

IA Group										PERIODIC TABLE OF ELEMENTS										Non Metals					VIII A																																																																																																																																																										
1 1,008 2,2 -253 -260 Hydrogen 1s ¹ IIA										25 54,94 1,55 2097 1244 Mn Manganese [Ar]3d ⁵ 4s ²										2 4,003 -268,6 — Helium 1s ²					2 4,003 -268,6 — Helium 1s ²																																																																																																																																																										
3 6,941 0,98 1318 179 Lithium [He]2s ¹										4 9,012 1,57 — 1278 Beryllium [He]2s ²										5 10,81 2,04 — 2300 Boron [He]2s ² 2p ¹					6 12,01 2,55 4827 3550 Carbon [He]2s ² 2p ²					7 14,01 3,04 -195,8 -209,9 Nitrogen [He]2s ² 2p ³					8 16,00 3,44 -183,0 -218,4 Oxygen [He]2s ² 2p ⁴					9 19,00 4,1 -188,1 -219,6 Fluorine [He]2s ² 2p ⁵					10 20,18 — -246,1 -248,7 Neon 2s ² 2p ⁶																																																																																																																																						
11 22,99 0,93 892 97,8 Sodium [Ne]3s ¹										12 24,30 1,31 1107 651 Magnesium [Ne]3s ²										13 26,98 1,61 2467 660,4 Aluminum [Ne] 3s ² 3p ¹					14 28,09 1,90 2355 1410 Silicon [Ne] 3s ² 3p ²					15 30,97 2,19 280 44 P4 Phosphorus [Ne] 3s ² 3p ³					16 32,06 2,58 444 114,6 Sulfur [Ne] 3s ² 3p ⁴					17 35,45 3,16 -34,6 101,0 Chlorine [Ne] 3s ² 3p ⁵					18 39,95 — -185,7 -189,2 Argon 3s ² 3p ⁶																																																																																																																																						
19 39,10 0,82 774 63,7 Potassium [Ar]4s ¹										20 40,08 1,00 1487 845 Calcium [Ar]4s ²										21 44,96 1,36 2832 1539 Scandium [Ar]3d ¹ 4s ²										22 47,90 1,54 3260 1675 Titanium [Ar]3d ² 4s ²										23 50,94 1,63 3380 1890 Vanadium [Ar]3d ³ 4s ²										24 52,00 1,66 2482 1890 Chromium [Ar]3d ⁴ 4s ²										25 54,94 1,55 2097 1244 Manganese [Ar]3d ⁵ 4s ²										26 55,85 1,83 2750 1535 Iron [Ar]3d ⁶ 4s ²										27 58,93 1,88 2870 1495 Cobalt [Ar] 3d ⁷ 4s ²										28 58,70 1,91 2730 1453 Nickel [Ar] 3d ⁸ 4s ²										29 63,55 1,90 2595 1083 Copper [Ar]3d ¹⁰ 4s ¹										30 65,38 1,65 907 419,6 Zinc [Ar] 3d ¹⁰ 4s ²										31 69,72 1,81 2403 29,8 Gallium [Ar] 3d ¹⁰ 4s ² 4p ¹										32 72,59 2,01 2830 937,4 Germanium [Ar]3d ¹⁰ 4s ² 4p ²										33 74,92 2,18 subl. Arsenic [Ar]3d ¹⁰ 4s ² 4p ³										34 78,96 2,55 685 217 Selenium [Ar] 3d ¹⁰ 4s ² 4p ⁴										35 79,90 2,96 58,8 -7,2 Bromine [Ar] 3d ¹⁰ 4s ² 4p ⁵										36 83,80 — -152,3 -156,6 Krypton 3d ¹⁰ 4s ² 4p ⁶									
37 85,45 0,82 688 38,9 Rubidium [Kr]5s ¹										38 87,62 0,95 1384 769 Strontium [Kr]5s ²										39 88,91 1,22 3337 1523 Yttrium [Kr]4d ¹ 5s ²										40 91,22 1,33 4377 1852 Zirconium [Kr]4d ² 5s ²										41 92,95 1,60 4927 2468 Niobium [Kr]4d ³ 5s ²										42 95,94 2,16 5560 2610 Molybdenum [Kr]4d ⁴ 5s ²										43 (98) 1,9 5030 2200 Technetium [Kr]4d ⁵ 5s ²										44 101,1 2,20 3900 2310 Ruthenium [Kr]4d ⁶ 5s ²										45 102,9 2,28 3730 1966 Rhodium [Kr]4d ⁷ 5s ²										46 106,4 2,20 3140 1552 Palladium [Kr]4d ⁸ 5s ²										47 107,8 1,93 2212 962 Silver [Kr]4d ¹⁰ 5s ¹										48 112,4 1,69 765 320,9 Cadmium [Kr] 4d ¹⁰ 5s ²										49 114,8 1,78 2080 156,6 Indium [Kr] 4d ¹⁰ 5s ² 4p ¹										50 118,7 1,96 2270 231,9 Tin [Kr] 4d ¹⁰ 5s ² 4p ²										51 121,7 2,05 1750 630,7 Antimony [Kr] 4d ¹⁰ 5s ² 4p ³										52 127,6 2,10 890 449,5 Tellurium [Kr] 4d ¹⁰ 5s ² 4p ⁴										53 126,9 2,66 184,4 113,5 Iodine [Kr] 4d ¹⁰ 5s ² 4p ⁵										54 131,29 — -107 -111,9 Xenon 4d ¹⁰ 5s ² 4p ⁶									
