

# Periodic Table of the Elements

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII			IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1 H 1.008 2.20																	2 He 4.002602 5.50†
3 Li 6.94 0.98	4 Be 9.012 183 1 1.57											5 B 10.81 2.04	6 C 12.011 2.55	7 N 14.007 3.04	8 O 15.999 3.44	9 F 18.998 403 163 3.98	10 Ne 20.1797 4.84†
11 Na 22.989 769 28 0.93	12 Mg 24.3050 1.31											13 Al 26.981 5385 1.61	14 Si 28.085 1.90	15 P 30.973 761 998 2.19	16 S 32.06 2.58	17 Cl 35.45 3.16	18 Ar 39.948 3.20†
19 K 39.0983 0.82	20 Ca 40.078 1.00	21 Sc 44.955 908 1.36	22 Ti 47.867 1.54	23 V 50.9415 1.63	24 Cr 51.9961 1.66	25 Mn 54.938044 1.55	26 Fe 55.845 1.88	27 Co 58.933 194 1.88	28 Ni 58.6934 1.91	29 Cu 63.546 1.90	30 Zn 65.38 1.65	31 Ga 69.723 1.81	32 Ge 72.63 2.01	33 As 74.921 595 2.18	34 Se 78.971 2.55	35 Br 79.904 2.96	36 Kr 83.798 2.94†
37 Rb 85.4678 0.82	38 Sr 87.62 0.95	39 Y 88.905 84 1.22	40 Zr 91.224 1.33	41 Nb 92.906 37 1.6	42 Mo 95.95 2.16	43 Tc [97] 1.9	44 Ru 101.07 2.2	45 Rh 102.905 50 2.28	46 Pd 106.42 2.20	47 Ag 107.8682 1.93	48 Cd 112.414 1.69	49 In 114.818 1.78	50 Sn 118.710 1.96	51 Sb 121.760 2.05	52 Te 127.60 2.1	53 I 126.904 47 2.68	54 Xe 131.293 2.6
55 Cs 132.905 451 96 0.79	56 Ba 137.327 0.89	57 La 138.905 47 1.10	72 Hf 178.49 1.3	73 Ta 180.947 88 1.5	74 W 183.84 2.36	75 Re 186.207 1.9	76 Os 190.23 2.2	77 Ir 192.217 2.20	78 Pt 195.084 2.28	79 Au 196.966 569 2.54	80 Hg 200.592 2.00	81 Tl 204.38 1.62	82 Pb 207.2 2.33	83 Bi 208.980 40 2.02	84 Po [209] 2.0	85 At [210] 2.2	86 Rn [222] 2.06†
87 Fr [223] 0.7	88 Ra [226] 0.89	89 Ac [227] 1.1	104 Rf [267] --	105 Db [270] --	106 Sg [269] --	107 Bh [270] --	108 Hs [270] --	109 Mt [278] --	110 Ds [281] --	111 Rg [281] --	112 Cn [285] --	113 Nh [286] --	114 Fl [289] --	115 Mc [289] --	116 Lv [293] --	117 Ts [293] --	118 Og [294] --

58 Ce 140.116 1.12	59 Pr 140.907 66 1.13	60 Nd 144.242 1.14	61 Pm [145] 1.07†	62 Sm 150.36 1.17	63 Eu 151.964 1.01†	64 Gd 157.25 1.20	65 Tb 158.925 35 1.10†	66 Dy 162.500 1.22	67 Ho 164.930 33 1.23	68 Er 167.259 1.24	69 Tm 168.934 22 1.25	70 Yb 173.045 1.06†	71 Lu 174.9668 1.27
90 Th 232.0377 1.3	91 Pa 231.035 88 1.5	92 U 238.028 91 1.38	93 Np [237] 1.36	94 Pu [244] 1.28	95 Am [243] 1.3	96 Cm [247] 1.3	97 Bk [247] 1.3	98 Cf [251] 1.3	99 Es [252] 1.3	100 Fm [257] 1.3	101 Md [258] 1.3	102 No [259] 1.3	103 Lr [262] 1.3

s-block

p-block

d-block

f-block

Atomic Number	Xx	Xx	Xx	Xx
Atomic Symbol	Xx	Xx	Xx	Xx
Relative Average Atomic Mass	Solid	Liquid	Gas	Synthetic
Electronegativity				

