Magic™ Chemistry Sheet

Activity Series

Li
K
Ba
Ca — Replace
Na — H in H_20
Mg — in steam
Al
Mn
Zn
Cr
Fe
Co
Ni
Sn
Pb
H_2
Cu | increasing
Ag | reactivity
Hg |
Pt |
Au

Strong acids

$HCl \Rightarrow H^+, Cl^-$
HBr
HI
H_2SO_4 (first H)
$HClO_3$
$HClO_4$
HNO_3

Weak acids

$HF \Leftrightarrow H^+, F^-$
etc

Strong bases

Grp1 OH^-
$Ba(OH)_2$
$Sr(OH)_2$
$Ca(OH)_2$
$NaOCH_3$
$NaNH_2$

Root Oxyacids

MnO_4^{2-}
WO_4^{2-}
SO_4^{2-}
CrO_4^{2-}
SeO_4^{2-}
AsO_4^{3-}
PO_4^{3-}
AlO_3^{3-}
BO_3^{3-}
CO_3^{2-}
IO_3^-
ClO_3^-
BrO_3^-
NO_3^-
ZnO_2^{2-}

Oxidation States

1,2 Cu Hg
1,3 Au In Tl
2,3 Cr Co Fe Mn
2,4 Pb Pt Sn Zr
3,4 Ce
3,5 Sb As Bi P
2,3,4 Ir Ti
2,4,5 W
3,4,5 U
2,3,4,5 V
1 Ag
2 Cd Zn
3 Ga In Al
4 Ge

Organic Prefixes

1-meth
2-eth
3-prop
4-but
5-pent
6-hex
7-hept
8-oct
9-non
10-dec

Soluble

NO_3^-
ClO_3^-
Group 1
NH_4^+
Formate ?
Acetate ~~Ag*~~
Cl^- ~~Ag Hg_2 Pb*~~
Br^- ~~Ag Hg_2 Pb* Hg*~~
I^- ~~Ag Hg_2 Hg Pb~~
SO_4^{2-} ~~Ba Pb Hg_2 Ca Ag* Sr*~~

Insoluble

CO_3^{2-} ~~grp1, NH_4^+~~
CrO_4^{2-} ~~grp1, NH_4^+ Ca* Sr*~~
OH^- ~~grp1, NH_4^+ Ba Sr* Ca*~~
PO_4^{3-} ~~grp1, NH_4^+~~
SO_3^{2-} ~~grp1, NH_4^+~~
S^{2-} ~~grp1, NH_4^+ grp2~~

*Slightly soluble

Reactions

Mchlorate → O_2 + Mchloride
$(NH_4)_2CO_3 \rightarrow NH_3 + CO_2 + H_2O$
$H_2CO_3 \leftrightarrow H_2O + CO_2$
Moxide + NMoxide→ polyionic
Moxide + H_2O → Mhydroxide
NMoxide + H_2O → oxyacid
dd → H_2S, CO_2, H_2O, H_2
Mcarbonate → Moxide +CO2
Sulfide + acid → H_2S + salt
CO_3 + acid → CO_2 + H_2O
Sulfite + acid → SO_2

Polyatomic Ions

acetate CH_3COO^-
amide NH_2^-
azide N_3^-
formate $HCOO^-$
thiocyanate SCN^-
imide NH^{2-}
ammonium $NH4^+$
hydronium H_3O^+
tartrate $C_4H_4O_6^{2-}$
phthalate $C_8H_4O_4^{2-}$

Functional Groups

Alkene — *-ene*
Alkyne — *-yne*
Alcohol — *-ol*
Ether — *ether*
Haloalkane — *halo-*
Amine — *-amine*
Aldehyde — *-al*
Ketone — *-one*
Carboxylic acid — *-oic acid*
Ester — *-oate*
Amide — *-amide*

Flame Tests

Li – red
Na – yellow
K – lilac
Ca – brick red
Sr – crimson red
Ba – green

$IE = Z_e^2/n^2 * 313.6$ $r_{ave} = .528n^2/Z_e\ (3/2 – l(l+1)/(2n^2))$ $r = n^2 / Z * .528$

$E = -Z^2 * 2.12E\text{-}18 / n^2$ $E = h\nu$ $h = 6.626E\text{-}24$ J/s $\lambda = h/m\nu$

$$E_a = \frac{\ln(k_1/k_2) * 8.314 \text{ J/mol-K}}{1/T_2 - 1/T_1}$$

order	0	1	2
rate law	$r = k$	$r = k[]$	$r = k[]^2$
integrated	$[]_t = -kt + []_0$	$\ln[]_t = -kt + \ln[]_0$	$1/[]_t = kt + 1/[]_0$
half life	$t_{1/2} = []_0/2k$	$t_{1/2} = \ln 0.5 / k$	$t_{1/2} = 1/[]_0 k$

$aA + bB <-> cC + dD$

$$K_c = \frac{[C]^c[D]^d}{[A]^a[B]^b} \qquad K_p = \frac{(P_D)^d(P_C)^c}{(P_A)^a(P_B)^b}$$

K < 1, favors reactants
K > 1, favors products
solids and liquids don't matter
Q = substitute at current concs
Q < K, will make more products

Arrhenius acid – produces H+ in water, base- produces OH- in water
Lowry-Bronsted acid – proton donor, base – proton accepter, amphiprotic – either/or
conjugate acid – what's left when base takes proton
conjugate base – what's left when acid loses proton

$pH = -\log[H+]$ autoionization $K_w = [H+][OH-] = 1E\text{-}14$ (25C) $K_a * K_b = K_w$
$pOH = -\log[OH-]$ $pH + pOH = 14$

ICE Chart, for weaks assume x<<[A-] to avoid quadratic

24 yottaY
21 zetta Z
18 exa E
15 peta P
12 tera T
9 giga G
6 mega M
3 kilo k
-3 milli m
-6 micro μ
-9 nano n
-12 pico p
-15 femto f
-18 atto a
-21 zepto z
-24 yocto y