55 132,9 0,79 690 28,5 Cesium [Xe] 6s ¹										56 137,3 0,89 1640 725 Barium [Xe] 6s ²										57 138,9 1,10 3454 920 Lanthanum [Xe] 5d ¹ 6s ²										72 178,5 1,30 5400 2150 Hafnium Xe 4f ¹⁴ d ² 6s ²										73 181,0 1,50 5430 2996 Tantalum [Xe] 5d ³ 6s ²										74 183,8 2,36 5927 3410 Tungsten [Xe] 5d ⁴ 6s ²										75 186,2 1,90 5630 3180 Rhenium [Xe] 5d ⁵ 6s ²										76 190,2 2,20 5030 3045 Osmium [Xe] 5d ⁶ 6s ²										77 192,2 2,20 4130 2410 Iridium [Xe] 5d ⁷ 6s ²										78 195,1 2,28 3830 1772 Platinum [Xe] 5d ⁸ 6s ²										79 197,0 2,04 2940 1064 Gold [Xe] 5d ¹⁰ 6s ¹										80 200,6 1,90 356,6 -38,9 Mercury [Xe] 5d ¹⁰ 6s ²										81 204,4 1,80 1457 303,5 Thallium [Xe]5d ¹⁰ 6s ² 4p ¹										82 207,2 1,8 1740 327,5 Lead [Xe] 6s ² 4p ²										83 209,0 1,9 1560 271,3 Bismuth [[Xe] 6s ² 4p ³										84 208,99 2,00 962 254 Polonium [[Xe]6s ² 4p ⁴										85 209,99 2,20 — 302 Astatine [Xe] 6s ² 4p ⁵										86 222,02 — -61,8 — Radon [Xe] 6s ² 4p ⁶									
87 [223,02] 0,70 — 27 Francium [Rn]7s ¹										88 226,03] 0,90 1140 700 Radium [Rn]7s ²										89 [227,03] 1,10 Actinid 1050 Actinium [Rn] 6d ¹ 7s ²										104 [265,12] — — — Rutherfordium Rn5f ¹⁴ 6d ² 7s ²										105 [268,13] — — — Dubnium [Rn]f] 6d ³ 7s ²										106 [271,13] — — — Seaborgium [Rn]f]6d ⁴ 7s ²										107 [270] — — — Bohrium [Rn]f]6d ⁵ 7s ²										108 [277,15] — — — Hassium [Rn]f]6d ⁶ 7s ²										109 [276,15] — — — Meitnerium [Rn]f]6d ⁷ 7s ²										110 [281,16] — — — Darmstadtium [Rn]f]6d ⁸ 7s ²										111 [280,16] — — — Roentgenium [Rn]f]6d ¹⁰ 7s ¹										112 285,17] — — — Copernicium [Rn]f]6d ¹⁰ 7s ²										113 [?] — — — Ununtrium [Rn]d ¹⁰ 7s ² 2p ¹										114 289,19] — — — Flerovium [Rn] d ¹⁰ 7s ² 3p ²										116 [293] — — — Livermorium [Rn] d ¹⁰ 7s ² 5p ²										Metals										Non Metals																			
58 140,1 1,12 3257 798 Cerium [Xe] 4f ² 6s ²										59 140,9 1,13 3212 931 Praseodymium [Xe]4f ³ 6s ²										60 144,2 1,14 3127 1010 Neodymium [Xe]4f ⁴ 6s ²										61 (145) 1,13 1080 Promethium [Xe] 4f ⁵ 6s ²										62 150,4 1,17 1778 1072 Samarium [Xe]4f ⁶ 6s ²										63 151,96 1,20 1597 822 Europium [Xe]4f ⁷ 6s ²										64 157,2 1,20 3233 1312 Gadolinium Xe 4f ⁷ 5d ¹ 6s ²										65 158,9 1,20 3041 1360 Terbium [Xe]4f ⁹ 6s ²										66 162,5 1,22 2335 1409 Dysprosium [Xe]4f ¹⁰ 6s ²										67 164,9 1,23 2720 1470 Holmium [Xe]4f ¹¹ 6s ²										68 167,3 1,24 2510 1522 Erbium [Xe]4f ¹² 6s ²										69 168,9 1,25 1727 1545 Thulium [Xe]4f ¹³ 6s ²										70 173,0 1,10 1193 824 Ytterbium [Xe]4f ¹⁴ 6s ²										71 175,0 1,27 3315 1656 Lutetium [Xe]4f ¹⁴ 5d ¹ 6s ²																																																	
90 232,0 1,30 3800 1750 Thorium [Rn] 6d ² 7s ²										91 231,04 1,50 1554 Protactinium [Rn] 5f ² 6d ¹ 7s ²										92 238,0 1,38 3818 1132 Uranium [Rn] 5f ³ 6d ¹ 7s ²										93 237,05 1,36 3902 640 Neptunium [Rn] 5f ⁴ 6d ¹ 7s ²										94 244,06 1,28 3327 641 Plutonium [Rn] 5f ⁶ 7s ²										95 243,06 1,30 1000 Americium [Rn] 5f ⁷ 7s ²										96 247,07 1,30 1340 Curium [Rn] 5f ⁷ 6d ¹ 7s ²										97 247,07 1,30 986 Berkelium [Rn] 5f ⁹ 7s ²										98 251,08 1,30 900 Californium [Rn] 5f ¹⁰ 7s ²										99 252,08 1,30 — Einsteinium [Rn] 5f ¹¹ 7s ²										100 257,09] 1,30 — Fermium [Rn] 5f ¹² 7s ²										101 258,10 1,30 — Mendelevium [Rn] 5f ¹³ 7s ²										102 259,10 1,30 — Nobelium [Rn] 5f ¹⁴ 7s ²										103 260,11 — — Lawrencium [Rn]5f ¹⁴ 6d ¹ 7s ²																																																	