Electronegativity values are those of Pauling except † from Allred  
Atomic masses conform to NIST 2005 values. \* indicates provisional IUPAC symbol.  
Values in square brackets [ ] are mass numbers of longest lived isotope.  
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Single Bonds (in kJ mol <sup>-1</sup> )												
	H	C	N	O	S	F	Cl	Br	I	B	Si	As
H	436											
C	414	346										
N	391	286	158									
O	463	358	214	144								
S	364	289		265	266							
F	567	485	278	191	327	159						
Cl	431	327	192	206	271	255	242					
Br	366	285	163	201	218	249	219	193				
I	298	228		201		280	211	178	151			
B	389	356		536		613	456	410		293		
Si	323	307		466	293	597	400	330	234		226	
As	247			301		484	322	458	200			146

  

Multiple Bonds (in kJ mol <sup>-1</sup> )												
C=C	614			C=C	839			N=N	470		S=S	429
C=N	615			C≡N	890			N=O	587		P=O	544
C=O	745	799 in CO <sub>2</sub>		C=O	1076			O=O	498		P=S	335
C=S	536			N≡N	945			S=O	532			

#### Some Useful Constants

Avogadro constant, $N_A$	$6.022\ 141\ 79 \times 10^{23}\ \text{mol}^{-1}$	Planck constant, $h$	$6.626\ 068\ 96 \times 10^{-34}\ \text{J s}$
Ideal gas constant, $R$	$8.314\ 472\ \text{J mol}^{-1}\ \text{K}^{-1}$	Rydberg constant, $R_H$	$2.179\ 871\ 97 \times 10^{-18}\ \text{J}$
	$0.082\ 057\ 458\ 7\ \text{L atm mol}^{-1}\ \text{K}^{-1}$	Faraday constant, $F$	$96\ 485.339\ 9\ \text{C mol}^{-1}$
	$0.083\ 144\ 72\ \text{L bar mol}^{-1}\ \text{K}^{-1}$	Specific heat of liquid water, $s_l$	$4.181\ \text{J g}^{-1}\ \text{°C}^{-1}$
	$62.363\ 668\ 6\ \text{L torr(mmHg) mol}^{-1}\ \text{K}^{-1}$	Specific heat of solid water, $s_s$	$2.050\ \text{J g}^{-1}\ \text{°C}^{-1}$
Molar volume of an ideal gas, $V_m$	$22.413\ 996\ \text{L mol}^{-1}$ (at 273.15 K and 1.000 atm)	Specific heat of water vapor, $s_g$	$2.027\ \text{J g}^{-1}\ \text{°C}^{-1}$
	$22.710\ 981\ \text{L mol}^{-1}$ (at 273.15 K and 1.000 bar)	Heat of vaporization of water, $\Delta H_{\text{vap}}$	$40.9\ \text{kJ mol}^{-1}$ (at 100.0°C)
Speed of light, $c$	$299\ 792\ 458\ \text{m s}^{-1}$ (exact)	Heat of fusion of water, $\Delta H_{\text{fus}}$	$6.01\ \text{kJ mol}^{-1}$
Ebullioscopic constant for water, $K_b$	$0.512\ \text{°C m}^{-1}$	Cryoscopic constant for water, $K_f$	$1.858\ \text{°C m}^{-1}$
Mass of hydrogen-1, $^1_1\text{H}$	$1.007\ 825\ 032\ 23\ \text{amu}$	Mass of the neutron, $^1_0\text{n}$	$1.008\ 664\ 915\ 85\ \text{amu}$
Mass of the electron, $^0_{-1}\text{e}$	$5.485\ 799\ 094\ 3 \times 10^{-4}\ \text{amu}$	Mass of the alpha particle, $^4_2\text{He}$	$4.002\ 603\ 254\ 13\ \text{amu}$

#### Solubility Rules

Salts which are soluble:

1. All salts containing Group IA ions.
2. All salts containing ammonium ion
3. All salts containing nitrate ions and chlorate ions

Salts which are generally soluble with some exceptions:

1. All salts containing acetate ions except with silver and mercury(I).
2. All chlorides, bromides, and iodides are soluble except with silver, lead(II), and mercury(I).
3. All sulfates are soluble except with silver, lead(II), mercury(I), calcium, strontium, and barium.

Salts which are generally insoluble with some exceptions:

1. All hydroxides are insoluble except with Group IA ions, calcium, strontium, and barium.
2. All carbonates, phosphates, and sulfides are insoluble except with Group IA ions and ammonium ions.