KITCHEN PERIODIC TABLE OF THE ELEMENTS

Not for laboratory, industrial, or nuclear applications.

Fe	Hg	He	Tc
solid	liquid	gas	synthetic

The group numbers 1–18 were adopted in 1984 by the International Union of Pure and Applied Chemistry (IUPAC). The older scheme was originated by Mendeleev. Roman numerals were conventionally used in the older schemes, but I also see Arabic numerals, which are used here for simplicity. The old IUPAC system, still seen in Europe, suffixed A for the left side of the table, B for the right. The U.S. system suffixed A for the main groups, B for the transition groups. Groups are also referred to by the names shown at bottom (names in parentheses are not IUPAC standards), or by the names of the first element of the group. Atkins (1995) anticipates that the use of the older schemes will continue, though with decreasing frequency, as a secondary practice, in cases where that scheme is particularly appropriate.

shell	subshell	subshell max electrons	shell max electrons
K / 1	1s	2	2
L / 2	2s	2	8
	2p	6	
M / 3	3s	2	18
	3p	6	
	3d	10	
N / 4	4s	2	32
	4p	6	
	4d	10	
	4f	14	
O / 5	5s	2	50
	5p	6	
	5d	10	
	5f	14	
	5g	18	

In the transition metals, a valence electron can also be in an inner shell. The electrons that determine how an atom reacts chemically are those that travel farthest from the nucleus, that is, those with the highest energy, and not necessarily in the valence shell. (W)

isotopes

I20: **123** **124** 125
I: **x** **x** x

number of known isotopes: **most common (most stable for radioactive elements)** **other important** misc., or importance TBD

†(before shells) Electronic configuration tentative, after that of the element above it.
Other repeated text in info boxes to notes section.
Optically center weights w/ superscript after

s-block · *d*-block · *p*-block

1 H Hydrogen 1.007 — $1s^1$ • 1

Hydrogen has properties that warrant its placement at the head of Group IA (though not a metal) or at the head of Group VIIA (it has resemblances to the halogens). Both placements are seen, as well as placement by itself.

