# Periodic Table of the Elements

Alkali metal | Alkaline earth metal | Lanthanide | Actinide | Transition metal | Post transition metal | Metalloid | Nonmetal | Noble gase | Unclassified | Group 17 = Halogen

**Key**

group
# Xy
Atomname
MW
ox. no.
$r_a/r_i$
m.p./b.p.
p,$Xy_n$,$Xy^{+/-}$
el. conf.
abc
relative ionic radius ($r_i$,$Xy^{+/-}$)
relative atomic radius ($r_a$)

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)*
**p** .....phases*: solid (**s**), liquid (**l**), gas (**g**)
$Xy_n$.....Elemntar form
$Xy^{+/-}$.....Ion corresponding to $r_i$
**el. conf.** .....electron configuration
*abc*.....crystal structure

*Values at STP (273.15 K,1 bar)

bcc: body centered cubic
cub: cubic
dhcp: double hexagonal close-packed
fcc: face-centered cubic
fcd: face-centered diamond-cubic
hcp: hexagonal closed-packed
hex: hexagonal
mon: monoclinic
ort: orthorhombic
rho: rhombohedral
she: simple hexagonal

**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: $pV = nRT = NkT$

**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 = $10^5$ N/m$^2$ = $10^5$ Pa; 1 atm = 101325 Pa = 1.01325 bar
Torr = 1/760 atm = 1.333 mbar = 1 mmHg
1 L = $10^{-3}$ m$^3$ = 1 dm$^3$ = $10^3$ cm$^3$ = $10^6$ mm$^3$

**Constants:**

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

The unified atomic mass is equal to 1/12 of the mass of a single isolated C-atom.

**REFERENCES:**


[MW] Comission on Isotopic Abundancies 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


