

Periodic Table of the Elements

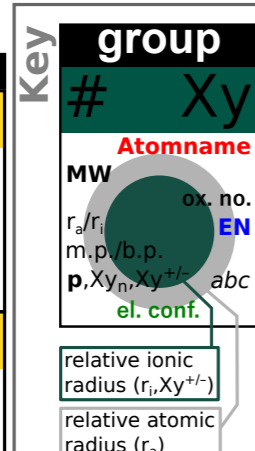
Alkali metal	Alkaline earth metal	Lanthanide	Actinide	Transition metal	Post transition metal	Metalloid	Nonmetal	Noble gas	Unclassified	Group 17 = Halogen
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REFERENCES:

[MW] Commission on Isotopic Abundances and Atomic Weights, <http://www.ciaaw.org/>
[r_a] E. Clementi, D.L. Raimondi, W.P. Reinhardt, *J. Chem. Phys.*, **1967**, *47*, 1300-1307.
[r_i] R. D. Shannon, *Acta Cryst.*, **1976**, *A32*, 751-767 and https://en.wikipedia.org/wiki/ionic_radius.
[m.s., b.p., phases, cryst. struct., ox. no.] <https://www.wikipedia.org>
[EN] A. L. Allred, *J. Inorg. Nucl. Chem.*, **1961**, *17*, 215-221.
[Constants] <http://physics.nist.gov/cuu/Constants/index.html>

1 H Hydrogen 1.00794 -1,1 52.9/154 13.99/20.271 g, H ₂ , H 1s ²
3 Li Lithium 6.941 1 167/90 453.65/1603 s, Li, Li ⁺ 1s ² 2s ¹
11 Na Sodium 22.98976928(2) 1 190/116 370.94/1156.09 s, Na, Na ⁺ [Ne]3s ¹
19 K Potassium 39.0983(1) 1 243/152 336.7/1032 s, K, K ⁺ [Ar]4s ¹
55 Cs Cesium 132.90545196 1 298/181 301.7/944 s, Cs, Cs ⁺ [Xe]6s ¹
87 Fr Francium (223) 1 n.a./n.a. n.a./n.a. n.a./n.a., n.a. [Rn]7s ¹

2 He Helium 4.002602(2) - 31/- 0.95/4.222 g, He 1s ²
4 Be Beryllium 9.0121831(5) 2 112/59 1560/2742 s, Be, Be ²⁺ 1s ² 2s ²
12 Mg Magnesium 24.305 2 145/86 923/1363 s, Mg, Mg ²⁺ [Ne]3s ²
20 Ca Calcium 40.078(4) 2 194/114 1115/1757 s, Ca, Ca ²⁺ [Ar]4s ²
38 Sr Strontium 87.62(1) 2 219/132 1050/1650 s, Sr, Sr ²⁺ [Kr]5s ²
56 Ba Barium 137.327(7) 2 253/149 1000/2118 s, Ba, Ba ²⁺ [Xe]6s ²
88 Ra Radium (226) 2 n.a./162 973/2010 s, Ra, Ra ²⁺ [Rn]7s ²



Note: values written in gray are predictions
#.....Atomic number
Xy.....Symbol
Atomname.....If written in black, the atom is usually produced synthetically.
MW.....Molecular weight (g/mol)
ox. no.Most common oxidation states
EN.....Electro negativity (pauling scale)
r_a.....atomic radius (pm)
r_i.....ionic radius (pm)
m.p.melting point (K)*
b.p.boiling point (K)*
pphases*: solid (s), liquid (l), gas (g)
Xy.....Elementar form
Xy⁺.....Ion corresponding to r_i
el. conf.electron configuration
abc.....crystal structure
*Values at STP (273.15 K, 1 bar)

Equations:
Concentration: $c = n/V$ [mol/L]
Amount of substance: n [mol]
Volume: V [L]
Particle number: $N = n \cdot N_A$
Pressure: p [Pa]
Ideal gas equation: $pV = nRT = Nk_B T$

Conversion factors:

