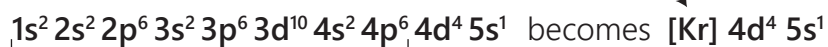


Electron Configuration Chart

Writing out the full electron configuration for elements, particularly those with many electrons, can be long and cumbersome. The condensed form simplifies this by using a previous noble gas on the periodic table to represent a large chunk of the electron configuration.

The element **niobium**, for example, uses the previous noble gas **krypton** to represent the first chunk of its electron configuration.



ATOMIC NUMBER	SYMBOL	ELEMENT	CONDENSED ELECTRON CONFIGURATION
1	H	Hydrogen	$1s^1$
2	He	Helium	$1s^2$
3	Li	Lithium	$[\text{He}] 2s^1$
4	Be	Beryllium	$[\text{He}] 2s^2$
5	B	Boron	$[\text{He}] 2s^2 2p^1$
6	C	Carbon	$[\text{He}] 2s^2 2p^2$
7	N	Nitrogen	$[\text{He}] 2s^2 2p^3$
8	O	Oxygen	$[\text{He}] 2s^2 2p^4$
9	F	Fluorine	$[\text{He}] 2s^2 2p^5$
10	Ne	Neon	$[\text{He}] 2s^2 2p^6$
11	Na	Sodium	$[\text{Ne}] 3s^1$
12	Mg	Magnesium	$[\text{Ne}] 3s^2$
13	Al	Aluminum	$[\text{Ne}] 3s^2 3p^1$
14	Si	Silicon	$[\text{Ne}] 3s^2 3p^2$
15	P	Phosphorus	$[\text{Ne}] 3s^2 3p^3$
16	S	Sulfur	$[\text{Ne}] 3s^2 3p^4$
17	Cl	Chlorine	$[\text{Ne}] 3s^2 3p^5$
18	Ar	Argon	$[\text{Ne}] 3s^2 3p^6$

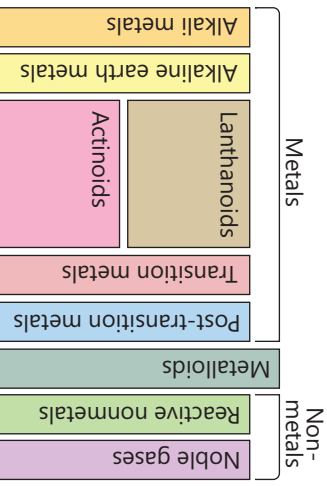
19	K	Potassium	[Ar] 4s ¹
20	Ca	Calcium	[Ar] 4s ²
21	Sc	Scandium	[Ar] 3d ¹ 4s ²
22	Ti	Titanium	[Ar] 3d ² 4s ²
23	V	Vanadium	[Ar] 3d ³ 4s ²
24	Cr	Chromium	[Ar] 3d ⁵ 4s ¹
25	Mn	Manganese	[Ar] 3d ⁵ 4s ²
26	Fe	Iron	[Ar] 3d ⁶ 4s ²
27	Co	Cobalt	[Ar] 3d ⁷ 4s ²
28	Ni	Nickel	[Ar] 3d ⁸ 4s ²
29	Cu	Copper	[Ar] 3d ¹⁰ 4s ¹
30	Zn	Zinc	[Ar] 3d ¹⁰ 4s ²
31	Ga	Gallium	[Ar] 3d ¹⁰ 4s ² 4p ¹
32	Ge	Germanium	[Ar] 3d ¹⁰ 4s ² 4p ²
33	As	Arsenic	[Ar] 3d ¹⁰ 4s ² 4p ³
34	Se	Selenium	[Ar] 3d ¹⁰ 4s ² 4p ⁴
35	Br	Bromine	[Ar] 3d ¹⁰ 4s ² 4p ⁵
36	Kr	Krypton	[Ar] 3d ¹⁰ 4s ² 4p ⁶
37	Rb	Rubidium	[Kr] 5s ¹
38	Sr	Strontium	[Kr] 5s ²
39	Y	Yttrium	[Kr] 4d ¹ 5s ²
40	Zr	Zirconium	[Kr] 4d ² 5s ²
41	Nb	Niobium	[Kr] 4d ⁴ 5s ¹
42	Mo	Molybdenum	[Kr] 4d ⁵ 5s ¹
43	Tc	Technetium	[Kr] 4d ⁵ 5s ²
44	Ru	Ruthenium	[Kr] 4d ⁷ 5s ¹
45	Rh	Rhodium	[Kr] 4d ⁸ 5s ¹