| I–IA | II–IIA | III–IIIB | IV–IVB | V–VB | VI–VIB | VII–VIIB | VIII–VIIIB | VIII–VIIIB | VIII–VIIIB | I–IB | II–IIB | III–IIIA | IV–IVA | V–VA | VI–VIA | VII–VIIA | VIII–VIIIA | VIII–VIIIA | VIII–VIIIA | I–IB | II–IIB | III–IIIA | IV–IVA | V–VA | VI–VIA | VII–VIIA | VIII–VIIIA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 H | | | | | | | 2 He | | | | | | | | | | | | | | | | | | | | 2 He |
| Hydrogen | | | | | | | Helium | | | | | | | | | | | | | | | | | | | | Helium |
| 1.00794 | | | | | | | 4.002602(2) | | | | | | | | | | | | | | | | | | | | 4.002602(2) |
| -1,1 | | | | | | | - | | | | | | | | | | | | | | | | | | | | - |
| 52.9/154 2.20 | | | | | | | 31/- n.a. | | | | | | | | | | | | | | | | | | | | 31/- n.a. |
| 13.99/20.271 | | | | | | | 0.95/4.222 | | | | | | | | | | | | | | | | | | | | 0.95/4.222 |
| g,$H_2$,H *hex* | | | | | | | g,He *hcp* | | | | | | | | | | | | | | | | | | | | g,He *hcp* |
| $1s^2$ | | | | | | | $1s^2$ | | | | | | | | | | | | | | | | | | | | $1s^2$ |
| 3 Li | 4 Be | 5 B | 6 C | 7 N | 8 O | 9 F | 10 Ne | | | | | | | | | | | | | | | | | | | | |
| Lithium | Beryllium | Boron | Carbon | Nitrogen | Oxygen | Fluorine | Neon | | | | | | | | | | | | | | | | | | | | |
| 6.941 | 9.0121831(5) | 10.81 | 12.011 | 14.007 | 15.999 | 18.998403163 | 20.1797(6) | | | | | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | -3,3,5 | -2 | -1 | - | | | | | | | | | | | | | | | | | | | | |
| 167/90 0.98 | 112/59 1.57 | 87/41 2.04 | 67/30 2.55 | 56/132/27 3.04 | 48/126 3.44 | 42/119 3.98 | 38/- n.a. | | | | | | | | | | | | | | | | | | | | |
| 453.65/1603 | 1560/2742 | 2349/4200 | 3915 (subl.) | 63.15/77.355 | 54.36/90.188 | 53.48/85.03 | 24.56/27.104 | | | | | | | | | | | | | | | | | | | | |
| s,$Li_n$,$Li^+$ *bcc* | s,$Be_n$,$Be^{2+}$ *hcp* | s,$B_n$,$B^{3+}$ *rho* | s,$C_n$,$C^{4+}$ *she,fcd* | g,$N_2$,$N^{3-}$,$N^{5+}$ *hex* | g,$O_2$,$O^{2-}$ *cub* | g,$F_2$,$F^-$ *cub* | g,Ne *fcc* | | | | | | | | | | | | | | | | | | | | |
| $1s^2 2s^1$ | $1s^2 2s^2$ | $1s^2 2s^2 p^1$ | $1s^2 2s^2 p^2$ | $1s^2 2s^2 p^3$ | $1s^2 2s^2 p^4$ | $1s^2 2s^2 p^5$ | $1s^2 2s^2 p^6$ | | | | | | | | | | | | | | | | | | | | |
| 11 Na | 12 Mg | 13 Al | 14 Si | 15 P | 16 S | 17 Cl | 18 Ar | | | | | | | | | | | | | | | | | | | | |
| Sodium | Magnesium | Aluminium | Silicon | Phosphorous | Sulfur | Chlorine | Argon | | | | | | | | | | | | | | | | | | | | |