IUPAC GROUPS (U.S. / old IUPAC) · **PERIODS**

Period	1 1A / 1A	2 2A / 2A	3 3B / 3A	4 4B / 4A	5 5B / 5A	6 6B / 6A	7 7B / 7A	8 8B / 8A	9 8B / 8A	10 8B / 8A	11 1B / 1B	12 2B / 2B	13 3A / 3B	14 4A / 4B	15 5A / 5B	16 6A / 6B	17 7A / 7B	18 8A / 8B
1																		**2 He** Helium 4.002 $1s^2$ • 2
2	**3 Li** Lithium 6.941 $[He]2s^1$ • 2-1	**4 Be** Beryllium 9.012 [He]2s2 • 2-2											**5 B** Boron 10.811 $[He]2s^22p^1$ • 2-3	**6 C** Carbon 12.011 $[He]2s^22p^2$ • 2-4	**7 N** Nitrogen 14.0067 $[He]2s^22p^3$ • 2-5	**8 O** Oxygen 15.9994 $[He]2s^22p^4$ • 2-6	**9 F** Fluorine 18.998 $[He]2s^22p^5$ • 2-7	**10 Ne** Neon 20.179 $[He]2s^22p^6$ • 2-8
3	**11 Na** Sodium 22.989 $[Ne]3s^1$ • 2-8-1	**12 Mg** Magnesium 24.305 $[Ne]3s^2$ • 2-8-2											**13 Al** Aluminum 26.981 $[Ne]3s^23p^1$ • 2-8-3	**14 Si** Silicon 28.0855 $[Ne]3s^23p^2$ • 2-8-4	**15 P** Phosphorus 30.973 $[Ne]3s^23p^3$ • 2-8-5	**16 S** Sulfur 32.06 $[Ne]3s^23p^4$ • 2-8-6	**17 Cl** Chlorine 35.453 $[Ne]3s^23p^5$ • 2-8-7	**18 Ar** Argon 39.948 $[Ne]3s^23p^6$ • 2-8-8
4	**19 K** Potassium 39.0983 $[Ar]4s^1$ • 2-8-8-1	**20 Ca** Calcium 40.08 $[Ar]4s^2$ • 2-8-8-2	**21 Sc** Scandium 44.9559 $[Ar]4s^23d^1$ • 2-8-9-2	**22 Ti** Titanium 47.88 $[Ar]4s^23d^2$ • 2-8-10-2	**23 V** Vanadium 50.9415 $[Ar]4s^23d^3$ • 2-8-11-2	**24 Cr** Chromium 51.996 $[Ar]4s^13d^5$ • 2-8-13-1	**25 Mn** Manganese 54.9380 $[Ar]4s^23d^5$ • 2-8-13-2	**26 Fe** Iron 55.847 $[Ar]4s^23d^6$ • 2-8-14-2 The heaviest element formed by nuclear fusion in stars.	**27 Co** Cobalt 58.9332 $[Ar]4s^23d^7$ • 2-8-15-2	**28 Ni** Nickel 58.69 $[Ar]4s^23d^8$ • 2-8-16-2	**29 Cu** Copper 63.546 $[Ar]4s^13d^{10}$ • 2-8-18-1	**30 Zn** Zinc 65.38 $[Ar]4s^23d^{10}$ • 2-8-18-2	**31 Ga** Gallium 69.72 $[Ar]3d^{10}4s^24p^1$ • 2-8-18-3	**32 Ge** Germanium 72.59 $[Ar]3d^{10}4s^24p^2$ • 2-8-18-4	**33 As** Arsenic 74.9216 $[Ar]3d^{10}4s^24p^3$ • 2-8-18-5	**34 Se** Selenium 78.96 $[Ar]3d^{10}4s^24p^4$ • 2-8-18-6	**35 Br** Bromine 79.904 $[Ar]3d^{10}4s^24p^5$ • 2-8-18-7	**36 Kr** Krypton 83.80 $[Ar]3d^{10}4s^24p^6$ • 2-8-18-8
5	**37 Rb** Rubidium 85.4678 $[Kr]5s^1$ • 2-8-18-8-1	**38 Sr** Strontium 87.62 $[Kr]5s^2$ • 2-8-18-8-2	**39 Y** Yttrium 88.9059 $[Kr]4d^15s^2$ • 2-8-18-9-2	**40 Zr** Zirconium 91.22 $[Kr]4d^25s^2$ • 2-8-18-10-2	**41 Nb** Niobium 92.9064 $[Kr]4d^45s^1$ • 2-8-18-12-1	**42 Mo** Molybdenum 95.94 $[Kr]4d^55s^1$ • 2-8-18-13-1	**43 Tc** Technetium (98) $[Kr]4d^55s^2$ • 2-8-18-13-2	**44 Ru** Ruthenium 101.07 $[Kr]4d^75s^1$ • 2-8-18-15-1 44–46, 74–79: siderophiles. Strongly tend to combine with iron, thus 98% of them drawn with it to interior of Earth, therefore rare on surface.	