

元素周期表 (Periodic Table of the Elements)

碱金属 碱土金属 镧系元素 锕系元素 过渡金属 主族金属 类金属 非金属 稀有气体 待确认化学特性 组17 = 卤素

参考:

[MW] Commission 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.
[物理常数] <http://physics.nist.gov/cuu/Constants/index.html>

1-IA	1 H 1.00794 52.9/154 13.99/20.271 g, H ₂ , H 1s ²	2-IIA	3 Li 6.941 167/90 453.65/1603 s, Li _n , Li ⁺ 1s ² 2s ¹	4 Be 9.0121831(5) 112/59 1560/2742 s, Be _n , Be ²⁺ 1s ² 2s ²
11 Na 22.98976928(2) 190/116 370.94/1156.09 s, Na _n , Na ⁺ [Ne]3s ¹	12 Mg 24.305 145/86 923/1363 s, Mg _n , Mg ²⁺ [Ne]3s ²			
19 K 39.0983(1) 243/152 336.7/1032 s, K _n , K ⁺ [Ar]4s ¹	20 Ca 40.078(4) 194/114 1115/1757 s, Ca _n , Ca ²⁺ [Ar]4s ²			
37 Rb 85.4678(3) 265/166 312.45/961 s, Rb _n , Rb ⁺ [Kr]5s ¹	38 Sr 87.62(1) 219/132 1050/1650 s, Sr _n , Sr ²⁺ [Kr]5s ²			
55 Cs 132.90545196 298/181 301.7/944 s, Cs _n , Cs ⁺ [Xe]6s ¹	56 Ba 137.327(7) 253/149 1000/2118 s, Ba _n , Ba ²⁺ [Xe]6s ²			
87 Fr (223) n.a./n.a. n.a./n.a. n.a./n.a., n.a. bcc [Rn]7s ¹	88 Ra (226) n.a./162 973/2010 s, Ra _n , Ra ²⁺ [Rn]7s ²			

组 # **Xy**

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: (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)

相对离子半径 (r_i, Xy⁺)
相对原子半径 (r_a)

方程:
浓度: c = n/V [mol/L]
物质质量: n [mol]
体积: V [L]
粒子数: N = n · N_A
压强: p [Pa]
理想气体状态方程: pV = nRT = Nk_BT

晶体结构:
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

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 = 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

物理常数:

阿伏伽德罗常数 N_A = 6.022 141 79(30) · 10²³ 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
玻尔兹曼常数 R = 8.314 472(15) J/(mol·K)
真空光速 c = 2.997 924 58 · 10⁸ 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 ħ = h/2π = 1.054 571 628(53) · 10⁻³⁴ J·s
原子质量单位 1 u = 1.660 538 921(73) · 10⁻²⁷ kg