46	Pd	Palladium	[Kr] 4d ¹⁰
47	Ag	Silver	[Kr] 4d ¹⁰ 5s ¹
48	Cd	Cadmium	[Kr] 4d ¹⁰ 5s ²
49	In	Indium	[Kr] 4d ¹⁰ 5s ² 5p ¹
50	Sn	Tin	[Kr] 4d ¹⁰ 5s ² 5p ²
51	Sb	Antimony	[Kr] 4d ¹⁰ 5s ² 5p ³
52	Te	Tellurium	[Kr] 4d ¹⁰ 5s ² 5p ⁴
53	I	Iodine	[Kr] 4d ¹⁰ 5s ² 5p ⁵
54	Xe	Xenon	[Kr] 4d ¹⁰ 5s ² 5p ⁶
55	Cs	Cesium	[Xe] 6s ¹
56	Ba	Barium	[Xe] 6s ²
57	La	Lanthanum	[Xe] 5d ¹ 6s ²
58	Ce	Cerium	[Xe] 4f ¹ 5d ¹ 6s ²
59	Pr	Praseodymium	[Xe] 4f ³ 6s ²
60	Nd	Neodymium	[Xe] 4f ⁴ 6s ²
61	Pm	Promethium	[Xe] 4f ⁵ 6s ²
62	Sm	Samarium	[Xe] 4f ⁶ 6s ²
63	Eu	Europium	[Xe] 4f ⁷ 6s ²
64	Gd	Gadolinium	[Xe] 4f ⁷ 5d ¹ 6s ²
65	Tb	Terbium	[Xe] 4f ⁹ 6s ²
66	Dy	Dysprosium	[Xe] 4f ¹⁰ 6s ²
67	Ho	Holmium	[Xe] 4f ¹¹ 6s ²
68	Er	Erbium	[Xe] 4f ¹² 6s ²
69	Tm	Thulium	[Xe] 4f ¹³ 6s ²
70	Yb	Ytterbium	[Xe] 4f ¹⁴ 6s ²
71	Lu	Lutetium	[Xe] 4f ¹⁴ 5d ¹ 6s ²
72	Hf	Hafnium	[Xe] 4f ¹⁴ 5d ² 6s ²

73	Ta	Tantalum	[Xe] 4f ¹⁴ 5d ³ 6s ²
74	W	Tungsten	[Xe] 4f ¹⁴ 5d ⁴ 6s ²
75	Re	Rhenium	[Xe] 4f ¹⁴ 5d ⁵ 6s ²
76	Os	Osmium	[Xe] 4f ¹⁴ 5d ⁶ 6s ²
77	Ir	Iridium	[Xe] 4f ¹⁴ 5d ⁷ 6s ²
78	Pt	Platinum	[Xe] 4f ¹⁴ 5d ⁹ 6s ¹
79	Au	Gold	[Xe] 4f ¹⁴ 5d ¹⁰ 6s ¹
80	Hg	Mercury	[Xe] 4f ¹⁴ 5d ¹⁰ 6s ²
81	Tl	Thallium	[Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ¹
82	Pb	Lead	[Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ²
83	Bi	Bismuth	[Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ³
84	Po	Polonium	[Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁴
85	At	Astatine	[Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁵
86	Rn	Radon	[Xe] 4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶
87	Fr	Francium	[Rn] 7s ¹
88	Ra	Radium	[Rn] 7s ²
89	Ac	Actinium	[Rn] 6d ¹ 7s ²
90	Th	Thorium	[Rn] 6d ² 7s ²
91	Pa	Protactinium	[Rn] 5f ² 6d ¹ 7s ²
92	U	Uranium	[Rn] 5f ³ 6d ¹ 7s ²
93	Np	Neptunium	[Rn] 5f ⁴ 6d ¹ 7s ²
94	Pu	Plutonium	[Rn] 5f ⁶ 7s ²
95	Am	Americium	[Rn] 5f ⁷ 7s ²
96	Cm	Curium	[Rn] 5f ⁷ 6d ¹ 7s ²
97	Bk	Berkelium	[Rn] 5f ⁹ 7s ²
98	Cf	Californium	[Rn] 5f ¹⁰ 7s ²
99	Es	Einsteinium	[Rn] 5f ¹¹ 7s ²