**45 Rh** Rhodium 102.9055 $[Kr]4d^85s^1$ • 2-8-18-16-1 44–46, 74–79: siderophiles. Strongly tend to combine with iron, thus 98% of them drawn with it to interior of Earth, therefore rare on surface.	**46 Pd** Palladium 106.42 $[Kr]4d^{10}$ • 2-8-18-18-0 44–46, 74–79: siderophiles. Strongly tend to combine with iron, thus 98% of them drawn with it to interior of Earth, therefore rare on surface.	**47 Ag** Silver 107.8682 $[Kr]4d^{10}5s^1$ • 2-8-18-18-1	**48 Cd** Cadmium 112.41 $[Kr]4d^{10}5s^2$ • 2-8-18-18-2	**49 In** Indium 114.82 $[Kr]4d^{10}5s^25p^1$ 2-8-18-18-3	**50 Sn** Tin 118.69 $[Kr]4d^{10}5s^25p^2$ 2-8-18-18-4	**51 Sb** Antimony 121.75 $[Kr]4d^{10}5s^25p^3$ 2-8-18-18-5	**52 Te** Tellurium 127.60 $[Kr]4d^{10}5s^25p^4$ 2-8-18-18-6	**53 I** Iodine 126.9045 $[Kr]4d^{10}5s^25p^5$ 2-8-18-18-7	**54 Xe** Xenon 131.29 $[Kr]4d^{10}5s^25p^6$ 2-8-18-18-8
6	**55 Cs** Cesium 132.9054 $[Xe]6s^1$ • 2-8-18-18-8-1	**56 Ba** Barium 137.33 $[Xe]6s^2$ • 2-8-18-18-8-2	**57 La** Lanthanum 138.9055 $[Xe]5d^16s^2$ • 2-8-18-18-9-2	**72 Hf** Hafnium 178.49 $[Xe]4f^{14}5d^26s^2$ 2-8-18-32-10-2	**73 Ta** Tantalum 180.9479 $[Xe]4f^{14}5d^36s^2$ 2-8-18-32-11-2	**74 W** Tungsten 183.85 $[Xe]4f^{14}5d^46s^2$ 2-8-18-32-12-2 44–46, 74–79: siderophiles. Strongly tend to combine with iron, thus 98% of them drawn with it to interior of Earth, therefore rare on surface.	**75 Re** Rhenium 186.207 $[Xe]4f^{14}5d^56s^2$ 2-8-18-32-13-2 44–46, 74–79: siderophiles. Strongly tend to combine with iron, thus 98% of them drawn with it to interior of Earth, therefore rare on surface.	**76 Os** Osmium 190.2 $[Xe]4f^{14}5d^66s^2$ 2-8-18-32-14-2 44–46, 74–79: siderophiles. Strongly tend to combine with iron, thus 98% of them drawn with it to interior of Earth, therefore rare on surface.	**77 Ir** Iridium 192.22 $[Xe]4f^{14}5d^76s^2$ 2-8-18-32-15-2 44–46, 74–79: siderophiles. Strongly tend to combine with iron, thus 98% of them drawn with it to interior of Earth, therefore rare on surface.	**78 Pt** Platinum 195.08 $[Xe]4f^{14}5d^96s^1$ 2-8-18-32-17-1 44–46, 74–79: siderophiles. Strongly tend to combine with iron, thus 98% of them drawn with it to interior of Earth, therefore rare on surface.	**79 Au** Gold 196.9665 $[Xe]4f^{14}5d^{10}6s^1$ 2-8-18-32-18-1 44–46, 74–79: siderophiles. Strongly tend to combine with iron, thus 98% of them drawn with it to interior of Earth, therefore rare on surface.	**80 Hg** Mercury 200.59 $[Xe]4f^{14}5d^{10}6s^2$ 2-8-18-32-18-2	**81 Tl** Thallium 204.37 $[Xe]4f^{14}5d^{10}6s^26p^1$ 2-8-18-32-18-3	**82 Pb** Lead 207.2 $[Xe]4f^{14}5d^{10}6s^26p^2$ 2-8-18-32-18-4	**83 Bi** Bismuth 208.9804 $[Xe]4f^{14}5d^{10}6s^26p^3$ 2-8-18-32-18-5	**84 Po** Polonium (209)[c] $[Xe]4f^{14}5d^{10}6s^26p^4$ 2-8-18-32-18-6	**85 At** Astatine (210)[c] $[Xe]4f^{14}5d^{10}6s^26p^5$ 2-8-18-32-18-7 Exists on Earth only in submicroscopic quantities.	**86 Rn** Radon (222)[c] $[Xe]4f^{14}5d^{10}6s^26p^6$ 2-8-18-32-18-8
