元素周期表 (Periodic Table of the Elements)

鹼金屬 | 鹼土金屬 | 鑭系元素 | 錒系元素 | 過渡金屬 | 主族金屬 | 類金屬 | 非金屬 | 稀有氣體 | 待確認化學特性 | 組17 = 鹵素

参考:
[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.
[物理常數] http://physics.nist.gov/cuu/Constants/index.html

图例

组
 # Xy
原子名称
MW ox. no.
r_a/r_i **EN**
m.p./b.p.
p,Xy_n,$Xy^{+/-}$ *abc*
el. conf.

相对离子半径 (r_i,$Xy^{+/-}$)
相对原子半径 (r_a)

#.....原子数　　信息, 灰度值：预测
Xy.....符号
原子名称...黑色字体：合成原子
MW.....分子量 (g/mol)
ox. no.....氧化态
EN.....电负性 (pauling scale)
r_a.....原子半径 (pm)
r_i.....离子半径 (pm)
m.p.....熔点 (K)*
b.p.....沸点 (K)*
p.....相*: 固 (**s**), 液相 (**l**), 气 (**g**)
Xy_n.....基本形式
$Xy^{+/-}$.....离子属于 r_i
el. conf....电子配置
abc.....晶体结构
*标准压力和温度 (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

方程:

浓度: $c = n/V$ [mol/L]
物質量: n [mol]
体积: V [L]
粒子数: $N = n \cdot N_a$
压强: p [Pa]
理想气体状态方程: $pV = nRT = Nk_BT$

转换因子:

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

物理常数:

阿伏伽德罗常数	N_a	= 6.022 141 79(30) • 10^{-23} mol^{-1}
质子质量	m_p	= 1.672 621 777(74) • 10^{-27} kg
电子质量	m_e	= 9.109 382 91(40) • 10^{-31} kg
中子质量	m_n	= 1.674 927 351(74) • 10^{-27} kg
标准温度	T_s	= 273.15 K = 0 °C
气体常数	R	= 8.314 472(15) J/(mol•K)
玻尔兹曼常数	k_B	= 1.380 650 4(24) • 10^{-23} J/K
真空中光速	c	= 2.997 924 58 • 10^8 m/s
电子电荷,基本电荷	e	= 1.602 176 487(40) • 10^{-19} C
约化普朗克常数	h	= 6.626 068 96 (33) • 10^{-34} J•s
	$\hbar = h/2\pi$	= 1.054 571 628(53) • 10^{-34} J•s
原子质量单位	$l\ u$	= 1.660 538 921(73) • 10^{-27} kg