100	Fm	Fermium	[Rn] 5f ¹² 7s ²
101	Md	Mendelevium	[Rn] 5f ¹³ 7s ²
102	No	Nobelium	[Rn] 5f ¹⁴ 7s ²
103	Lr	Lawrencium	[Rn] 5f ¹⁴ 7s ² 7p ¹
104	Rf	Rutherfordium	[Rn] 5f ¹⁴ 6d ² 7s ²
105	Db	Dubnium	[Rn] 5f ¹⁴ 6d ³ 7s ²
106	Sg	Seaborgium	[Rn] 5f ¹⁴ 6d ⁴ 7s ²
107	Bh	Bohrium	[Rn] 5f ¹⁴ 6d ⁵ 7s ²
108	Hs	Hassium	[Rn] 5f ¹⁴ 6d ⁶ 7s ²
109	Mt	Meitnerium	[Rn] 5f ¹⁴ 6d ⁷ 7s ²
110	Ds	Darmstadtium	[Rn] 5f ¹⁴ 6d ⁸ 7s ²
111	Rg	Roentgenium	[Rn] 5f ¹⁴ 6d ⁹ 7s ²
112	Cn	Copernicium	[Rn] 5f ¹⁴ 6d ¹⁰ 7s ²
113	Nh	Nihonium	[Rn] 5f ¹⁴ 6d ¹⁰ 7s ² 7p ¹
114	Fl	Flerovium	[Rn] 5f ¹⁴ 6d ¹⁰ 7s ² 7p ²
115	Mc	Moscovium	[Rn] 5f ¹⁴ 6d ¹⁰ 7s ² 7p ³
116	Lv	Livermorium	[Rn] 5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁴
117	Ts	Tennesine	[Rn] 5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁵
118	Og	Oganesson	[Rn] 5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁶

1	Hydrogen H 1 1.0079	2	Beryllium Be 4 9.0122	3	Scandium Sc 21 44.956	4	Titanium Ti 22 47.867	5	Vanadium V 23 50.942	6	Chromium Cr 24 51.996	7	Manganese Mn 25 54.938	8	Iron Fe 26 55.845	9	Cobalt Co 27 58.933	10	Nickel Ni 28 58.693	11	Copper Cu 29 63.546	12	Zinc Zn 30 65.38	13	Gallium Ga 31 69.723	14	Germanium Ge 32 72.64	15	Arsenic As 33 74.922	16	Selenium Se 34 78.96	17	Bromine Br 35 79.904	18	Krypton Kr 36 83.298
2	Lithium Li 3 6.941	Beryllium Be 4 9.0122	Scandium Sc 21 44.956	Titanium Ti 22 47.867	Vanadium V 23 50.942	Chromium Cr 24 51.996	Manganese Mn 25 54.938	Iron Fe 26 55.845	Cobalt Co 27 58.933	Nickel Ni 28 58.693	Copper Cu 29 63.546	Zinc Zn 30 65.38	Gallium Ga 31 69.723	Germanium Ge 32 72.64	Arsenic As 33 74.922	Selenium Se 34 78.96	Bromine Br 35 79.904	Krypton Kr 36 83.298																	
3	Sodium Na 11 22.990	Magnesium Mg 12 24.305	Yttrium Y 39 88.906	Zirconium Zr 40 91.224	Niobium Nb 41 92.906	Molybdenum Mo 42 95.96	Technetium Tc 43 [98]	Ruthenium Ru 44 101.07	Rhodium Rh 45 102.91	Palladium Pd 46 106.42	Silver Ag 47 107.87	Cadmium Cd 48 112.41	Indium In 49 114.82	Tin Sn 50 118.71	Antimony Sb 51 121.76	Tellurium Te 52 127.60	Iodine I 53 126.90	Xenon Xe 54 131.29																	
4	Potassium K 19 39.098	Calcium Ca 20 40.078	Strontium Sr 38 87.62	Strontium Sr 38 87.62	Yttrium Y 39 88.906	Zirconium Zr 40 91.224	Niobium Nb 41 92.906	Molybdenum Mo 42 95.96	Technetium Tc 43 [98]	Ruthenium Ru 44 101.07	Rhodium Rh 45 102.91	Palladium Pd 46 106.42	Silver Ag 47 107.87	Cadmium Cd 48 112.41	Indium In 49 114.82	Tin Sn 50 118.71	Antimony Sb 51 121.76	Tellurium Te 52 127.60	Iodine I 53 126.90	Xenon Xe 54 131.29															
5	Rubidium Rb 37 85.468	Sr Sr 38 87.62	Yttrium Y 39 88.906	Zirconium Zr 40 91.224	Niobium Nb 41 92.906	Molybdenum Mo 42 95.96	Technetium Tc 43 [98]	Ruthenium Ru 44 101.07	Rhodium Rh 45 102.91	Palladium Pd 46 106.42	Silver Ag 47 107.87	Cadmium Cd 48 112.41	Indium In 49 114.82	Tin Sn 50 118.71	Antimony Sb 51 121.76	Tellurium Te 52 127.60	Iodine I 53 126.90	Xenon Xe 54 131.29																	
6	Caesium Cs 55 132.91	Barium Ba 56 137.33	(57-71)	Hafnium Hf 72 178.49	Tantalum Ta 73 180.95	Tungsten W 74 183.84	Rhenium Re 75 186.21	Osmium Os 76 190.23	Iridium Ir 77 192.22	Platinum Pt 78 195.08	Gold Au 79 196.97	Mercury Hg 80 200.59	Thallium Tl 81 204.38	Lead Pb 82 207.2	Bismuth Bi 83 208.98	Polonium Po 84 [209]	Astatine At 85 [210]	Radon Rn 86 [222]																	
7	Francium Fr 87 [223]	Radium Ra 88 [226]	(98-103)	Rutherfordium Rf 104 [267]	Dubnium Db 105 [268]	Seaborgium Sg 106 [269]	Bohrium Bh 107 [270]	Hassium Hs 108 [277]	Meitnerium Mt 109 [278]	Darmstadtium Ds 110 [281]	Roentgenium Rg 111 [282]	Copernicium Cn 112 [285]	Nihonium Nh 113 [286]	Flerovium Fl 114 [289]	Moscovium Mc 115 [290]	Livermorium Lv 116 [293]	Tennesse Ts 117 [294]	Oganesson Og 118 [294]																	