| 22.98976928(2) | 24.305 | 26.9815385(7) | 28.085 | 30.973761998 | 32.06 | 35.45 | 39.948(1) | | | | | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | -4,4 | -3,5 | -2,2,4,6 | -1,1,3,5,7 | - | | | | | | | | | | | | | | | | | | | | |
| 190/116 0.93 | 145/86 1.31 | 118/67.5 1.61 | 111/54 1.90 | 98/52 2.19 | 88/170 2.58 | 79/167 3.16 | 71/- n.a. | | | | | | | | | | | | | | | | | | | | |
| 370.94/1156.09 | 923/1363 | 933.47/2743 | 1687/3538 | 317/553 (white) | 388.36/717.8 | 171.6/239.11 | 83.81/87.302 | | | | | | | | | | | | | | | | | | | | |
| s,$Na_n$,$Na^+$ *bcc* | s,$Mg_n$,$Mg^{2+}$ *hcp* | s,$Al_n$,$Al^{3+}$ *fcc* | s,$Si_n$,$Si^{4+}$ *fcd* | s,$P_n$,$P^{5+}$ *bcc* | s,$S_8$,$S^{2-}$ *ort* | g,$Cl_2$,$Cl^-$ *ort* | g,Ar *fcc* | | | | | | | | | | | | | | | | | | | | |
| [Ne]$3s^1$ | [Ne]$3s^2$ | [Ne]$3s^2 p^1$ | [Ne]$3s^2 p^2$ | [Ne]$3s^2 p^3$ | [Ne]$3s^2 p^4$ | [Ne]$3s^2 p^5$ | [Ne]$3s^2 p^6$ | | | | | | | | | | | | | | | | | | | | |
| 19 K | 20 Ca | 21 Sc | 22 Ti | 23 V | 24 Cr | 25 Mn | 26 Fe | 27 Co | 28 Ni | 29 Cu | 30 Zn | 31 Ga | 32 Ge | 33 As | 34 Se | 35 Br | 36 Kr | | | | | | | | | | |
| Potassium | Calcium | Scandium | Titanium | Vanadium | Chromium | Manganese | Iron | Cobalt | Nickel | Copper | Zinc | Gallium | Germanium | Arsenic | Selenium | Bromine | Krypton | | | | | | | | | | |
| 39.0983(1) | 40.078(4) | 44.955908(5) | 47.867(1) | 50.9415(1) | 51.9961(6) | 54.938044(3) | 55.845(2) | 58.933194(4) | 58.6934(4) | 63.546(3) | 65.38(2) | 69.723(1) | 72.630(8) | 74.921595(6) | 78.971(8) | 79.904 | 83.798(2) | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 3,6 | 2,4,7 | 2,3,6 | 2,3 | 2 | 2 | 2 | 3 | -4,2,4 | -3,3,5 | -2,2,4,6 | -1,1,3,5 | 2 | | | | | | | | | | |
| 243/152 0.82 | 194/114 1.00 | 184/88.5 1.36 | 176/74.5 1.54 | 171/68 1.63 | 166/58 1.66 | 161/60 1.55 | 156/39 1.83 | 152/68.5 1.88 | 149/83 1.91 | 145/87 1.90 | 142/88 1.65 | 136/76 1.81 | 125/67 2.01 | 114/72 2.18 | 103/184 2.55 | 94/182 2.96 | 88/- 3.00 | | | | | | | | | | |
| 336.7/1032 | 1115/1757 | 1814/3109 | 1941/3560 | 2183/3680 | 2180/2944 | 1519/2334 | 1811/3134 | 1768/3200 | 1728/3003 | 1357.77/2835 | 692.68/1180 | 302.91/2673 | 1211.40/3106 | 887 (subl.) | 494/958 | 265.8/332.0 | 115.78/119.93 | | | | | | | | | | |