1 μm = 10⁻⁶ m; 1 nm = 10⁻⁹ m; 1 Å (Angs.) = 10⁻¹⁰ m; 1 pm = 10⁻¹² m; 1 fm = 10⁻¹⁵ m
1 bar = 10⁵ N/m² = 10⁵ Pa; 1 atm = 101325 Pa = 1.01325 bar
Torr = 1/760 atm = 1.333 mbar = 1 mmHg
1 L = 10⁻³ m³ = 1 dm³ = 10³ cm³ = 10⁶ mm³

Constants:

Avogadro number $N_A = 6.022\ 141\ 79(30) \cdot 10^{23}$ mol⁻¹
Mass of proton $m_p = 1.672\ 621\ 777(74) \cdot 10^{-27}$ kg
Mass of electron $m_e = 9.109\ 382\ 91(40) \cdot 10^{-31}$ kg
Mass of neutron $m_n = 1.674\ 927\ 351(74) \cdot 10^{-27}$ kg
Standard temperature $T_s = 273.15$ K = 0 °C
Universal gas constant $R = 8.314\ 472(15)$ J/(mol·K)
Boltzmann-constant $k_B = 1.380\ 650\ 4(24) \cdot 10^{-23}$ J/K
Speed of light $c = 2.997\ 924\ 58 \cdot 10^8$ m/s
Elementary charge $e = 1.602\ 176\ 487(40) \cdot 10^{-19}$ C
Planck constant $h = 6.626\ 068\ 96(33) \cdot 10^{-34}$ J·s
 $\hbar = h/2\pi = 1.054\ 571\ 628(53) \cdot 10^{-34}$ J·s
Unified atomic mass unit $1\ u = 1.660\ 538\ 921(73) \cdot 10^{-27}$ kg
The unified atomic mass is equal to 1/12 of the mass of a single isolated C-atom.