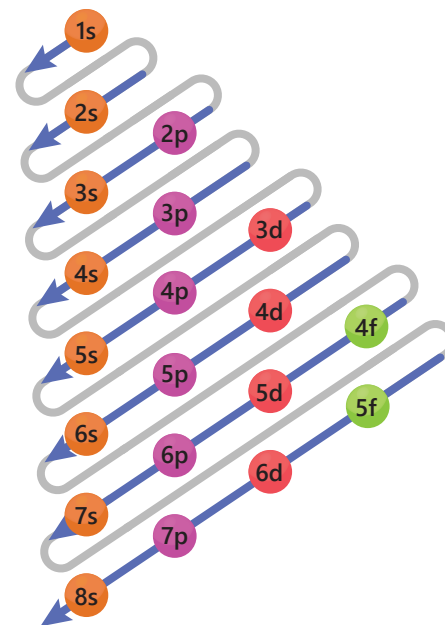
(6)	Lanthanum La 57 138.91	Cerium Ce 58 140.12	Praseodymium Pr 59 140.91	Neodymium Nd 60 144.24	Promethium Pm 61 [145]	Samarium Sm 62 150.36	Europium Eu 63 151.96	Gadolinium Gd 64 157.25	Terbium Tb 65 158.93	Dysprosium Dy 66 162.50	Holmium Ho 67 164.93	Erbium Er 68 167.26	Thulium Tm 69 168.93	Ytterbium Yb 70 173.05	Lutetium Lu 71 174.97
(7)	Actinium Ac 89 [227]	Thorium Th 90 232.04	Protactinium Pa 91 231.04	Uranium U 92 238.03	Neptunium Np 93 [237]	Plutonium Pu 94 [244]	Americium Am 95 [243]	Curium Cm 96 [247]	Berkelium Bk 97 [247]	Californium Cf 98 [251]	Einsteinium Es 99 [252]	Fermium Fm 100 [257]	Mendelevium Md 101 [258]	Nobelium No 102 [259]	Lawrencium Lr 103 [261]

AUFBAU PRINCIPLE

The Aufbau principle states that an electron occupies orbitals in order from lowest energy to highest.

This order is not just based on distance from the nucleus but also on the energy levels of the orbitals, influenced by both their size and shape.

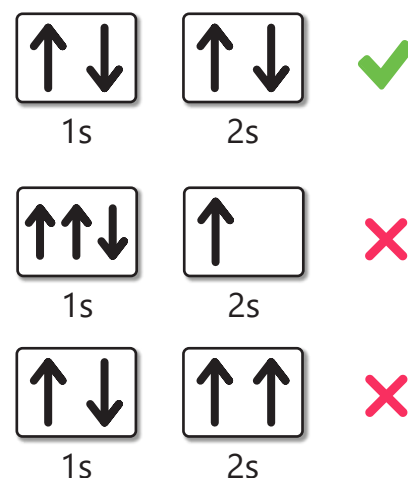
The Aufbau principle helps explain why certain elements behave similarly and is crucial for predicting an element's chemical properties.



PAULI EXCLUSION PRINCIPLE

This principle states that no two electrons in the same atom can have identical values for all four of their quantum numbers. In other words:

1. No more than two electrons can occupy the same orbital
2. Two electrons in the same orbital must have opposite spins



HUND'S FIRST RULE

Hund's first rule states:

1. Every orbital in a sublevel is singly occupied before any orbital is doubly occupied
2. All of the electrons in singly occupied orbitals have the same spin