| s,$K_n$,$K^+$ *bcc* | s,$Ca_n$,$Ca^{2+}$ *fcc* | s,$Sc_n$,$Sc^{3+}$ *hcp* | s,$Ti_n$,$Ti^{4+}$ *hcp* | s,$V_n$,$V^{5+}$ *bcc* | s,$Cr_n$,$Cr^{6+}$ *bcc* | s,$Mn_n$,$Mn^{2+}$ *bcc* | s,$Fe_n$,$Fe^{6+}$*bcc,fcc* | s,$Co_n$,$Co^{3+}$ *hcp* | s,$Ni_n$,$Ni^{2+}$ *fcc* | s,$Cu_n$,$Cu^{2+}$ *fcc* | s,$Zn_n$,$Zn^{2+}$ *hcp* | s,$Ga_n$,$Ga^{3+}$ *ort* | s,$Ge_n$,$Ge^{4+}$ *fcd* | s,$As_n$,$As^{3+}$ *rho* | s,$Se_8$,$Se^{2-}$ *hex* | I,$Br_2$,$Br^-$ *ort* | g,Kr *fcc* | | | | | | | | | | |
| [Ar]$4s^1$ | [Ar]$4s^2$ | [Ar]$3d^1 4s^2$ | [Ar]$3d^2 4s^2$ | [Ar]$3d^3 4s^2$ | [Ar]$3d^5 4s^1$ | [Ar]$3d^5 4s^2$ | [Ar]$3d^6 4s^2$ | [Ar]$3d^7 4s^2$ | [Ar]$3d^8 4s^2$ | [Ar]$3d^{10} 4s^1$ | [Ar]$3d^{10} 4s^2$ | [Ar]$3d^{10} 4s^2 p^1$ | [Ar]$3d^{10} 4s^2 p^2$ | [Ar]$3d^{10} 4s^2 p^3$ | [Ar]$3d^{10} 4s^2 p^4$ | [Ar]$3d^{10} 4s^2 p^5$ | [Ar]$3d^{10} 4s^2 p^6$ | | | | | | | | | | |
| 37 Rb | 38 Sr | 39 Y | 40 Zr | 41 Nb | 42 Mo | 43 Tc | 44 Ru | 45 Rh | 46 Pd | 47 Ag | 48 Cd | 49 In | 50 Sn | 51 Sb | 52 Te | 53 I | 54 Xe | | | | | | | | | | |
| Rubidium | Strontium | Yttrium | Zirconium | Niobium | Molybdenum | Technetium | Ruthenium | Rhodium | Palladium | Silver | Cadmium | Indium | Tin | Antimony | Tellurium | Iodine | Xenon | | | | | | | | | | |
| 85.4678(3) | 87.62(1) | 88.90584(2) | 91.224(2) | 92.90637(2) | 95.95(1) | (98) | 101.07(2) | 102.90550(2) | 106.42(1) | 107.8682(2) | 112.414(4) | 114.818(1) | 118.710(7) | 121.760(1) | 127.60(3) | 126.90447(3) | 131.293(6) | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 4,6 | 4,7 | 3,4 | 3 | 2,4 | 1 | 2 | 3 | -4,2,4 | -3,3,5 | -2,2,4,6 | -1,1,3,5,7 | 2,4,6 | | | | | | | | | | |
| 265/166 0.82 | 219/132 0.95 | 212/104 1.22 | 206/86 1.33 | 198/78 1.60 | 190/73 2.16 | 183/70 1.9 | 178/76 2.2 | 173/80.5 2.28 | 169/100 2.20 | 165/129 1.93 | 161/109 1.69 | 156/94 1.78 | 145/83 1.96 | 133/74 2.05 | 123/207 2.1 | 115/206 2.66 | 108 2.60 | | | | | | | | | | |
| 312.45/961 | 1050/1650 | 1799/3203 | 2128/4650 | 2750/5017 | 2896/4912 | 2430/4538 | 2607/4423 | 2237/3968 | 1828.05/3236 | 1234.93/2435 | 594.22/1040 | 429.75/2345 | 505.08/2875 | 903.73/1908 | 722.66/1261 | 386.85/457.4 | 161.40/165.051 | | | | | | | | | | |
| s,$Rb_n$,$Rb^+$ *bcc* | s,$Sr_n$,$Sr^{2+}$ *fcc* | s,$Y_n$,$Y^{3+}$ *hcp* | s,$Zr_n$,$Zr^{4+}$ *hcp* | s,$Nb_n$,$Nb^{5+}$ *bcc* | s,$Mo_n$,$Mo^{6+}$ *bcc* | s,$Tc_n$,$Tc^{7+}$ *hcp* | s,$Ru_n$,$Ru^{4+}$ *hcp* | s,$Rh_n$,$Rh^{3+}$ *fcc* | s,$Pd_n$,$Pd^{2+}$ *fcc* | s,$Ag_n$,$Ag^{1+}$ *fcc* | s,$Cd_n$,$Cd^{2+}$ *hcp* | s,$In_n$,$In^{3+}$ *tet* | s,$Sn_n$,$Sn^{4+}$*tet,fcd* | s,$Sb_n$,$Sb^{5+}$ *rho* | s,$Te_n$,$Te^{2-}$ *hex* | s,$I_2$,$I^-$ *ort* | g,Xe *fcc* | | | | | | | | | | |