21 Sc Scandium 44.955908(5) 3 184/88.5 1814/3109 s, Sc, Sc ³⁺ [Ar]3d ¹ 4s ²	22 Ti Titanium 47.867(1) 4 176/74.5 1814/3109 s, Ti, Ti ⁴⁺ [Ar]3d ² 4s ²	23 V Vanadium 50.9415(1) 5 171/68 161/60 1519/2334 s, V, V ⁵⁺ [Ar]3d ³ 4s ²	24 Cr Chromium 51.9961(6) 6 166/58 2180/2944 s, Cr, Cr ⁶⁺ [Ar]3d ⁵ 4s ¹	25 Mn Manganese 54.938044(3) 7 161/60 1768/3200 s, Mn, Mn ²⁺ [Ar]3d ⁵ 4s ²	26 Fe Iron 55.845(2) 8 156/39 1811/3134 s, Fe, Fe ²⁺ [Ar]3d ⁶ 4s ²	27 Co Cobalt 58.933194(4) 9 152/68.5 1728/3200 s, Co, Co ³⁺ [Ar]3d ⁷ 4s ²	28 Ni Nickel 58.6934(4) 10 149/83 1728/3200 s, Ni, Ni ²⁺ [Ar]3d ⁸ 4s ²	29 Cu Copper 63.546(3) 11 145/87 1357.77/2835 s, Cu, Cu ²⁺ [Ar]3d ¹⁰ 4s ¹	30 Zn Zinc 65.38(2) 12 142/88 692.68/1180 s, Zn, Zn ²⁺ [Ar]3d ¹⁰ 4s ²	31 Ga Gallium 69.723(1) 13 136/76 302.91/2673 s, Ga, Ga ³⁺ [Ar]3d ¹⁰ 4s ² 4p ¹	32 Ge Germanium 72.630(8) 14 125/67 1211.40/3106 s, Ge, Ge ⁴⁺ [Ar]3d ¹⁰ 4s ² 4p ²	33 As Arsenic 74.921595(6) 15 114/72 887 (subl.) s, As, As ³⁺ [Ar]3d ¹⁰ 4s ² 4p ³	34 Se Selenium 78.971(8) 16 103/184 494/958 s, Se, Se ²⁻ [Ar]3d ¹⁰ 4s ² 4p ⁴	35 Br Bromine 79.904 17 94/182 265.8/332.0 l, Br ₂ , Br ⁻ [Ar]3d ¹⁰ 4s ² 4p ⁵	36 Kr Krypton 83.798(2) 18 88/- 115.78/119.93 g, Kr [Ar]3d ¹⁰ 4s ² 4p ⁶		
37 Rb Rubidium 85.4678(3) 1 265/166 312.45/961 s, Rb, Rb ⁺ [Kr]5s ¹	38 Sr Strontium 87.62(1) 2 219/132 1050/1650 s, Sr, Sr ²⁺ [Kr]5s ²	39 Y Yttrium 88.90584(2) 3 212/104 1799/3203 s, Y, Y ³⁺ [Kr]4d ¹ 5s ²	40 Zr Zirconium 91.224(2) 4 206/86 2128/4650 s, Zr, Zr ⁴⁺ [Kr]4d ² 5s ²	41 Nb Niobium 92.90637(2) 5 198/78 2750/5017 s, Nb, Nb ⁵⁺ [Kr]4d ⁴ 5s ¹	42 Mo Molybdenum 95.95(1) 6 190/73 2896/4912 s, Mo, Mo ⁶⁺ [Kr]4d ⁵ 5s ¹	43 Tc Technetium (98) 7 183/70 2430/4538 s, Tc, Tc ⁷⁺ [Kr]4d ⁵ 5s ²	44 Ru Ruthenium 101.07(2) 8 178/76 2607/4423 s, Ru, Ru ⁴⁺ [Kr]4d ⁷ 5s ¹	45 Rh Rhodium 102.90550(2) 9 173/80.5 2237/3968 s, Rh, Rh ³⁺ [Kr]4d ⁸ 5s ¹	46 Pd Palladium 106.42(1) 10 169/100 1828.05/3236 s, Pd, Pd ²⁺ [Kr]4d ¹⁰	47 Ag Silver 107.8682(2) 11 165/129 1234.93/2435 s, Ag, Ag ⁺ [Kr]4d ¹⁰ 5s ¹	48 Cd Cadmium 112.414(4) 12 161/109 594.22/1040 s, Cd, Cd ²⁺ [Kr]4d ¹⁰ 5s ²	49 In Indium 114.818(1) 13 156/94 429.75/2345 s, In, In ³⁺ [Kr]4d ¹⁰ 5s ² 4p ¹	50 Sn Tin 118.710(7) 14 145/83 505.08/2875 s, Sn, Sn ⁴⁺ [Kr]4d ¹⁰ 5s ² 4p ²	51 Sb Antimony 121.760(1) 15 133/74 903.73/1908 s, Sb, Sb ³⁺ [Kr]4d ¹⁰ 5s ² 4p ³	52 Te Tellurium 127.60(3) 16 123/207 722.66/1261 s, Te, Te ²⁻ [Kr]4d ¹⁰ 5s ² 4p ⁴	53 I Iodine 126.90447(3) 17 115/206 386.85/457.4 s, I ₂ , I ⁻ [Kr]4d ¹⁰ 5s ² 4p ⁵	54 Xe Xenon 131.293(6) 18 108 161.40/165.051 g, Xe [Kr]4d ¹⁰ 5s ² 4p ⁶