I–IA	II–IIA	III–IIIB	IV–IVB	V–VB	VI–VIB	VII–VIIB	VIII–VIIIB	IX–VIIIB	X–VIIIB	XI–IB	XII–IIB	XIII–IIIB	XIV–IVB	XV–VB	XVI–VIB	XVII–VIIB	XVIII–VIIIB
1 H 氢 1.00794 -1,1 52.9/154 2.20 13.99/20.271 g,H_2,H hex $1s^2$																	2 He 氦 4.002602(2) - 31/- n.a. 0.95/4.222 g,He hcp $1s^2$
3 Li 锂 6.941 1 167/90 0.98 453.65/1603 s,Li_n,Li^+ bcc $1s^22s^1$	4 Be 铍 9.0121831(5) 2 112/59 1.57 1560/2742 s,Be_n,Be^{2+} hcp $1s^22s^2$											5 B 硼 10.81 3 87/41 2.04 2349/4200 s,B_n,B^{3+} rho $1s^22s^2p^1$	6 C 碳 12.011 -4,-3,-2,-1,1,2,3,4 67/30 2.55 3915 (subl.) s,C_n,C^{4+} she,fcd $1s^22s^2p^2$	7 N 氮 14.007 -3,3,5 56/132/27 3.04 63.15/77.355 g,N_2,N^{3-},N^{5+} hex $1s^22s^2p^3$	8 O 氧 15.999 -2 48/126 3.44 54.36/90.188 g,O_2,O^{2-} cub $1s^22s^2p^4$	9 F 氟 18.998403163 -1 42/119 3.98 53.48/85.03 g,F_2,F^- cub $1s^22s^2p^5$	10 Ne 氖 20.1797(6) - 38/- n.a. 24.56/27.104 g,Ne fcc $1s^22s^2p^6$
11 Na 钠 22.98976928(2) 1 190/116 0.93 370.94/1156.09 s,Na_n,Na^+ bcc [Ne]$3s^1$	12 Mg 镁 24.305 2 145/86 1.31 923/1363 s,Mg_n,Mg^{2+} hcp [Ne]$3s^2$											13 Al 铝 26.9815385(7) 3 118/67.5 1.61 933.47/2743 s,Al_n,Al^{3+} fcc [Ne]$3s^2p^1$	14 Si 硅 28.085 -4,4 111/54 1.90 1687/3538 s,Si_n,Si^{4+} fcd [Ne]$3s^2p^2$	15 P 磷 30.973761998 -3,5 98/52 2.19 317/553 (white) s,P_n,P^{5+} bcc [Ne]$3s^2p^3$	16 S 硫 32.06 -2,2,4,6 88/170 2.58 388.36/717.8 s,S_8,S^{2-} ort [Ne]$3s^2p^4$	17 Cl 氯 35.45 -1,1,3,5,7 79/167 3.16 171.6/239.11 g,Cl_2,Cl^- ort [Ne]$3s^2p^5$	18 Ar 氩 39.948(1) - 71/- n.a. 83.81/87.302 g,Ar fcc [Ne]$3s^2p^6$
19 K 钾 39.0983(1) 1 243/152 0.82 336.7/1032 s,K_n,K^+ bcc [Ar]$4s^1$	20 Ca 钙 40.078(4) 2 194/114 1.00 1115/1757 s,Ca_n,Ca^{2+} fcc [Ar]$4s^2$	21 Sc 钪 44.955908(5) 3 184/88.5 1.36 1814/3109 s,Sc_n,Sc^{3+} hcp [Ar]$3d^14s^2$	22 Ti 钛 47.867(1) 4 176/74.5 1.54 1941/3560 s,Ti_n,Ti^{4+} hcp [Ar]$3d^24s^2$	23 V 钒 