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Standard Electrode Potentials

E	Red. form=Oxidized form+ne ⁻	H ₂ O classic E _o	Thermodyn. H ₂ O account	Absolute -0.3982 V
H	$\text{H(Pt)+H}_2\text{O}=\text{H}_3\text{O}^++(\text{Pt})+\text{e}^-$ $\text{H(Pt)+OH}^-=\text{H}_2\text{O}+(\text{Pt})+\text{e}^-$	classic 0 -0.932195	0.10166 -0.93268	-0.2965 -1.33088
O	$6\text{H}_2\text{O}=\text{O}_2^{(g)}+4\text{H}_3\text{O}^++4\text{e}^-$ $\text{H}_2\text{O}_2+2\text{H}_2\text{O}=\text{O}_2^{\text{aq}}+2\text{H}_3\text{O}^++\text{e}^-$ $4\text{H}_2\text{O}=\text{H}_2\text{O}_2+2\text{H}_3\text{O}^++2\text{e}^-$ $\text{H}_2\text{O}_2^{\text{aq}}+2\text{H}_2\text{O}=\text{O}_2^{\text{aq}}+2\text{H}_3\text{O}^++2\text{e}^-$	1.2288 1.2764 1.776 0.6945	+1.48466 +1.58416 +2.08366 0.8477	1.0865 1.0829 1.6855 0.4495
N	$\text{NO}_2^-+2\text{OH}^-=\text{NO}_3^-+\text{H}_2\text{O}+2\text{e}^-$ $\text{HNO}_2+4\text{H}_2\text{O}=\text{NO}_3^-+3\text{H}_3\text{O}^++2\text{e}^-$ $\text{NO}_{\text{aq}}+6\text{H}_2\text{O}=\text{NO}_3^-+4\text{H}_3\text{O}^++3\text{e}^-$ $\text{NH}_4^++13\text{H}_2\text{O}=\text{NO}_3^-+10\text{H}_3\text{O}^++8\text{e}^-$	0.01 0.94 0.96 0.87	0.0602 1.2477 1.2677 1.4180	-0.3380 0.8495 0.8695 1.0198
Br	$2\text{Br}^-=\text{Br}_2(\text{aq})+2\text{e}^-$	1.0873	1.18896	0.79076
Bi	$\text{BiO}^++6\text{H}_2\text{O}=\text{BiO}_3^-+4\text{H}_3\text{O}^++2\text{e}^-$	1.80	2.210645	1.812445
Mn	$\text{Mn}^{2+}+12\text{H}_2\text{O}=\text{MnO}_4^-+8\text{H}_3\text{O}^++5\text{e}^-$ $\text{MnO}_2+4\text{OH}^-=\text{MnO}_4^-+2\text{H}_2\text{O}+3\text{e}^-$ $\text{MnO}_4^{2-}=\text{MnO}_4^-+\text{e}^-$	1.51 0.603 0.558	1.8588 0.6360 0.6597	1.4506 0.2378 0.2615
Pb	$\text{Pb}^{2+}+6\text{H}_2\text{O}=\text{PbO}_2(\text{s})+4\text{H}_3\text{O}^++2\text{e}^-$ $\text{Pb}+\text{H}_2\text{O}=\text{Pb}^{2+}+2\text{e}^-$	1.455 -0.126	1.8656 0.0272	1.4674 -0.3710