| [Kr]$5s^1$ | [Kr]$5s^2$ | [Kr]$4d^1 5s^2$ | [Kr]$4d^2 5s^2$ | [Kr]$4d^4 5s^1$ | [Kr]$4d^5 5s^1$ | [Kr]$4d^5 5s^2$ | [Kr]$4d^7 5s^1$ | [Kr]$4d^8 5s^1$ | [Kr]$4d^{10}$ | [Kr]$4d^{10} 5s^1$ | [Kr]$4d^{10} 5s^2$ | [Kr]$4d^{10} 5s^2 p^1$ | [Kr]$4d^{10} 5s^2 p^2$ | [Kr]$4d^{10} 5s^2 p^3$ | [Kr]$4d^{10} 5s^2 p^4$ | [Kr]$4d^{10} 5s^2 p^5$ | [Kr]$4d^{10} 5s^2 p^6$ | | | | | | | | | | |
| 55 Cs | 56 Ba | 57-71 | 72 Hf | 73 Ta | 74 W | 75 Re | 76 Os | 77 Ir | 78 Pt | 79 Au | 80 Hg | 81 Tl | 82 Pb | 83 Bi | 84 Po | 85 At | 86 Rn | | | | | | | | | | |
| Cesium | Barium | | Hafnium | Tantalum | Tungsten | Rhenium | Osmium | Iridium | Platinum | Gold | Mercury | Thallium | Lead | Bismuth | Polonium | Astatine | Radon | | | | | | | | | | |
| 132.90545196 | 137.327(7) | | 178.49(2) | 180.94788(2) | 183.84(1) | 186.207(1) | 190.23(3) | 192.217(3) | 195.084(9) | 196.966569(5) | 200.592(3) | 204.38 | 207.2(1) | 208.98040(1) | (209) | (210) | (222) | | | | | | | | | | |
| 1 | 2 | | 4 | 5 | 4,6 | 4 | 4 | 3,4 | 2,4 | 3 | 1,2 | 1,3 | 2,4 | 3 | -2,2,4 | -1,1 | 2 | | | | | | | | | | |
| 298/181 0.79 | 253/149 0.89 | | 208/85 1.30 | 200/78 1.50 | 193/74 2.36 | 188/67 1.9 | 185/53 2.2 | 180/82 2.20 | 177/94 2.28 | 174/99 2.54 | 171/116 2.00 | 156/102.5 1.62 | 154/133 1.87 | 143/90 2.02 | 135/108 2.0 | 127/n.a. 2.2 | 120 2.2 | | | | | | | | | | |
| 301.7/944 | 1000/2118 | | 2506/4876 | 3290/5731 | 3695/6203 | 3459/5869 | 3306/5285 | 2719/4403 | 2041.4/4098 | 1337.33/3243 | 234.3210/629.88 | 577/1746 | 600.61/2022 | 544.7/1837 | 527/1235 | 575/610 | 202/211.5 | | | | | | | | | | |
| s,$Cs_n$,$Cs^+$ *bcc* | s,$Ba_n$,$Ba^{2+}$ *bcc* | | s,$Hf_n$,$Hf^{4+}$ *hcp* | s,$Ta_n$,$Ta^{5+}$*bcc,tet* | s,$W_n$,$W^{6+}$ *bcc* | s,$Re_n$,$Re^{7+}$ *hcp* | s,$Os_n$,$Os^{8+}$ *hcp* | s,$Ir_n$,$Ir^{3+}$ *fcc* | s,$Pt_n$,$Pt^{2+}$ *fcc* | s,$Au_n$,$Au^{3+}$ *fcc* | l,$Hg_n$,$Hg^{2+}$ *rho* | s,$Tl_n$,$Tl^{3+}$ *hcp* | s,$Pb_n$,$Pb^{2+}$ *fcc* | s,$Bi_n$,$Bi^{5+}$ *rho* | s,$Po_n$,$Po^{4+}$ *cub* | n.a.,n.a.,n.a. *fcc* | g,Rn *fcc* | | | | | | | | | | |