50.9415(1) 5 171/68 1.63 2183/3680 s,V_n,V^{5+} bcc [Ar]$3d^34s^2$	24 Cr 铬 51.9961(6) 3,6 166/58 1.66 2180/2944 s,Cr_n,Cr^{6+} bcc [Ar]$3d^54s^1$	25 Mn 锰 54.938044(3) 2,4,7 161/60 1.55 1519/2334 s,Mn_n,Mn^{7+} bcc [Ar]$3d^54s^2$	26 Fe 铁 55.845(2) 2,3,6 156/39 1.83 1811/3134 s,Fe_n,Fe^{6+}bcc,fcc [Ar]$3d^64s^2$	27 Co 钴 58.933194(4) 2,3 152/68.5 1.88 1768/3200 s,Co_n,Co^{3+} hcp [Ar]$3d^74s^2$	28 Ni 镍 58.6934(4) 2 149/83 1.91 1728/3003 s,Ni_n,Ni^{2+} fcc [Ar]$3d^84s^2$	29 Cu 铜 63.546(3) 2 145/87 1.90 1357.77/2835 s,Cu_n,Cu^{2+} fcc [Ar]$3d^{10}4s^1$	30 Zn 锌 65.38(2) 2 142/88 1.65 692.68/1180 s,Zn_n,Zn^{2+} hcp [Ar]$3d^{10}4s^2$	31 Ga 镓 69.723(1) 3 136/76 1.81 302.91/2673 s,Ga_n,Ga^{3+} ort [Ar]$3d^{10}4s^2p^1$	32 Ge 锗 72.630(8) -4,2,4 125/67 2.01 1211.40/3106 s,Ge_n,Ge^{4+} fcd [Ar]$3d^{10}4s^2p^2$	33 As 砷 74.921595(6) -3,3,5 114/72 2.18 887 (subl.) s,As_n,As^{3+} rho [Ar]$3d^{10}4s^2p^3$	34 Se 硒 78.971(8) -2,2,4,6 103/184 2.55 494/958 s,Se_8,Se^{2-} hex [Ar]$3d^{10}4s^2p^4$	35 Br 溴 79.904 -1,1,3,5 94/182 2.96 265.8/332.0 l,Br_2,Br^- ort [Ar]$3d^{10}4s^2p^5$	36 Kr 氪 83.798(2) 2 88/- 3.00 115.78/119.93 g,Kr fcc [Ar]$3d^{10}4s^2p^6$
37 Rb 铷 85.4678(3) 1 265/166 0.82 312.45/961 s,Rb_n,Rb^+ bcc [Kr]$5s^1$	38 Sr 锶 87.62(1) 2 219/132 0.95 1050/1650 s,Sr_n,Sr^{2+} fcc [Kr]$5s^2$	39 Y 钇 88.90584(2) 3 212/104 1.22 1799/3203 s,Y_n,Y^{3+} hcp [Kr]$4d^15s^2$	40 Zr 锆 91.224(2) 4 206/86 1.33 2128/4650 s,Zr_n,Zr^{4+} hcp [Kr]$4d^25s^2$	41 Nb 铌 92.90637(2) 5 198/78 1.60 2750/5017 s,Nb_n,Nb^{5+} bcc [Kr]$4d^45s^1$	42 Mo 钼 95.95(1) 4,6 190/73 2.16 2896/4912 s,Mo_n,Mo^{6+} bcc [Kr]$4d^55s^1$	43 Tc 锝 (98) 4,7 183/70 1.9 2430/4538 s,Tc_n,Tc^{7+} hcp [Kr]$4d^55s^2$	44 Ru 钌 101.07(2) 3,4 178/76 2.2 2607/4423 s,Ru_n,Ru^{4+} hcp [Kr]$4d^75s^1$	45 Rh 铑 102.90550(2) 3 173/80.5 2.28 2237/3968 s,Rh_n,Rh^{3+} fcc [Kr]$4d^85s^1$	