57-71 Lanthanide	72 Hf Hafnium 178.49(2) 4 208/85 2506/4876 s, Hf, Hf ⁴⁺ [Xe]4f ¹⁴ 5d ² 6s ²	73 Ta Tantalum 180.94788(2) 5 200/78 3290/5731 s, Ta, Ta ⁵⁺ [Xe]4f ¹⁴ 5d ³ 6s ²	74 W Tungsten 183.84(1) 6 193/74 3459/5869 s, W, W ⁶⁺ [Xe]4f ¹⁴ 5d ⁴ 6s ²	75 Re Rhenium 186.207(1) 7 188/67 3459/5869 s, Re, Re ⁷⁺ [Xe]4f ¹⁴ 5d ⁵ 6s ²	76 Os Osmium 190.23(3) 8 185/53 3105/5285 s, Os, Os ⁸⁺ [Xe]4f ¹⁴ 5d ⁶ 6s ²	77 Ir Iridium 192.227(3) 9 180/82 2719/4403 s, Ir, Ir ³⁺ [Xe]4f ¹⁴ 5d ⁷ 6s ²	78 Pt Platinum 195.084(9) 10 177/94 2041.4/4098 s, Pt, Pt ²⁺ [Xe]4f ¹⁴ 5d ⁹ 6s ¹	79 Au Gold 196.966569(5) 11 174/99 1629.33/2435 s, Au, Au ³⁺ [Xe]4f ¹⁴ 5d ¹⁰ 6s ¹	80 Hg Mercury 200.592(3) 12 171/116 234.3210/629.88 l, Hg, Hg ²⁺ [Xe]4f ¹⁴ 5d ¹⁰ 6s ²	81 Tl Thallium 204.38 13 156/102.5 577/1746 s, Tl, Tl ³⁺ [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 4p ¹	82 Pb Lead 207.2(1) 14 154/133 600.61/2022 s, Pb, Pb ²⁺ [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 4p ²	83 Bi Bismuth 208.98040(1) 15 143/90 544.7/1837 s, Bi, Bi ³⁺ [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 4p ³	84 Po Polonium (209) 16 135/108 527/n.a. n.a./n.a., n.a. [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 4p ⁴	85 At Astatine (210) 17 127/n.a. 575/610 n.a./n.a., n.a. [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 4p ⁵	86 Rn Radon (222) 18 120 202/211.5 g, Rn [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 4p ⁶		
89-103 Actinide	104 Rf Rutherfordium (267) 4 n.a./n.a. 2400/5800 s, n.a., n.a. [Rn]5f ¹⁴ 6d ² 7s ²	105 Db Dubnium (268) 5 n.a./n.a. n.a./n.a. n.a./n.a. [Rn]5f ¹⁴ 6d ³ 7s ²	106 Sg Seaborgium (269) 6 n.a./n.a. n.a./n.a. n.a./n.a. [Rn]5f ¹⁴ 6d ⁴ 7s ²	107 Bh Bohrium (270) 7 n.a./n.a. n.a./n.a. n.a./n.a. [Rn]5f ¹⁴ 6d ⁵ 7s ²	108 Hs Hassium (269) 8 n.a./n.a. n.a./n.a. n.a./n.a. [Rn]5f ¹⁴ 6d ⁶ 7s ²	109 Mt Meitnerium (278) 9 n.a./n.a. n.a./n.a. n.a./n.a. [Rn]5f ¹⁴ 6d ⁷ 7s ²	110 Ds Darmstadtium (281) 10 n.a./n.a. n.a./n.a. n.a./n.a. [Rn]5f ¹⁴ 6d ⁸ 7s ²	111 Rg Roentgenium (282) 11 n.a./n.a. 1814/3109 n.a./n.a. [Rn]5f ¹⁴ 6d ⁹ 7s ²	112 Cn Copernicium (285) 12 n.a./n.a. n.a./n.a. n.a./n.a. [Rn]5f ¹⁴ 6d ¹⁰ 7s ²	113 Nh Nihonium (286) 13 n.a./n.a. 700/1430 n.a./n.a. [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 4p ¹	114 Fl Flerovium (289) 14 n.a./n.a. 340/420 n.a./n.a. [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 4p ²	115 Mc Moscovium (289) 15 n.a./n.a. 670/1400 n.a./n.a. [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 4p ³	116 Lv Livermorium (293) 16 n.a./n.a. n.a./n.a. n.a./n.a. [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 4p ⁴	117 Ts Tennesine (294) 17 n.a./n.a. n.a./n.a. n.a./n.a. [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 4p ⁵	118 Og Oganesson (294) 18 n.a./n.a. n.a./n.a. n.a./n.a. [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 4p ⁶		