S	$\text{H}_2\text{SO}_3+4\text{H}_2\text{O}=\text{HSO}_4^-+3\text{H}_3\text{O}^++2\text{e}^-$ $\text{HSO}_3^-+4\text{H}_2\text{O}=\text{SO}_4^{2-}+3\text{H}_3\text{O}^++2\text{e}^-$ $\text{SO}_3^{2-}+2\text{OH}^-=\text{SO}_4^{2-}+\text{H}_2\text{O}+2\text{e}^-$ $\text{S}^{2-}=\text{S}_{\text{rombic}}+\text{H}_2\text{O}+2\text{e}^-$ $\text{HS}^-+\text{OH}^-=\text{S}_{\text{rombic}}+2\text{H}_2\text{O}+2\text{e}^-$ $\text{H}_2\text{S}_{\text{aq}}+2\text{H}_2\text{O}=\text{S}_{\text{rombic}}+2\text{H}_3\text{O}^++2\text{e}^-$ $2\text{S}_2\text{O}_3^{2-}=\text{S}_4\text{O}_6^{2-}+2\text{e}^-$	0.172 0.172 -0.93 -0.4763 -0.478 0.142 0.08	0.47965 0.47965 -0.87984 -0.4261 -0.4793 0.3467 0.18166	0.08145 0.08145 -1.27804 -0.8243 -0.8775 -0.0515 -0.2165
Fe	$\text{Fe}^{2+}=\text{Fe}^{3+}+\text{e}^-$ $\text{Fe}(\text{s})+\text{H}_2\text{O}=\text{Fe}^{2+}+2\text{e}^-$	0.769 -0.4402	0.8717 -0.2870	0.4735 -0.6852
Ag	$\text{Ag}+\text{H}_2\text{O}=\text{Ag}^++\text{e}^-$ $\text{Ag}(\text{s})+\text{Cl}^-=\text{AgCl}(\text{s})+\text{H}_2\text{O}+\text{e}^-$ $\text{Ag}+2\text{NH}_3(\text{aq})=\text{Ag}(\text{NH}_3)_2^++\text{e}^-$ $2\text{Ag}+2\text{OH}^-=\text{Ag}_2\text{O}(\text{s})+\text{H}_2\text{O}+2\text{e}^-$	0.7994 0.2223 0.373 0.345	1.0041 0.2210 0.4747 0.3952	0.6059 -0.1772 0.0765 -0.0030
I	$3\text{I}^-=\text{I}_3^-+2\text{e}^-$	0.6276	0.72926	0.33106
Cu	$\text{Cu}(\text{Hg})+\text{H}_2\text{O}=\text{Cu}^{2+}+(\text{Hg})+2\text{e}^-$	0.3435	0.4967	0.0985
F	$2\text{F}^-=\text{F}_2(\text{g})+2\text{e}^-$	2.87	2.97166	2.5735
Cl	$2\text{Cl}^-=\text{Cl}_2(\text{g})+2\text{e}^-$ $\text{Cl}_2(\text{g})+4\text{H}_2\text{O}=2\text{HOCl}+2\text{H}_3\text{O}^++2\text{e}^-$	1.358 1.63	1.45966 1.93765	1.06146 1.53945
Cr	$2\text{Cr}^{3+}+21\text{H}_2\text{O}=\text{Cr}_2\text{O}_7^{2-}+14\text{H}_3\text{O}^++6\text{e}^-$ $\text{Cr}^{3+}+11\text{H}_2\text{O}=\text{HCrO}_4^-+7\text{H}_3\text{O}^++3\text{e}^-$	1.33 1.20	1.7921 1.6793	1.3939 1.2811
C	$\text{H}_2\text{C}_2\text{O}_4+2\text{H}_2\text{O}=2\text{CO}_2+2\text{H}_3\text{O}^++2\text{e}^-$	-0.49	-0.28534	-0.6835
Cr	$\text{Cr}+\text{H}_2\text{O}=\text{Cr}^{3+}+3\text{e}^-$	-0.744	-0.6080	-1.0062
Zn	$\text{Zn}+\text{H}_2\text{O}=\text{Zn}^{2+}+2\text{e}^-$	-0.7628	-0.6096	-1.0078
Al	$\text{Al}+\text{H}_2\text{O}=\text{Al}^{3+}+3\text{e}^-$	-1.662	-1.5260	-1.9242
Al	$\text{Al}+4\text{OH}^-=\text{H}_2\text{AlO}_3^-+\text{H}_2\text{O}+3\text{e}^-$	-2.33	-2.2627	-2.6609