46 Pd 钯 106.42(1) 2,4 169/100 2.20 1828.05/3236 s,Pd_n,Pd^{2+} fcc [Kr]$4d^{10}$	47 Ag 銀 107.8682(2) 1 165/129 1.93 1234.93/2435 s,Ag_n,Ag^{1+} fcc [Kr]$4d^{10}5s^1$	48 Cd 镉 112.414(4) 2 161/109 1.69 594.22/1040 s,Cd_n,Cd^{2+} hcp [Kr]$4d^{10}5s^2$	49 In 铟 114.818(1) 3 156/94 1.78 429.75/2345 s,In_n,In^{3+} tet [Kr]$4d^{10}5s^2p^1$	50 Sn 锡 118.710(7) -4,2,4 145/83 1.96 505.08/2875 s,Sn_n,Sn^{4+}tet,fcd [Kr]$4d^{10}5s^2p^2$	51 Sb 锑 121.760(1) -3,3,5 133/74 2.05 903.73/1908 s,Sb_n,Sb^{5+} rho [Kr]$4d^{10}5s^2p^3$	52 Te 碲 127.60(3) -2,2,4,6 123/207 2.1 722.66/1261 s,Te_n,Te^{2-} hex [Kr]$4d^{10}5s^2p^4$	53 I 碘 126.90447(3) -1,1,3,5,7 115/206 2.66 386.85/457.4 s,I_2,I^- ort [Kr]$4d^{10}5s^2p^5$	54 Xe 氙 131.293(6) 2,4,6 108 2.60 161.40/165.051 g,Xe fcc [Kr]$4d^{10}5s^2p^6$
55 Cs 铯 132.90545196 1 298/181 0.79 301.7/944 s,Cs_n,Cs^+ bcc [Xe]$6s^1$	56 Ba 钡 137.327(7) 2 253/149 0.89 1000/2118 s,Ba_n,Ba^{2+} bcc [Xe]$6s^2$	57-71	72 Hf 铪 178.49(2) 4 208/85 1.30 2506/4876 s,Hf_n,Hf^{4+} hcp [Xe]$4f^{14}5d^26s^2$	73 Ta 钽 180.94788(2) 5 200/78 1.50 3290/5731 s,Ta_n,Ta^{5+}bcc,tet [Xe]$4f^{14}5d^36s^2$	74 W 钨 183.84(1) 4,6 193/74 2.36 3695/6203 s,W_n,W^{6+} bcc [Xe]$4f^{14}5d^46s^2$	75 Re 铼 186.207(1) 4 188/67 1.9 3459/5869 s,Re_n,Re^{7+} hcp [Xe]$4f^{14}5d^56s^2$	76 Os 锇 190.23(3) 4 185/53 2.2 3306/5285 s,Os_n,Os^{8+} hcp [Xe]$4f^{14}5d^66s^2$	77 Ir 铱 192.217(3) 3,4 180/82 2.20 2719/4403 s,Ir_n,Ir^{3+} fcc [Xe]$4f^{14}5d^76s^2$	78 Pt 铂 195.084(9) 2,4 177/94 2.28 2041.4/4098 s,Pt_n,Pt^{2+} fcc [Xe]$4f^{14}5d^96s^1$	79 Au 金 196.966569(5) 3 174/99 2.54 1337.33/3243 s,Au_n,Au^{3+} fcc [Xe]$4f^{14}5d^{10}6s^1$	80 Hg 汞 200.592(3) 1,2 171/116 2.00 234.3210/629.88 l,Hg_n,Hg^{2+} rho [Xe]$4f^{14}5d^{10}6s^2$	81 Tl 铊 204.38 1,3 156/102.5 1.62 577/1746 s,Tl_n,Tl^{3+} hcp [Xe]$4f^{14}5d^{10}6s^2p^1$	82 Pb 铅 