57 La Lanthanum 138.90547(7) 3 n.a./117.2 1193/3737 s, La, La ³⁺ [Xe]5d ¹ 6s ²	58 Ce Cerium 140.116(1) 4 n.a./101 1068/3716 s, Ce, Ce ⁴⁺ [Xe]4f ¹ 5d ¹ 6s ²	59 Pr Praseodymium 140.90766(2) 3 n.a./113 1208/3403 s, Pr, Pr ³⁺ [Xe]4f ³ 6s ²	60 Nd Neodymium 144.242(3) 3 n.a./112.3 1297/3347 s, Nd, Nd ³⁺ [Xe]4f ⁴ 6s ²	61 Pm Promethium (145) 3 n.a./111 1315/3273 s, Pm, Pm ³⁺ [Xe]4f ⁵ 6s ²	62 Sm Samarium 150.36(2) 3 n.a./109.8 1345/2173 s, Sm, Sm ³⁺ [Xe]4f ⁶ 6s ²	63 Eu Europium 151.964(1) 3 n.a./108.7 1099/1802 s, Eu, Eu ³⁺ [Xe]4f ⁷ 6s ²	64 Gd Gadolinium 157.25(3) 3 n.a./107.8 1585/3273 s, Gd, Gd ³⁺ [Xe]4f ⁷ 5d ¹ 6s ²	65 Tb Terbium 158.92535(2) 3 n.a./106.3 1629/3396 s, Tb, Tb ³⁺ [Xe]4f ⁹ 6s ²	66 Dy Dysprosium 162.500(1) 3 n.a./105.2 1680/2840 s, Dy, Dy ³⁺ [Xe]4f ¹⁰ 6s ²	67 Ho Holmium 164.93033(2) 3 n.a./104.1 1734/2873 s, Ho, Ho ³⁺ [Xe]4f ¹¹ 6s ²	68 Er Erbium 167.259(3) 3 n.a./103 1802/3141 s, Er, Er ³⁺ [Xe]4f ¹² 6s ²	69 Tm Thulium 168.93422(2) 3 n.a./102 1818/2223 s, Tm, Tm ³⁺ [Xe]4f ¹³ 6s ²	70 Yb Ytterbium 173.045(10) 3 n.a./100.8 1097/1469 s, Yb, Yb ³⁺ [Xe]4f ¹⁴ 6s ²	71 Lu Lutetium 174.9668(1) 3 n.a./100.1 1925/3675 s, Lu, Lu ³⁺ [Xe]4f ¹⁴ 5d ¹ 6s ²
89 Ac Actinium (227) 3 n.a./126 n.a./n.a. s, Ac, Ac ³⁺ [Rn]6d ¹ 7s ²	90 Th Thorium 232.0377(4) 4 n.a./108 2023/5061 s, Th, Th ⁴⁺ [Rn]6d ² 7s ²	91 Pa Protactinium 231.03588(2) 5 n.a./104 1841/4300 s, Pa, Pa ⁵⁺ [Rn]5f ² 6d ¹ 7s ²	92 U Uranium 238.02891(3) 6 n.a./103 1405.3/4404 s, U, U ⁴⁺ [Rn]5f ³ 6d ¹ 7s ²	93 Np Neptunium (237) 5 n.a./89 912/444 s, Np, Np ³⁺ [Rn]5f ⁴ 6d ¹ 7s ²	94 Pu Plutonium (244) 4 n.a./100 912.5/3505 s, Pu, Pu ⁴⁺ [Rn]5f ⁶ 7s ²	95 Am Americium (243) 3 n.a./111.5 1449/n.a. s, Am, Am ³⁺ [Rn]5f ⁷ 7s ²	96 Cm Curium (247) 3 n.a./99 1613/3383 s, Cm, Cm ³⁺ [Rn]5f ⁸ 6d ¹ 7s ²	97 Bk Berkelium						