| [Xe]$6s^1$ | [Xe]$6s^2$ | | [Xe]$4f^{14} 5d^2 6s^2$ | [Xe]$4f^{14} 5d^3 6s^2$ | [Xe]$4f^{14} 5d^4 6s^2$ | [Xe]$4f^{14} 5d^5 6s^2$ | [Xe]$4f^{14} 5d^6 6s^2$ | [Xe]$4f^{14} 5d^7 6s^2$ | [Xe]$4f^{14} 5d^9 6s^1$ | [Xe]$4f^{14} 5d^{10} 6s^1$ | [Xe]$4f^{14} 5d^{10} 6s^2$ | [Xe]$4f^{14} 5d^{10} 6s^2 p^1$ | [Xe]$4f^{14} 5d^{10} 6s^2 p^2$ | [Xe]$4f^{14} 5d^{10} 6s^2 p^3$ | [Xe]$4f^{14} 5d^{10} 6s^2 p^4$ | [Xe]$4f^{14} 5d^{10} 6s^2 p^5$ | [Xe]$4f^{14} 5d^{10} 6s^2 p^6$ | | | | | | | | | | |
| 87 Fr | 88 Ra | 89-103 | 104 Rf | 105Db | 106 Sg | 107 Bh | 108 Hs | 109 Mt | 110 Ds | 111 Rg | 112 Cn | 113 Nh | 114 Fl | 115 Mc | 116 Lv | 117 Ts | 118 Og | | | | | | | | | | |
| Francium | Radium | | Rutherfordium | Dubnium | Seaborgium | Bohrium | Hassium | Meitnerium | Darmstadtium | Roentgenium | Copernicium | Nihonium | Flerovium | Moscovium | Livermorium | Tennessine | Oganesson | | | | | | | | | | |
| (223) | (226) | | (267) | (268) | (269) | (270) | (269) | (278) | (281) | (282) | (285) | (286) | (289) | (289) | (293) | (294) | (294) | | | | | | | | | | |
| 1 | 2 | | 4 | 5 | 6 | 7 | 8 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | | | | | | | | | | |
| n.a./n.a. 0.7 | n.a./162 0.90 | | n.a./n.a. n.a. | n.a./n.a. n.a. | n.a./n.a. n.a. | n.a./n.a. n.a. | n.a./n.a. n.a. | n.a./n.a. n.a. | n.a./n.a. n.a. | n.a./n.a. n.a. | n.a./n.a. n.a. | n.a./n.a. n.a. | n.a./n.a. n.a. | n.a./n.a. n.a. | n.a./n.a. n.a. | n.a./n.a. n.a. | n.a./n.a. n.a. | | | | | | | | | | |
| n.a./n.a. | 973/2010 | | 2400/5800 | n.a./n.a. | n.a./n.a. | n.a./n.a. | n.a./n.a. | n.a./n.a. | n.a./n.a. | 1814/3109 | n.a./n.a. | 700/1430 | 340/420 | 670/1400 | n.a./n.a. | n.a./n.a. | n.a./n.a. | | | | | | | | | | |
| n.a.,n.a.,n.a. *bcc* | s,$Ra_n$,$Ra^{2+}$ *bcc* | | s,n.a.,n.a. *hcp* | s,n.a.,n.a. *bcc* | s,n.a.,n.a. *bcc* | s,n.a.,n.a. *hcp* | s,n.a.,n.a. *hcp* | s,n.a.,n.a. *fcc* | s,n.a.,n.a. *bcc* | s,n.a.,n.a. *bcc* | n.a.,n.a.,n.a. *hcp* | s,n.a.,n.a. *hcp* | s,n.a.,n.a. *n.a.* | s,n.a.,n.a. *n.a.* | s,n.a.,n.a. *n.a.* | s,n.a.,n.a. *n.a.* | s,n.a.,n.a. *n.a.* | | | | | | | | | | |
| [Rn]$7s^1$ | [Rn]$7s^2$ | | [Rn]$5f^{14} 6d^2 7s^2$ | [Rn]$5f^{14} 6d^3 7s^2$ | [Rn]$5f^{14} 6d^4 7s^2$ | [Rn]$5f^{14} 6d^5 7s^2$ | [Rn]$5f^{14} 6d^6 7s^2$ | [Rn]$5f^{14} 6d^7 7s^2$ | [Rn]$5f^{14} 6d^8 7s^2$ | [Rn]$5f^{14} 6d^9 7s^2$ | [Rn]$5f^{14} 6d^{10} 7s^2$ | [Rn]$5f^{14} 6d^{10} 7s^2 p^1$ | [Rn]$5f^{14} 6d^{10} 7s^2 p^2$ | [Rn]$5f^{14} 6d^{10} 7s^2 p^3$ | [Rn]$5f^{14} 6d^{10} 7s^2 p^4$ | [Rn]$5f^{14} 6d^{10} 7s^2 p^5$ | [Rn]$5f^{14} 6d^{10} 7s^2 p^6$ | | | | | | | | | | |