207.2(1) 2,4 154/133 1.87 600.61/2022 s,Pb_n,Pb^{2+} fcc [Xe]$4f^{14}5d^{10}6s^2p^2$	83 Bi 铋 208.98040(1) 3 143/90 2.02 544.7/1837 s,Bi_n,Bi^{3+} rho [Xe]$4f^{14}5d^{10}6s^2p^3$	84 Po 钋 (209) -2,2,4 135/108 2.0 527/1235 s,Po_n,Po^{4+} cub [Xe]$4f^{14}5d^{10}6s^2p^4$	85 At 砹 (210) -1,1 127/n.a. 2.2 575/610 n.a.,n.a.,n.a. fcc [Xe]$4f^{14}5d^{10}6s^2p^5$	86 Rn 氡 (222) 2 120 2.2 202/211.5 g,Rn fcc [Xe]$4f^{14}5d^{10}6s^2p^6$
87 Fr 钫 (223) 1 n.a./n.a. 0.7 n.a./n.a. n.a.,n.a.,n.a. bcc [Rn]$7s^1$	88 Ra 镭 (226) 2 n.a./162 0.90 973/2010 s,Ra_n,Ra^{2+} bcc [Rn]$7s^2$	89-103	104 Rf 鑪 (267) 4 n.a./n.a. n.a. 2400/5800 s,n.a.,n.a. hcp [Rn]$5f^{14}6d^27s^2$	105 Db 鉭 (268) 5 n.a./n.a. n.a. n.a./n.a. s,n.a.,n.a. bcc [Rn]$5f^{14}6d^37s^2$	106 Sg 鐪 (269) 6 n.a./n.a. n.a. n.a./n.a. s,n.a.,n.a. bcc [Rn]$5f^{14}6d^47s^2$	107 Bh 鈶 (270) 7 n.a./n.a. n.a. n.a./n.a. s,n.a.,n.a. hcp [Rn]$5f^{14}6d^57s^2$	108 Hs 黑 (269) 8 n.a./n.a. n.a. n.a./n.a. s,n.a.,n.a. hcp [Rn]$5f^{14}6d^67s^2$	109 Mt 鋨 (278) n.a. n.a./n.a. n.a. n.a./n.a. s,n.a.,n.a. fcc [Rn]$5f^{14}6d^77s^2$	110 Ds 鐽 (281) n.a. n.a./n.a. n.a. n.a./n.a. s,n.a.,n.a. bcc [Rn]$5f^{14}6d^87s^2$	111 Rg 錀 (282) n.a. n.a./n.a. n.a. 1814/3109 s,n.a.,n.a. bcc [Rn]$5f^{14}6d^97s^2$	112 Cn 鉨 (285) n.a. n.a./n.a. n.a. n.a./n.a. n.a.,n.a.,n.a. hcp [Rn]$5f^{14}6d^{10}7s^2$	113 Nh 钅尔 (286) n.a. n.a./n.a. n.a. 700/1430 s,n.a.,n.a. hcp [Rn]$5f^{14}6d^{10}7s^2$	114 Fl 鈇 (289) n.a. n.a./n.a. n.a. 340/420 s,n.a.,n.a. n.a. [Rn]$5f^{14}6d^{10}7s^2$	115 Mc 镆 (289) n.a. n.a./n.a. n.a. 670/1400 s,n.a.,n.a. n.a. [Rn]$5f^{14}6d^{10}7s^2$	116 Lv 鉝 (293) n.a. n.a./n.a. n.a. n.a./n.a. s,n.a.,n.a. n.a. [Rn]$5f^{14}6d^87s^2$	117 Ts 石田 (294) n.a. n.a./n.a. n.a. n.a./n.a. s,n.a.,n.a. n.a. [Rn]$5f^{14}6d^97s^2$	118 Og 奥气 (294) n.a. n.a./n.a. n.a. n.a./n.a. s,n.a.,n.a. n.a. [Rn]$5f^{14}6d^{10}7s^2$