13-IIIB	14-IVB	15-VB	16-VIB	17-VIIB	18-VIIIB												
5 B 10.81 87/41 2349/4200 s, B _n , B ³⁺ 1s ² 2s ² 2p ¹	6 C 12.011 67/30 3915 (subl.) s, C _n , C ⁴⁺ she, fcd 1s ² 2s ² 2p ²	7 N 14.007 56/132/27 63.15/77.355 g, N ₂ , N ³⁺ , N ⁵⁺ hex 1s ² 2s ² 2p ³	8 O 15.999 48/126 54.36/90.188 g, O ₂ , O ²⁻ cub 1s ² 2s ² 2p ⁴	9 F 18.998403163 42/119 53.48/85.03 g, F ₂ , F ⁻ cub 1s ² 2s ² 2p ⁵	10 Ne 20.1797(6) 38/- 24.56/27.104 g, Ne 1s ² 2s ² 2p ⁶												
13 Al 26.9815385(7) 118/67.5 933.47/2743 s, Al _n , Al ³⁺ fcc [Ne]3s ² 3p ¹	14 Si 28.085 111/54 1687/3538 s, Si _n , Si ⁴⁺ fcd [Ne]3s ² 3p ²	15 P 30.973761998 98/52 317/553 (white) 887 (subl.) s, P _n , P ⁵⁺ bcc [Ne]3s ² 3p ³	16 S 32.06 88/170 388.36/717.8 s, S ₈ , S ²⁻ ort [Ne]3s ² 3p ⁴	17 Cl 35.45 79/167 171.6/239.11 g, Cl ₂ , Cl ⁻ ort [Ne]3s ² 3p ⁵	18 Ar 39.948(1) 71/- 83.81/87.302 g, Ar [Ne]3s ² 3p ⁶												
19 K 39.0983(1) 243/152 336.7/1032 s, K _n , K ⁺ [Ar]4s ¹	20 Ca 40.078(4) 194/114 1115/1757 s, Ca _n , Ca ²⁺ [Ar]4s ²	21 Sc 44.955908(5) 184/88.5 1814/3109 s, Sc _n , Sc ³⁺ hcp [Ar]3d ¹ 4s ²	22 Ti 47.867(1) 176/74.5 1941/3560 s, Ti _n , Ti ⁴⁺ hcp [Ar]3d ² 4s ²	23 V 50.9415(1) 171/68 2183/3680 s, V _n , V ⁵⁺ bcc [Ar]3d ³ 4s ²	24 Cr 51.9961(6) 166/58 2180/2944 s, Cr _n , Cr ⁶⁺ bcc [Ar]3d ⁵ 4s ¹	25 Mn 54.938044(3) 161/60 1519/2334 s, Mn _n , Mn ⁷⁺ bcc [Ar]3d ⁵ 4s ²	26 Fe 55.845(2) 156/39 1811/3134 s, Fe _n , Fe ⁶⁺ bcc, fcc [Ar]3d ⁶ 4s ²	27 Co 58.933194(4) 152/68.5 1768/3200 s, Co _n , Co ³⁺ hcp [Ar]3d ⁷ 4s ²	28 Ni 58.6934(4) 149/83 1728/3003 s, Ni _n , Ni ²⁺ fcc [Ar]3d ⁸ 4s ²	29 Cu 63.546(3) 145/87 1357.77/2835 s, Cu _n , Cu ²⁺ fcc [Ar]3d ¹⁰ 4s ¹	30 Zn 65.38(2) 142/88 692.68/1180 s, Zn _n , Zn ²⁺ hcp [Ar]3d ¹⁰ 4s ²	31 Ga 69.723(1) 136/76 302.91/2673 s, Ga _n , Ga ³⁺ ort [Ar]3d ¹⁰ 4s ² 4p ¹	32 Ge 72.630(8) 125/67 1211.40/3106 887 (subl.) s, Ge _n , Ge ⁴⁺ fcd [Ar]3d ¹⁰ 4s ² 4p ²	33 As 74.921595(6) 114/72 887 (subl.) s, As _n , As ³⁺ rho [Ar]3d ¹⁰ 4s ² 4p ³	34 Se 78.971(8) 103/184 494/958 s, Se ₈ , Se ²⁻ hex [Ar]3d ¹⁰ 4s ² 4p ⁴	35 Br 79.904 94/182 265.8/332.0 l, Br ₂ , Br ⁻ ort [Ar]3d ¹⁰ 4s ² 4p ⁵	36 Kr 83.798(2) 88/- 115.78/119.93 g, Kr [Ar]3d ¹⁰ 4s ² 4p ⁶
37 Rb 85.4678(3) 265/166 312.45/961 s, Rb _n , Rb ⁺ [Kr]5s ¹	38 Sr 87.62(1) 219/132 1050/1650 s, Sr _n , Sr ²⁺ fcc [Kr]5s ²	39 Y 88.90584(2) 212/104 1799/3203 s, Y _n , Y ³⁺ hcp [Kr]4d ¹ 5s ²	40 Zr 91.224(2) 206/86 2128/4650 s, Zr _n , Zr ⁴⁺ hcp [Kr]4d ² 5s ²	41 Nb 92.90637(2) 198/78 2750/5017 s, Nb _n , Nb ⁵⁺ bcc [Kr]4d ⁴ 5s ¹	42 Mo 95.95(1) 190/73 2896/4912 s, Mo _n , Mo ⁶⁺ bcc [Kr]4d ⁵ 5s ¹	43 Tc (98) 183/70 2430/4538 s, Tc _n , Tc ⁷⁺ hcp [Kr]4d ⁵ 5s ²	44 Ru 101.07(2) 178/76 2607/4423 s, Ru _n , Ru ⁴⁺ hcp [Kr]4d ⁷ 5s ¹	45 Rh 102.90550(2) 173/80.5 2237/3968 s, Rh _n , Rh ³⁺ fcc [Kr]4d ⁸ 5s ¹	46 Pd 106.42(1) 169/100 1828.05/3236 s, Pd _n , Pd ²⁺ fcc [Kr]4d ¹⁰	47 Ag 107.8682(2) 165/129 1234.93/2435 s, Ag _n , Ag ¹⁺ fcc [Kr]4d ¹⁰ 5s ¹	48 Cd 112.414(4) 161/109 594.22/1040 s, Cd _n , Cd ²⁺ hcp [Kr]4d ¹⁰ 5s ²	49 In 114.818(1) 156/94 429.75/2345 s, In _n , In ³⁺ tet [Kr]4d ¹⁰ 5s ² 4p ¹	50 Sn 118.710(7) 145/83 505.08/2875 s, Sn _n , Sn ⁴⁺ tet, fcd [Kr]4d ¹⁰ 5s ² 4p ²	51 Sb 121.760(1) 133/74 903.73/1908 s, Sb _n , Sb ³⁺ rho [Kr]4d ¹⁰ 5s ² 4p ³	52 Te 127.60(3) 123/207 722.66/1261 s, Te _n , Te ²⁻ hex [Kr]4d ¹⁰ 5s ² 4p ⁴	53 I 126.90447(3) 115/206 386.85/457.4 s, I ₂ , I ⁻ ort [Kr]4d ¹⁰ 5s ² 4p ⁵	54 Xe 131.293(6) 108 161.40/165.051 g, Xe [Kr]4d ¹⁰ 5s ² 4p ⁶
