = pK_a + \log \left(\frac{a_{A^-}}{a_{HA}} \right)$$

$$\Delta H_{rxn}^\circ = \sum (\Delta H_f^\circ(\text{products})) - \sum (\Delta H_f^\circ(\text{reactants}))$$

$$\Delta S_{rxn}^\circ = \sum (S^\circ(\text{products})) - \sum (S^\circ(\text{reactants}))$$

$$\Delta G_{rxn}^\circ = \sum (\Delta G_f^\circ(\text{products})) - \sum (\Delta G_f^\circ(\text{reactants}))$$

Activities

Solid	$a = 1$
Pure liquid	$a = 1$
Ideal Solvent	$a = X$
Ideal Solute	$a = \frac{c}{c^\circ}$
Ideal Gas	$a = \frac{P}{P^\circ}$

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CHEM 2000 Standard Periodic Table

1	CHEM 2000 Standard Periodic Table																18	
1.0079 H 1												13	14	15	16	17	4.0026 He 2	
6.941 Li 3	9.0122 Be 4												10.811 B 5	12.011 C 6	14.0067 N 7	15.9994 O 8	18.9984 F 9	20.1797 Ne 10
22.9898 Na 11	24.3050 Mg 12	3	4	5	6	7	8	9	10	11	12	26.9815 Al 13	28.0855 Si 14	30.9738 P 15	32.066 S 16	35.4527 Cl 17	39.948 Ar 18	
39.0983 K 19	40.078 Ca 20	44.9559 Sc 21	47.88 Ti 22	50.9415 V 23	51.9961 Cr 24	54.9380 Mn 25	55.847 Fe 26	58.9332 Co 27	58.693 Ni 28	63.546 Cu 29	65.39 Zn 30	69.723 Ga 31	72.61 Ge 32	74.9216 As 33	78.96 Se 34	79.904 Br 35	83.80 Kr 36	
85.4678 Rb 37	87.62 Sr 38	88.9059 Y 39	91.224 Zr 40	92.9064 Nb 41	95.94 Mo 42	(98) Tc 43	101.07 Ru 44	102.906 Rh 45	106.42 Pd 46	107.868 Ag 47	112.411 Cd 48	114.82 In 49	118.710 Sn 50	121.757 Sb 51	127.60 Te 52	126.905 I 53	131.29 Xe 54	
132.905 Cs 55	137.327 Ba 56	La-Lu	178.49 Hf 72	180.948 Ta 73	183.85 W 74	186.207 Re 75	190.2 Os 76	192.22 Ir 77	195.08 Pt 78	196.967 Au 79	200.59 Hg 80	204.383 Tl 81	207.19 Pb 82	208.980 Bi 83	(210) Po 84	(210) At 85	(222) Rn 86	
(223) Fr 87	226.025 Ra 88	Ac-Lr	(265) Rf 104	(268) Db 105	(271) Sg 106	(270) Bh 107	(277) Hs 108	(276) Mt 109	(281) Ds 110	(280) Rg 111	(285) Cn 112	(284) Nh 113	(289) Fl 114	(288) Mc 115	(293) Lv 116	(294) Ts 117	(294) Og 118	
		138.906 La 57	140.115 Ce 58	140.908 Pr 59	144.24 Nd 60	(145) Pm 61	150.36 Sm 62	151.965 Eu 63	157.25 Gd 64	158.925 Tb 65	162.50 Dy 66	164.930 Ho 67	167.26 Er 68	168.934 Tm 69	173.04 Yb 70	174.967 Lu 71		
		227.028 Ac 89	232.038 Th 90	231.036 Pa 91	238.029 U 92	237.048 Np 93	(240) Pu 94	(243) Am 95	(247) Cm 96	(247) Bk 97	(251) Cf 98	(252) Es 99	(257) Fm 100	(258) Md 101	(259) No 102	(262) Lr 103		

Developed by Prof. R. T. Boéré (updated 2016)

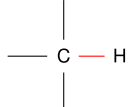
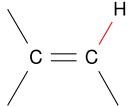
Table of Thermodynamic Data

formula	notes	$\Delta_f H^\circ \left(\frac{kJ}{mol} \right)$	$\Delta_f G_m^\circ \left(\frac{kJ}{mol} \right)$	$S^\circ \left(\frac{J}{mol \cdot K} \right)$
$C_{(s)}$	<i>use as a proxy for coal</i>			5.686
$CO_{2(g)}$		-393.50		213.7
$H_{2(g)}$				130.7
$H_2O_{(g)}$		-241.8	-228.6	188.8
$O_{2(g)}$				205.0

Table of pK_a Values

acid	pK_a
$-NH_3^+$ of amino acid	9-10
Acetic acid (CH_3CO_2H)	4.74

Table of IR Frequencies

Bond	Frequency range	Notes
	2800–3000 cm^{-1}	
	3000–3200 cm^{-1}	
$C=C$	1640–1675 cm^{-1}	May be absent for symmetry reasons
$C \equiv C$	1950–2300 cm^{-1}	May be absent for symmetry reasons