RELATIONSHIPS AMONG UNITS (Conversion Factors)

Length
1 in. = 2.54 cm
1 ft. = 30.48 cm
1 yd. = 91.44 cm
1 mi. = 5280 ft.
1 ft. = 12 in.

Volume
1 liq. oz. = 29.57 ml
1 qt. = 946.4 ml
1 gal. = 3.79 L
1 gal. = 4 qts.
1 qt. = 2 pints = 32 liquid oz.
$1ft^3 = 28.32$ L

Metric Prefixes

prefixed	base unit
1T (tera)	$= 1x10^{12}$
1G (giga)	$= 1x10^{9}$
1M (mega)	$= 1x10^{6}$
1k (kilo)	$= 1x10^{3}$
---base unit---	
1d (deci)	$= 1x10^{-1}$
1c (centi)	$=1x10^{-2}$
1m (milli)	$=1x10^{-3}$
1μ (micro)	$=1x10^{-6}$
1n (nano)	$=1x10^{-9}$
1p (pico)	$=1x10^{-12}$
1f (femto)	$=1x10^{-15}$

Mass
1 lb. = 454 g
1 lb. = 16 oz
1 carat = 0.2g

Pressure
1 atm = 760 torr
1 atm = 101325 Pa
1 atm = 1.01325 bar
1 atm = 14.7 psi (lb/in^2)
1 torr = 1 mm Hg

Energy
1 cal = 4.184 J
$1 J = 1 \times 10^7$ erg

Greek Prefixes

mono (1)	hepta (7)
di (2)	octa (8)
tri (3)	nona (9)
tetra(4)	deca (10)
penta (5)	undeca (11)
hexa (6)	dodeca (12)

Physical Constants
R (gas constant) = 0.0821 (L · atm) / (mol · K)
R = 8.314 J / (mol · K)
$Cp(H_2O)$= 4.184J/gK
c (speed of light in a vacuum) = 3.00×10^8 m/s
h (Planck's constant) = 6.626×10^{-34} Js
N (Avogadro's Number) = 6.02×10^{23} units/mol

1 mol of electrons = 9.65×10^4 C
1 F = 9.65×10^4 C
V = J/C

C=Coulomb
A=Ampere
F=Faraday
V=Volt

POLYATOMIC IONS

Acetate	$C_2H_3O_2^-$	Nitrate	NO_3^-
Ammonium	NH_4^+	Nitrite	NO_2^-
Bicarbonate	HCO_3^-	Oxalate	$C_2O_4^{2-}$
Bisulfate	HSO_4^-	Perchlorate	ClO_4^-
Carbonate	CO_3^{2-}	Permanganate	MnO_4^-
Chlorate	ClO_3^-	Phosphate	PO_4^{3-}
Chlorite	ClO_2^-	hydrogen phosphate	HPO_4^{2-}
Chromate	CrO_4^{2-}	dihydrogen phosphate	$H_2PO_4^-$
Cyanide	CN^-	Sulfate	SO_4^{2-}
Dichromate	$Cr_2O_7^{2-}$	Sulfite	SO_3^{2-}
Hydroxide	OH^-	Thiocyanate	SCN^-
Hypochlorite	ClO^-	Thiosulfate	$S_2O_3^{2-}$

FORMULAS

$°F = 1.8°C + 32$

$K = °C + 273$

$c = \lambda\nu$ $\quad E=hc/\lambda$

$PV = nRT$ $\quad \frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$

$pH = -\log[H^+]$

$pOH = -\log[OH^-]$

$pH + pOH = 14$

$pH = pKa + \log\frac{[A^-]}{[HA]}$

Where: A^- = conjugate base
HA = weak acid

$pOH = pKb + \log\frac{[B^+]}{[BOH]}$

Where: B^+ = conjugate acid
BOH = weak base

$\Delta H_{rxn}^o = \Sigma\Delta H_f^o{}_{products} - \Sigma\Delta H_f^o{}_{reactants}$

$\Delta G_{rxn}^o = \Sigma\Delta G_f^o{}_{products} - \Sigma\Delta G_f^o{}_{reactants}$

$\Delta S_{rxn}^o = \Sigma S^o{}_{products} - \Sigma S^o{}_{reactants}$

$\Delta G^o = \Delta H^o - T\Delta S^o$

For A→ Products

Zero Order
$[A]_t = [A]_o - kt$

First Order
$\ln([A]_o/[A]_t) = kt$
$t_{½} = 0.693/k$

Second Order
$\frac{1}{[A]_t} - \frac{1}{[A]_o} = kt$

$M = \frac{\text{moles solute}}{\text{L solution}}$ $\quad M_{conc}V_{conc} = M_{dilute}V_{dilute}$

