CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES ELECTRONIC CONFIGURATIONS - AND THE PERIODIC TABLE

The Aufbau principle and electronic configuration of the atoms of elements provide a theoretical foundation for the
classification of elements. It is now recognized that the periodic table is essentially the consequence of the periodic
variation in electronic configuration of the atoms of the elements which determine the physical and chemical
properties of the elements and their compounds. The elements in a vertical column ,i.e., in a group of the periodic table exhibit similar-chemical behaviour. This is due to the' fact that these elements have same number and same distribution of electrons in their outermost orbitals, *i.e.,* in the valency shell. For example, the group lA elements (alkali metals) which show same chemical behaviour possess same valence shell configuration, *i.e., ns*1. Similarly, the group VI lA elements (halogens) which are similar in chemical properties possess same valence shell configuration, *ns2np5.* In the periodic table, the elements have been arranged in order of increasing atomic number, i.e., increased number of orbital electrons. Thus, each element contains one more orbital electron. than the preceeding element Each period starts with ns1 configuration and ends with a noble gas (He, ls 2, in the first period and ninp6 configuration with rest of the elements). The sequence in which the various energy levels are filled determines the number of elements.

1st	period	1s				2	Elements in this period
2nd	period	2s			2p	8	Elements in this period
3rd	period	3s			3p	8	Elements in this period
4th	period	4s		3d	4p	18	Elements in this period
5th	period	5s		4d	5p	18	Elements in this period
6th	period	6s	4f	5d	6p	32	Elements in this period
7th	period	7s	5f	6d	7p	32	Elements in this period

The ground state electronic configurations oi the elements are given in the following table. For the sake of simplicity, condensed electronic configurations of the elements are given. In writing condensed electronic configuration of an element, the electronic configuration of the nearest noble gas of lower atomic number is represented by its chemical symbol in square bracket. For example, the condensed electronic configuration of sodium can be written as l

[Ne] 3 s^1

Electronic Structures of the Elements

Z	Element	Symbol	Structure
	Period - 1		
1	Hydrogen	H	$1s^1$
2	Helium	He	$1s^2$

		Period - 2	
3	Lithium	Li	[He] $2s^1$
4	Beryllium	Be	[He] $2s^2$
5	Boron	B	[He] $2s^2$ $2p^1$
6	Carbon	C	[He] $2s^2$ $2p^2$
7	Nitrogen	N	[He] $2s^2$ $2p^3$
8	Oxygen	O	[He] $2s^2$ $2p^4$
9	Fluorine	F	[He] $2s^2$ $2p^5$
10	Neon	Ne	[He] $2s^2$ $2p^6$
		Period - 3	
11	Sodium	Na	[Ne] $3s^1$
12	Magnesium	Mg	[Ne] $3s^2$
13	Aluminium	Al	[Ne] $3s^2$ $3p^1$
14	Silicon	Si	[Ne] $3s^2$ $3p^2$
15	Phosphorus	P	[Ne] $3s^2$ $3p^3$
16	Sulphur	S	[Ne] $3s^2$ $3p^4$
17	Chlorine	Cl	[Ne] $3s^2$ $3p^5$
18	Argon	Ar	[Ne] $3s^2$ $3p^6$
		Period - 4	
19	Sodium	Na	[Ne] $3s^1$
20	Magnesium	Mg	[Ne] $3s^2$
21	Aluminium	Al	[Ne] $3s^2$ $3p^1$
22	Silicon	Si	[Ne] $3s^2$ $3p^2$
23	Phosphorus	P	[Ne] $3s^2$ $3p^3$
24	Chromium	Cr	[Ar] $3d^5$ $4s^1$
25	Manganese	Mn	[Ar] $3d^5$ $4s^2$
26	Iron	Fe	[Ar] $3d^6$ $4s^2$
27	Cobalt	Co	[Ar] $3d^7$ $4s^2$
28	Nickel	Ni	[Ar] $3d^8$ $4s^2$
29	Copper	Cu	[Ar] $3d^{10}$ $4s^1$
30	Zine	Zn	[Ar] $3d^{10}$ $4s^2$
31	Gallium	Ga	[Ar] $3d^{10}$ $4s^2$ $4p^1$
32	Germanium	Ge	[Ar] $3d^{10}$ $4s^2$ $4p^2$
33	Arsenic	As	[Ar] $3d^{10}$ $4s^2$ $4p^3$
34	Selenium	Se	[Ar] $3d^{10}$ $4s^2$ $4p^4$
35	Bromine	Br	[Ar] $3d^{10}$ $4s^2$ $4p^5$
36	Krypton	Kr	[Ar] $3d^{10}$ $4s^2$ $4p^6$