| III–IIIB | IV–IVB | V–VB | VI–VIB | VII–VIIB | VIII–VIIIB | VIII–VIIIB | VIII–VIIIB | I–IB | II–IIB | III–IIIA | IV–IVA | V–VA | VI–VIA | VII–VIIA | VIII–VIIIA | VIII–VIIIA | VIII–VIIIA | I–IB | II–IIB | III–IIIA | IV–IVA | V–VA | VI–VIA | VII–VIIA | VIII–VIIIA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 57 La | 58 Ce | 59 Pr | 60 Nd | 61 Pm | 62 Sm | 63 Eu | 64 Gd | 65 Tb | 66 Dy | 67 Ho | 68 Er | 69 Tm | 70 Yb | 71 Lu | | | | | | | | | | | | | |
| Lanthanum | Cerium | Praseodymium | Neodymium | Promethium | Samarium | Europium | Gadolinium | Terbium | Dysprosium | Holmium | Erbium | Thulium | Ytterbium | Lutetium | | | | | | | | | | | | | |
| 138.90547(7) | 140.116(1) | 140.90766(2) | 144.242(3) | (145) | 150.36(2) | 151.964(1) | 157.25(3) | 158.92535(2) | 162.500 (1) | 164.93033(2) | 167.259(3) | 168.93422(2) | 173.045(10) | 174.9668(1) | | | | | | | | | | | | | |
| 3 | 3,4 | 3 | 3 | 3 | 3 | 2,3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | | | | | | | |
| n.a./117.2 1.1 | n.a./101 1.12 | n.a./113 1.13 | n.a./112.3 1.14 | n.a./111 1.13 | n.a./109.8 1.17 | n.a./108.7 1.2 | n.a./107.8 1.2 | n.a./106.3 1.1 | n.a./105.2 1.22 | n.a./104.1 1.23 | n.a./103 1.24 | n.a./102 1.25 | n.a./100.8 1.1 | n.a./100.1 1.27 | | | | | | | | | | | | | |
| 1193/3737 | 1068/3716 | 1208/3403 | 1297/3347 | 1315/3273 | 1345/2173 | 1099/1802 | 1585/3273 | 1629/3396 | 1680/2840 | 1734/2873 | 1802/3141 | 1818/2223 | 1097/1469 | 1925/3675 | | | | | | | | | | | | | |
| s,$La_n$,$La^{3+}$ *dhcp* | s,$Ce_n$,$Ce^{4+}$ *dhcp* | s,$Pr_n$,$Pr^{3+}$ *dhcp* | s,$Nd_n$,$Nd^{3+}$ *dhcp* | s,$Pm_n$,$Pm^{3+}$*dhcp* | s,$Sm_n$,$Sm^{3+}$ *rho* | s,$Eu_n$,$Eu^{3+}$ *bcc* | s,$Gd_n$,$Gd^{3+}$ *hcp* | s,$Tb_n$,$Tb^{3+}$ *hcp* | s,$Dy_n$,$Dy^{3+}$ *hcp* | s,$Ho_n$,$Ho^{3+}$ *hcp* | s,$Er_n$,$Er^{3+}$ *hcp* | s,$Tm_n$,$Tm^{3+}$ *hcp* | s,$Yb_n$,$Yb^{3+}$ *fcc* | s,$Lu_n$,$Lu^{3+}$ *hcp* | | | | | | | | | | | |