$m = \frac{\text{moles solute}}{\text{kg solvent}}$

$N = \frac{\text{equivalents solute}}{\text{L solution}}$ $\quad P_A = x_A * P°$

$\text{equivalents solute} = \frac{\text{mass solute}}{\text{EW solute}}$

$ppm^* = \frac{\text{mg solute}}{\text{L solution}}$ $\quad$ *d solution = 1g/ml

$ppm = \frac{\text{mass solute}}{\text{mass solution}} \times 10^6$

$\text{Mass \%} = \frac{\text{mass solute}}{\text{mass solution}} \times 10^2$

$q = mC_p\Delta T$ where: C=specific heat

$\Delta T_f = -mK_f$ $\quad K_f(\text{water}) = 1.86°C/m$

$\Delta T_b = mK_b$ $\quad K_b(\text{water}) = 0.52°C/m$

order = LOG(rate2/rate1) / LOG([]2/[]1)

$K_p = K_c(RT)^{\Delta n(g)}$

$\Delta G^o = -nFE^o{}_{cell} = -RT\ln(K)$

$E^o{}_{cell} = \frac{RT}{nF}\log K_c$

$E_{cell} = E^o{}_{cell} - \frac{RT}{nF}\log Q$

$E°cell = E°(\text{reduction}) - E°(\text{oxidation})$

$i = Q / t$
$mol = Q /(F \cdot \#e^-)$

SOLUBILITY RULES FOR IONIC COMPOUNDS

Soluble Ionic Compounds

1. All compounds of the alkali metals (Group IA) are soluble.

2. All salts containing NH_4^+, NO_3^-, ClO_4^-, and $C_2H_3O_2^-$ are soluble.

3. All chlorides (Cl^-), bromides (Br^-), and iodides (I^-) are soluble, *except* those of Ag^+, Pb^{2+}, and Hg_2^{2+} (note the subscript "2").

4. All sulfates are soluble, *except* those of Pb^{2+}, Ca^{2+}, Sr^{2+}, Hg_2^{2+}, and Ba^{2+}.

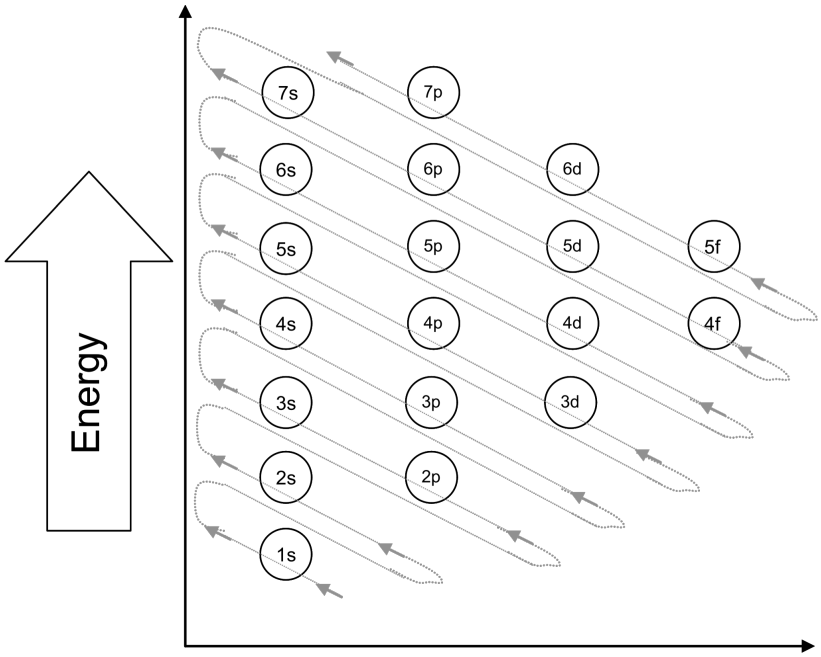
Insoluble Ionic Compounds

5. All hydroxides (OH^-) and metal oxides (containing O^{2-}) are insoluble, *except* those of Group IA and Ca^{2+}, Sr^{2+}, and Ba^{2+}. When metal oxides do dissolve, they give hydroxides (their solutions do not contain O^{2-} ions). For example, $Na_2O(s) + H_2O \rightarrow 2\ NaOH(aq)$.

6. All compounds that contain PO_4^{3-}, CO_3^{2-}, SO_3^{2-}, and CrO_4^{2-} are insoluble, *except* those of Group IA and NH_4^+

Activity Series

Strong reducing agent
K
Ca
Na
Mg - Strong
Al
Cr
Zn
Fe
Cd
Ni - Moderate
Sn
Pb
H_2
Cu - Weak
Ag
Hg
Au



Approximate electronegativity values: noble gases (0); alkali metals (1); transition metals (1.5); metalloids, H, P (2); C, S, Se, I (2.5); N, Cl, Br (3); O (3.5); F (4)