		Period - 5	
37	Rubidium	Rb	[Kr] $5s^1$
38	Strontium	Sr	[Kr] $5s^2$
39	Yttrium	Y	[Kr] $4d^1$ $5s^2$
40	Zirconium	Zr	[Kr] $4d^2$ $5s^2$
41	Niobium	Nb	[Kr] $4d^4$ $5s^1$
42	Molybdenum	Mo	[Kr] $4d^5$ $5s^1$
43	Technetium	Tc	[Kr] $4d^5$ $5s^2$
		Tc	[Kr] $4d^6$ $5s^1$
44	Ruthenium	Ru	[Kr] $4d^7$ $5s^1$
45	Rhodium	Rh	[Kr] $4d^8$ $5s^1$
46	Palladium	Pd	[Kr] $4d^{10}$ $5s^0$
47	Silver	Ag	[Kr] $4d^{10}$ $5s^1$
48	Cadmium	Cd	[Kr] $4d^{10}$ $5s^2$
49	Indium	In	[Kr] $4d^{10}$ $5s^2$ $5p^1$
50	Tin	Sn	[Kr] $4d^{10}$ $5s^2$ $5p^2$
51	Antimony	Sb	[Kr] $4d^{10}$ $5s^2$ $5p^3$
52	Tellurium	Te	[Kr] $4d^{10}$ $5s^2$ $5p^4$
53	Iodine	I	[Kr] $4d^{10}$ $5s^2$ $5p^5$
54	Xenon	Xe	[Kr] $4d^{10}$ $5s^2$ $5p^6$
		Period - 6	
55	Caesium	Cs	[Xe] $6s^1$
56	Barium	Ba	[Xe] $6s^2$
57	Lanthanum	La	[Xe] $5d^1$ $6s^2$
58	Cerium	Ce	[Xe] $4f^1$ $5d^1$ $6s^2$
59	Praseodymium	Pr	[Xe] $4f^3$ $5d^0$ $6s^2$
60	Neodymium	Nd	[Xe] $4f^4$ $5d^0$ $6s^2$
61	Promethium	Pm	[Xe] $4f^5$ $5d^0$ $6s^2$
62	Samarium	Sm	[Xe] $4f^6$ $5d^0$ $6s^2$
63	Europium	Eu	[Xe] $4f^7$ $5d^0$ $6s^2$
64	Gadolinium	Gd	[Xe] $4f^7$ $5d^1$ $6s^2$
65	Terbium	Tb	[Xe] $4f^9$ $5d^0$ $6s^2$
66	Dysprosium	Dy	[Xe] $4f^{10}$ $5d^0$ $6s^2$
67	Holmium	Ho	[Xe] $4f^{11}$ $5d^0$ $6s^2$
68	Erbium	Er	[Xe] $4f^{12}$ $5d^0$ $6s^2$
69	Thulium	Tm	[Xe] $4f^{13}$ $5d^0$ $6s^2$
70	Ytterbium	Yb	[Xe] $4f^{14}$ $5d^0$ $6s^2$
71	Lutetium	Lu	[Xe] $4f^{14}$ $5d^1$ $6s^2$
72	Hafnium	Hf	[Xe] $4f^{14}$ $5d^2$ $6s^2$
73	Tantalum	Ta	[Xe] $4f^{14}$ $5d^3$ $6s^2$
74	Tungsten	W	[Xe] $4f^{14}$ $5d^4$ $6s^2$
75	Rhenium	Re	[Xe] $4f^{14}$ $5d^5$ $6s^2$
76	Osmium	Os	[Xe] $4f^{14}$ $5d^6$ $6s^2$
77	Iridium	Ir	[Xe] $4f^{14}$ $5d^7$ $6s^2$