7	**87 Fr** Francium (223)[c] $[Rn]7s^1$ • 2-8-18-32-18-8-1 "It has been estimated that in the whole of Earth at any one time there are only about 17 atoms of francium." (Atkins.)	**88 Ra** Radium 226.0254[b] $[Rn]7s^2$ • 2-8-18-32-18-8-2	**89 Ac** Actinium 227.0278[b] $[Rn]6d^17s^2$ 2-8-18-32-18-9-2	**104 Rf** Rutherfordium (261)[d] $[Rn]5f^{14}6d^27s^2$ 2-8-18-32-32-10-2 Electronic configuration is tentative.	**105 Db** Dubnium (262)[d] $[Rn]5f^{14}6d^37s^2$ 2-8-18-32-32-11-2 Electronic configuration tentative, after tantalum.	**106 Sg** Seaborgium (263)[d] $[Rn]5f^{14}6d^47s^2$ 2-8-18-32-32-12-2 Electronic configuration tentative, after tungsten.	**107 Bh** Bohrium (262)[d] $[Rn]5f^{14}6d^57s^2$ 2-8-18-32-32-13-2 Electronic configuration tentative, after rhenium.	**108 Hs** Hassium (265)[d] $[Rn]5f^{14}6d^67s^2$ 2-8-18-32-32-14-2 Electronic configuration tentative, after osmium.	**109 Mt** Meitnerium (266)[d] $[Rn]5f^{14}6d^77s^2$ 2-8-18-32-32-15-2 Electronic configuration tentative, after iridium.	**110 Ds** Darmstadtium (269)[d] $[Rn]5f^{14}6d^97s^1$ [2-8-18-32-32-17-1] Electronic configuration tentative, after platinum. Extremely radioactive: the most stable known isotope, Ds-281, has a half-life of appx. 10 seconds.	**111 Rg** Roentgenium (272)[d] $[Rn]5f^{14}6d^{10}7s^1$ [2-8-18-32-32-18-1] Electronic configuration tentative, after gold. Extremely radioactive: the most stable known isotope, Rg-282, has a half-life of 121 seconds.	**112 Cn** Copernicium (277)[d] $[Rn]5f^{14}6d^{10}7s^2$ [2-8-18-32-32-18-2] Electronic configuration tentative, after mercury. The most stable known isotope, Cn-285, has a half-life of appx. 29 seconds.	**113 Nh** Nihonium Synthesis first reported (with that of 115) Jan. '04, by the Joint Institute for Nuclear Rsch, Dubna & Livermore. (*Physical Review C*, *NYT* 2/1/04, *SN* 2/7/04.)	**114 Fl** Flerovium (289)[d] $[Rn]5f^{14}6d^{10}7s^27p^2$ 2-8-18-32-32-18-4 Electronic configuration tentative, after lead.	**115 Mc** Moscovium Synthesis first reported (with that of 113) Jan. '04, by the Joint Institute for Nuclear Rsch, Dubna & Livermore. (Physical Review C, NYT 2/1/04, SN 2/7/04.)	**116 Lv** Livermorium (289)[d] $[Rn]5f^{14}6d^{10}7s^27p^4$ [2-8-18-32-32-18-6] Electronic configuration tentative, after polonium.	**117 Ts** Tennessine	**118 Og** Oganesson (293)[d] $[Rn]5f^{14}6d^{10}7s^27p^6$ 2-8-18-32-32-18-8 Electronic configuration tentative, after radon. (Above info based on an early claim of discovery that was retracted.)