57 La 镧 138.90547(7) 3 n.a./117.2 1.1 1193/3737 s,La_n,La^{3+} dhcp [Xe]$5d^16s^2$	58 Ce 铈 140.116(1) 3,4 n.a./101 1.12 1068/3716 s,Ce_n,Ce^{4+} dhcp [Xe]$4f^15d^16s^2$	59 Pr 镨 140.90766(2) 3 n.a./113 1.13 1208/3403 s,Pr_n,Pr^{3+} dhcp [Xe]$4f^36s^2$	60 Nd 钕 144.242(3) 3 n.a./112.3 1.14 1297/3347 s,Nd_n,Nd^{3+} dhcp [Xe]$4f^46s^2$	61 Pm 钷 (145) 3 n.a./111 1.13 1315/3273 s,Pm_n,Pm^{3+}dhcp [Xe]$4f^56s^2$	62 Sm 钐 150.36(2) 3 n.a./109.8 1.17 1345/2173 s,Sm_n,Sm^{3+} rho [Xe]$4f^66s^2$	63 Eu 铕 151.964(1) 2,3 n.a./108.7 1.2 1099/1802 s,Eu_n,Eu^{3+} bcc [Xe]$4f^76s^2$	64 Gd 钆 157.25(3) 3 n.a./107.8 1.2 1585/3273 s,Gd_n,Gd^{3+} hcp [Xe]$4f^75d^16s^2$	65 Tb 铽 158.92535(2) 3 n.a./106.3 1.1 1629/3396 s,Tb_n,Tb^{3+} hcp [Xe]$4f^96s^2$	66 Dy 镝 162.500 (1) 3 n.a./105.2 1.22 1680/2840 s,Dy_n,Dy^{3+} hcp [Xe]$4f^{10}6s^2$	67 Ho 钬 164.93033(2) 3 n.a./104.1 1.23 1734/2873 s,Ho_n,Ho^{3+} hcp [Xe]$4f^{11}6s^2$	68 Er 铒 167.259(3) 3 n.a./103 1.24 1802/3141 s,Er_n,Er^{3+} hcp [Xe]$4f^{12}6s^2$	69 Tm 铥 168.93422(2) 3 n.a./102 1.25 1818/2223 s,Tm_n,Tm^{3+} hcp [Xe]$4f^{13}6s^2$	70 Yb 镱 173.045(10) 3 n.a./100.8 1.1 1097/1469 s,Yb_n,Yb^{3+} fcc [Xe]$4f^{14}6s^2$	71 Lu 镥 174.9668(1) 3 n.a./100.1 1.27 1925/3675 s,Lu_n,Lu^{3+} hcp [Xe]$4f^{14}5d^16s^2$
89 Ac 锕 (227) 3 n.a./126 1.1 n.a./n.a. s,Ac_n,Ac^{3+} fcc [Rn]$6d^17s^2$	90 Th 钍 232.0377(4) 4 n.a./108 1.3 2023/5061. s,Th_n,Th^{4+} fcc [Rn]$6d^27s^2$	91 Pa 镤 231.03588(2) 5 n.a./104 1.5 1841/4300 s,Pa_n,Pa^{4+} tet [Rn]$5f^26d^17s^2$	92 U 鈾 238.02891(3) 6 n.a./103 1.38 1405.3/4404 s,U_n,U^{4+} ort [Rn]$5f^36d^17s^2$	93 Np 镎 (237) 5 n.a./89 1.36 912/4447 s,Np_n,Np^{5+} ort [Rn]$5f^46d^17s^2$	94 Pu 钚 (244) 4 n.a./100 1.28 912.5/3505 s,Pu_n,Pu^{4+} mon [Rn]$5f^67s^2$	95 Am 镅 (243) 3 n.a./111.5 1.13 1449/2880 s,Am_n,Am^{3+}dhcp [Rn]$5f^77s^2$	96 Cm 锔 (247) 3 n.a./99 1.28 1613/3383 s,Cm_n,Cm^{4+}dhcp [Rn]$5f^76d^17s^2$	97 Bk 锫 (247) 3 n.a./110 1.3 1259/2900 s,Bk_n,Bk^{3+} dhcp [Rn]$5f^97s^2$	98 Cf 锎 (251) 3 n.a./109 1.3 1173/1743 s,Cf_n,Cf^{3+} dhcp [Rn]$5f^{10}7s^2$	99 Es 锿 (252) 3 n.a./92.8 1.3 1133/1269 s,Es_n,Es^{2+} fcc [Rn]$5f^{11}7s^2$	100Fm 镄 (257) 3 n.a./n.a. 1.3 1800/n.a. s,n.a.,n.a. n.a. [Rn]$5f^{12}7s^2$	101Md 钔 (258) 3 n.a./n.a. 1.3 1100/n.a. s,n.a.,n.a. n.a. [Rn]$5f^{13}7s^2$	102No 锘 (259) 2 n.a./n.a. 1.3 1100/n.a. s,n.a.,n.a. n.a. [Rn]$5f^{14}7s^2$	103 Lr 鐒 (266) 3 n.a./n.a. 1.3 1900/n.a. s,n.a.,n.a. n.a. [Rn]$5f^{14}7s^27p^1$

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