Z	Element	Symbol	Structure
78	Platinum	Pt	[Xe] $4f^{14}$ $5d^{9}$ $6s^{1}$
79	Gold	Au	[Xe] $4f^{14}$ $5d^{10}$ $6s^{1}$
80	Mercury	Hg	[Xe] $4f^{14}$ $5d^{10}$ $6s^{2}$
81	Thallium	Tl	[Xe] $4f^{14}$ $5d^{9}$ $6s^{2}$ $6p^{1}$
82	Lead	Pb	[Xe] $4f^{14}$ $5d^{10}$ $6s^{2}$ $6p^{2}$
83	Bismuth	Bi	[Xe] $4f^{14}$ $5d^{10}$ $6s^{2}$ $6p^{3}$
84	Polonium	Po	[Xe] $4f^{14}$ $5d^{10}$ $6s^{2}$ $6p^{4}$
85	Astatine	At	[Xe] $4f^{14}$ $5d^{10}$ $6s^{2}$ $6p^{5}$
86	Radon	Rn	[Xe] $4f^{14}$ $5d^{10}$ $6s^{2}$ $6p^{6}$

Period - 7

87	Francium	Fr	[Rn] $7s^{1}$
88	Radium	Ra	[Rn] $7s^{2}$
89	Actinium	Ac	[Rn] $6d^{1}$ $7s^{2}$
90	Thorium	Th	[Rn] $6d^{2}$ $7s^{2}$
91	Protactinium	Pa	[Rn] $5f^{2}$ $6d^{1}$ $7s^{2}$
92	Uranium	U	[Rn] $5f^{3}$ $6d^{1}$ $7s^{2}$
93	Neptunium	Np	[Rn] $5f^{4}$ $6d^{1}$ $7s^{2}$
94	Plutonium	Pu	[Rn] $5f^{6}$ $6d^{0}$ $7s^{2}$
95	Americium	Am	[Rn] $5f^{7}$ $6d^{0}$ $7s^{2}$
96	Curium	Cm	[Rn] $5f^{7}$ $6d^{1}$ $7s^{2}$
97	Berkelium	Bk	[Rn] $5f^{9}$ $6d^{0}$ $7s^{2}$
		Bk	[Rn] $5f^{8}$ $6d^{1}$ $7s^{2}$
98	Californium	Cf	[Rn] $5f^{10}$ $6d^{0}$ $7s^{2}$
99	Einsteinium	Es	[Rn] $5f^{11}$ $6d^{0}$ $7s^{2}$
100	Fermium	Fm	[Rn] $5f^{12}$ $6d^{0}$ $7s^{2}$
101	Mendelevium	Md	[Rn] $5f^{13}$ $6d^{0}$ $7s^{2}$
102	Nobelium	No	[Rn] $5f^{14}$ $6d^{0}$ $7s^{2}$
103	Lawrencium	Lr	[Rn] $5f^{14}$ $6d^{1}$ $7s^{2}$
104	Rutherfordium	Rf	[Rn] $5f^{14}$ $6d^{2}$ $7s^{2}$
105	Dubnium	Db	[Rn] $5f^{14}$ $6d^{3}$ $7s^{2}$
106	Seaborgium	Sg	[Rn] $5f^{14}$ $6d^{4}$ $7s^{2}$
107	Bohrium	Bh	[Rn] $5f^{14}$ $6d^{5}$ $7s^{2}$
108	Hassnium	Hs	[Rn] $5f^{14}$ $6d^{6}$ $7s^{2}$
109	Meitnerium	Mt	[Rn] $5f^{14}$ $6d^{7}$ $7s^{2}$
110	Darmstadtiun	Ds	[Rn] $5f^{14}$ $6d^{8}$ $7s^{2}$
111	Rontgenium	Rg	[Rn] $5f^{14}$ $6d^{9}$ $7s^{2}$
112	Ununbium	Uub	[Rn] $5f^{14}$ $6d^{10}$ $7s^{2}$
113	Ununtrium	Uut	[Rn] $5f^{14}$ $6d^{10}$ $7s^{2}$ $7p^{1}$
114	Ununquadiun	Uuq	[Rn] $5f^{14}$ $6d^{10}$ $7s^{2}$ $7p^{2}$
115	Ununpentium	Uup	[Rn] $5f^{14}$ $6d^{10}$ $7s^{2}$ $7p^{3}$
116	Ununhexium	Uuh	[Rn] $5f^{14}$ $6d^{10}$ $7s^{2}$ $7p^{4}$
117	Ununoctium	Uuo	[Rn] $5f^{14}$ $6d^{10}$ $7s^{2}$ $7p^{6}$