55 Cs 132.90545196 298/181 301.7/944 s, Cs _n , Cs ⁺ [Xe]6s ¹	56 Ba 137.327(7) 253/149 1000/2118 s, Ba _n , Ba ²⁺ bcc [Xe]6s ²	57-71	72 Hf 178.49(2) 208/85 2506/4876 s, Hf _n , Hf ⁴⁺ hcp [Xe]4f ¹⁴ 5d ² 6s ²	73 Ta 180.94788(2) 200/78 3290/5731 s, Ta _n , Ta ⁵⁺ bcc, tet [Xe]4f ¹⁴ 5d ³ 6s ²	74 W 183.84(1) 193/74 3695/6203 s, W _n , W ⁶⁺ bcc [Xe]4f ¹⁴ 5d ⁴ 6s ²	75 Re 186.207(1) 188/67 3459/5869 s, Re _n , Re ⁷⁺ hcp [Xe]4f ¹⁴ 5d ⁵ 6s ²	76 Os 190.23(3) 185/53 3306/5285 s, Os _n , Os ⁸⁺ hcp [Xe]4f ¹⁴ 5d ⁶ 6s ²	77 Ir 192.217(3) 180/82 2719/4403 s, Ir _n , Ir ³⁺ fcc [Xe]4f ¹⁴ 5d ⁷ 6s ²	78 Pt 195.084(9) 177/94 2041.4/4098 s, Pt _n , Pt ²⁺ fcc [Xe]4f ¹⁴ 5d ⁸ 6s ¹	79 Au 196.966569(5) 174/99 1337.33/2435 s, Au _n , Au ³⁺ fcc [Xe]4f ¹⁴ 5d ¹⁰ 6s ¹	80 Hg 200.592(3) 171/116 234.3210/629.88 l, Hg _n , Hg ²⁺ rho [Xe]4f ¹⁴ 5d ¹⁰ 6s ²	81 Tl 204.38 156/102.5 577/1746 s, Tl _n , Tl ³⁺ hcp [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 4p ¹	82 Pb 207.2(1) 154/133 600.61/2022 s, Pb _n , Pb ²⁺ fcc [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 4p ²	83 Bi 208.98040(1) 143/90 544.7/1837 s, Bi _n , Bi ³⁺ rho [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 4p ³	84 Po (209) 135/108 527/1235 s, Po _n , Po ⁴⁺ cub [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 4p ⁴	85 At (210) 127/n.a. 575/610 n.a./n.a., n.a. fcc [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 4p ⁵	86 Rn (222) 120 202/211.5 g, Rn [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 4p ⁶
87 Fr (223) n.a./n.a. n.a./n.a. n.a./n.a., n.a. bcc [Rn]7s ¹	88 Ra (226) n.a./162 973/2010 s, Ra _n , Ra ²⁺ bcc [Rn]7s ²	89-103	104 Rf (267) n.a./n.a. 2400/5800 s, n.a./n.a. hcp [Rn]5f ¹⁴ 6d ² 7s ²	105 Db (268) n.a./n.a. n.a./n.a. s, n.a./n.a. bcc [Rn]5f ¹⁴ 6d ³ 7s ²	106 Sg (269) n.a./n.a. n.a./n.a. s, n.a./n.a. bcc [Rn]5f ¹⁴ 6d ⁴ 7s ²	107 Bh (270) n.a./n.a. n.a./n.a. s, n.a./n.a. hcp [Rn]5f ¹⁴ 6d ⁵ 7s ²	108 Hs (269) n.a./n.a. n.a./n.a. s, n.a./n.a. hcp [Rn]5f ¹⁴ 6d ⁶ 7s ²	109 Mt (278) n.a./n.a. n.a./n.a. s, n.a./n.a. fcc [Rn]5f ¹⁴ 6d ⁷ 7s ²	110 Ds (281) n.a./n.a. n.a./n.a. s, n.a./n.a. bcc [Rn]5f ¹⁴ 6d ⁸ 7s ²	111 Rg (282) n.a./n.a. n.a./n.a. s, n.a./n.a. bcc [Rn]5f ¹⁴ 6d ⁹ 7s ²	112 Cn (285) n.a./n.a. n.a./n.a. s, n.a./n.a. hcp [Rn]5f ¹⁴ 6d ¹⁰ 7s ²	113 Nh (286) n.a./n.a. 700/1430 s, n.a./n.a. hcp [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 4p ¹	114 Fl (289) n.a./n.a. 340/420 s, n.a./n.a. hcp [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 4p ²	115 Mc (289) n.a./n.a. 670/1400 s, n.a./n.a. hcp [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 4p ³	116 Lv (293) n.a./n.a. n.a./n.a. s, n.a./n.a. hcp [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 4p ⁴	117 Ts (294) n.a./n.a. n.a./n.a. s, n.a./n.a. hcp [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 4p ⁵	118 Og (294) n.a./n.a. n.a./n.a. s, n.a./n.a. hcp [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 4p ⁶