| [Xe]$5d^1 6s^2$ | [Xe]$4f^1 5d^1 6s^2$ | [Xe]$4f^3 6s^2$ | [Xe]$4f^4 6s^2$ | [Xe]$4f^5 6s^2$ | [Xe]$4f^6 6s^2$ | [Xe]$4f^7 6s^2$ | [Xe]$4f^7 5d^1 6s^2$ | [Xe]$4f^9 6s^2$ | [Xe]$4f^{10} 6s^2$ | [Xe]$4f^{11} 6s^2$ | [Xe]$4f^{12} 6s^2$ | [Xe]$4f^{13} 6s^2$ | [Xe]$4f^{14} 6s^2$ | [Xe]$4f^{14} 5d^1 6s^2$ | | | | | | | | | | | | | |
| 89 Ac | 90 Th | 91 Pa | 92 U | 93 Np | 94 Pu | 95 Am | 96 Cm | 97 Bk | 98 Cf | 99 Es | 100Fm | 101Md | 102No | 103 Lr | | | | | | | | | | | | | |
| Actinium | Thorium | Protactinium | Uranium | Neptunium | Plutonium | Americium | Curium | Berkelium | Californium | Einsteinium | Fermium | Mendelevium | Nobelium | Lawrencium | | | | | | | | | | | | | |
| (227) | 232.0377(4) | 231.03588(2) | 238.02891(3) | (237) | (244) | (243) | (247) | (247) | (251) | (252) | (257) | (258) | (259) | (266) | | | | | | | | | | | | | |
| 3 | 4 | 5 | 6 | 5 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | | | | | | | | | | | | | |
| n.a./126 1.1 | n.a./108 1.3 | n.a./104 1.5 | n.a./103 1.38 | n.a./89 1.36 | n.a./100 1.28 | n.a./111.5 1.13 | n.a./99 1.28 | n.a./110 1.3 | n.a./109 1.3 | n.a./92.8 1.3 | n.a./n.a. 1.3 | n.a./n.a. 1.3 | n.a./n.a. 1.3 | n.a./n.a. 1.3 | | | | | | | | | | | | | |
| n.a./n.a. | 2023/5061. | 1841/4300 | 1405.3/4404 | 912/4447 | 912.5/3505 | 1449/2011 | 1613/3383 | 1259/2900 | 1173/1743 | 1133/1289 | 1800/n.a. | 1100/n.a. | 1100/n.a. | 1900/n.a. | | | | | | | | | | | | | |
| s,$Ac_n$,$Ac^{3+}$ *fcc* | s,$Th_n$,$Th^{4+}$ *fcc* | s,$Pa_n$,$Pa^{4+}$ *tet* | s,$U_n$,$U^{4+}$ *ort* | s,$Np_n$,$Np^{5+}$ *ort* | s,$Pu_n$,$Pu^{4+}$ *mon* | s,$Am_n$,$Am^{3+}$*dhcp* | s,$Cm_n$,$Cm^{4+}$*dhcp* | s,$Bk_n$,$Bk^{3+}$ *dhcp* | s,$Cf_n$,$Cf^{3+}$ *dhcp* | s,$Es_n$,$Es^{2+}$ *fcc* | s,n.a.,n.a. *n.a.* | s,n.a.,n.a. *n.a.* | s,n.a.,n.a. *n.a.* | s,n.a.,n.a. *n.a.* | | | | | | | | | | | |
| [Rn]$6d^1 7s^2$ | [Rn]$6d^2 7s^2$ | [Rn]$5f^2 6d^1 7s^2$ | [Rn]$5f^3 6d^1 7s^2$ | [Rn]$5f^4 6d^1 7s^2$ | [Rn]$5f^6 7s^2$ | [Rn]$5f^7 7s^2$ | [Rn]$5f^7 6d^1 7s^2$ | [Rn]$5f^9 7s^2$ | [Rn]$5f^{10} 7s^2$ | [Rn]$5f^{11} 7s^2$ | [Rn]$5f^{12} 7s^2$ | [Rn]$5f^{13} 7s^2$ | [Rn]$5f^{14} 7s^2$ | [Rn]$5f^{14} 7s^2 7p^1$ | | | | | | | | | | | | | |

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