SOLUBILITY OF SALTS

ion	H ⁺	NH ₄ ⁺	K ⁺	Na ⁺	Ba ²⁺	Ca ²⁺	Mg ²⁺	Al ³⁺	Cr ³⁺	Fe ²⁺	Fe ³⁺	Mn ²⁺	Zn ²⁺	Ag ⁺	Hg ²⁺	Pb ²⁺	Sn ²⁺	Cu ²⁺
Cl ⁻	+	+	+	+	+	+	+	+	+	+	+	+	+	n	+	s	+	+
S ²⁻	+	+	+	+	+	s	+	#	#	n	n	n	n	n	n	n	n	n
SO ₃ ²⁻	+	+	+	+	n	n	n	#	#	n	#	n	n	n	n	n	#	n
SO ₄ ²⁻	+	+	+	+	n	s	+	+	+	+	+	+	+	s	+	n	+	+
PO ₄ ³⁻	+	+	+	+	n	n	n	n	n	n	n	n	n	n	n	n	n	n
CO ₃ ²⁻	+	+	+	+	n	n	n	#	#	n	#	n	n	n	n	n	n	n
SiO ₃ ²⁻	n	#	+	+	n	n	n	n	n	n	n	n	n	#	n	#	n	n
NO ₃ ⁻	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
acetate ⁻	+	+	+	+	+	+	+	s	+	+	+	+	+	+	+	+	+	+
OH ⁻	#	+	+	+	+	s	n	n	n	n	n	n	n	#	#	nn	n	n

Symbols in the table:

+ - soluble, n - practically insoluble, s - slightly soluble, # salt doesn't exist in water solution

-all nitrates NO₃⁻ are soluble .

What to remember about solubility:

-most chlorides Cl⁻, sulfates SO₄²⁻ and acetates CH₃COO⁻ are soluble .

-for other acids usually just the salts of alkaline metals (Na⁺, K⁺) and ammonium NH₄⁺ are soluble.

- sulfides S²⁻ usually are insoluble salts .

THE RANK OF METAL ACTIVITY (OF MEAL STANDARD POTENTIALS)

Li > K > Ca > Na > Mg > Al > Mn > Cr > Zn > Fe >

> Co > Ni > Sn > Pb > ~~Hg~~ > Cu > Hg > Ag > Au