57 La 138.90547(7) n.a./117.2 1193/3737 s, La _n , La ³⁺ dhcp [Xe]5d ¹ 6s ²	58 Ce 140.116(1) n.a./101 1068/3716 s, Ce _n , Ce ⁴⁺ dhcp [Xe]4f ¹ 5d ¹ 6s ²	59 Pr 140.90766(2) n.a./113 1208/3403 s, Pr _n , Pr ³⁺ dhcp [Xe]4f ³ 6s ²	60 Nd 144.242(3) n.a./112.3 1297/3347 s, Nd _n , Nd ³⁺ dhcp [Xe]4f ⁴ 6s ²	61 Pm (145) n.a./111 1315/3273 s, Pm _n , Pm ³⁺ dhcp [Xe]4f ⁵ 6s ²	62 Sm 150.36(2) n.a./109.8 1345/2173 s, Sm _n , Sm ³⁺ rho [Xe]4f ⁶ 6s ²	63 Eu 151.964(1) n.a./108.7 1099/1802 s, Eu _n , Eu ³⁺ bcc [Xe]4f ⁷ 6s ²	64 Gd 157.25(3) n.a./107.8 1585/3273 s, Gd _n , Gd ³⁺ hcp [Xe]4f ⁷ 5d ¹ 6s ²	65 Tb 158.92535(2) n.a./106.3 1629/3396 s, Tb _n , Tb ³⁺ hcp [Xe]4f ⁹ 6s ²	66 Dy 162.500(1) n.a./105.2 1680/2840 s, Dy _n , Dy ³⁺ hcp [Xe]4f ¹⁰ 6s ²	67 Ho 164.93033(2) n.a./104.1 1734/2873 s, Ho _n , Ho ³⁺ hcp [Xe]4f ¹¹ 6s ²	68 Er 167.259(3) n.a./103 1802/3141 s, Er _n , Er ³⁺ hcp [Xe]4f ¹² 6s ²	69 Tm 168.93422(2) n.a./102 1818/2223 s, Tm _n , Tm ³⁺ hcp [Xe]4f ¹³ 6s ²	70 Yb 173.045(10) n.a./100.8 1097/1469 s, Yb _n , Yb ³⁺ fcc [Xe]4f ¹⁴ 6s ²	71 Lu 174.9668(1) n.a./100.1 1925/3675 s, Lu _n , Lu ³⁺ hcp [Xe]4f ¹⁴ 5d ¹ 6s ²
89 Ac (227) n.a./126 n.a./n.a. s, Ac _n , Ac ³⁺ fcc [Rn]6d ¹ 7s ²	90 Th 232.0377(4) n.a./108 2023/5061 s, Th _n , Th ⁴⁺ fcc [Rn]6d ² 7s ²	91 Pa 231.03588(2) n.a./104 1841/4300 s, Pa _n , Pa ⁴⁺ tet [Rn]5f ² 6d ¹ 7s ²	92 U 238.02891(3) n.a./103 1405.3/4404 s, U _n , U ⁴⁺ ort [Rn]5f ³ 6d ¹ 7s ²	93 Np (237) n.a./89 912/4447 s, Np _n , Np ⁵⁺ ort [Rn]5f ⁴ 6d ¹ 7s ²	94 Pu (244) n.a./100 912.5/3505 s, Pu _n , Pu ⁴⁺ mon [Rn]5f ⁶ 7s ²	95 Am (243) n.a./111.5 1449/2700 s, Am _n , Am ^{3+</}								