Alkali Metals	Alkaline Earth Metals	Transition Metals (groups 3–12)	(coinage metals)	(other metals)	(pnictogens)	Chalcogens	Halogens	Noble Gases
Highly reactive, increasingly so with mass. Not found free in nature.	Very reactive, increasingly so with mass. Not found free in nature.						("salt-formers")	

f-block

The extent of the Lanthanoid and Actinoid series is open to various interpretations. Some include lanthanum and actinium. Atkins gives the superset of all proposed ranges: elements 57–79 and 89–103. (Information on this issue is scattered throughout Atkins, esp. p. 89ff.)

The placement of these series as an "island" is purely a graphic convenience. In fact, they constitute a further "isthmus" interrupting the d-block. Though part of periods 6 and 7, respectively, there is little practical point in assigning them to groups. They are chemically very similar, and generally of little interest.

According to Winter, "Lanthanoids" and "Actinoids" are more correct than "-ides". (The latter, however, is very common.) I presume this is because -ide is "a suffix used to denote chemical compounds" (*RHD*II) while -oid here signifies the close resemblance of the chemical properties of all the elements in the respective series to those of lanthanum and actinium.

Series	Period														
Lanthanoids ("rare earths")	6	**58 Ce** Cerium 140.12 $[Xe]4f^15d^16s^2$ 2-8-18-20-8-2	**59 Pr** Praseodymium 140.9077 $[Xe]4f^36s^2$ 2-8-18-21-8-2	**60 Nd** Neodymium 144.24 $[Xe]4f^46s^2$ 2-8-18-22-8-2	**61 Pm** Promethium (145)[c] $[Xe]4f^56s^2$ • 2-8-18-23-8-2	**62 Sm** Samarium 150.36 $[Xe]4f^66s^2$ • 2-8-18-24-8-2	**63 Eu** Europium 151.96 $[Xe]4f^76s^2$ • 2-8-18-25-8-2	**64 Gd** Gadolinium 157.25 $[Xe]4f^75d^16s^2$ 2-8-18-25-9-2	**65 Tb** Terbium 158.9254 $[Xe]4f^96s^2$ • 2-8-18-27-8-2	**66 Dy** Dysprosium 162.50 $[Xe]4f^{10}6s^2$ 2-8-18-28-8-2	**67 Ho** Holmium 164.9304 $[Xe]4f^{11}6s^2$ 2-8-18-29-8-2	**68 Er** Erbium 167.26 $[Xe]4f^{12}6s^2$ 2-8-18-30-8-2	**69 Tm** Thulium 168.9342 $[Xe]4f^{13}6s^2$ 2-8-18-31-8-2	**70 Yb** Ytterbium 173.04 $[Xe]4f^{14}6s^2$ 2-8-18-32-8-2	**71 Lu** Lutetium 174.967 $[Xe]4f^{14}5d^16s^2$ 2-8-18-32-9-2
Actinoids	7	**90 Th** Thorium 232.0381[a] $[Rn]6d^27s^2$ 2-8-18-32-18-10-2	**91 Pa** Protactinium 231.0359[b] $[Rn]5f^26d^17s^2$ 2-8-18-32-20-9-2	**92 U** Uranium 238.0289 $[Rn]5f^36d^17s^2$ 2-8-18-32-21-9-2 The heaviest naturally occurring element, formed in the collapse of very massive stars.	**93 Np** Neptunium 237.0482[b] $[Rn]5f^46d^17s^2$ 2-8-18-32-22-9-2	**94 Pu** Plutonium (244)[c] $[Rn]5f^67s^2$ 2-8-18-32-24-8-2	**95 Am** Americium (243)[c] $[Rn]5f^77s^2$ 2-8-18-32-25-8-2	**96 Cm** Curium (247)[c] $[Rn]5f^76d^17s^2$ 2-8-18-32-25-9-2	**97 Bk** Berkelium (247)[c] $[Rn]5f^97s^2$ 2-8-18-32-26-9-2	**98 Cf** Californium (249)[c] $[Rn]5f^{10}7s^2$ 2-8-18-32-28-8-2	**99 Es** Einsteinium (252)[c] $[Rn]5f^{11}7s^2$ 2-8-18-32-29-8-2	**100 Fm** Fermium (257)[c] $[Rn]5f^{12}7s^2$ 2-8-18-32-30-8-2	**101 Md** Mendelevium (258)[c] $[Rn]5f^{13}7s^2$ 2-8-18-32-31-8-2	**102 No** Nobelium (259)[c] $[Rn]5f^{14}7s^2$ 2-8-18-32-32-8-2	**103 Lr** Lawrencium (260)[c] $[Rn]5f^{14}7s^27p^1$ 2-8-18-32-32-9-2 Electronic configuration tentative. Symbol formerly Lw.

non-metals

Nearly full valence shells; tend to accept electrons to form stable compounds

metalloids

5 Bo, 14 Si, 32 Ge, 33 As, 51 Sb, 52 Te, 84 Po, 85 At

There is no definitive list of metalloids, the category represents a gradation between metals and non-metals. Po and At are somewhat less often included than the others. Se is occasionally group with them, and more rarely C and Al.

metals

Fewer electrons in valence shells; tend to lose electrons.

Radioactive elements: 43, 84+

Other elements have radioactive isotopes.

a) The atomic masses of many elements are not invariant but depend on the origin and treatment of the material; the values given here apply to elements as they exist naturally on the earth and to certain artificial elements. See Chemica notes for revisions begun in 2011.
b) For these radioactive elements the mass given is that for the longest-lived isotope.
c) Atomic masses for these radioactive elements cannot be quoted precisely without knowledge of the origin of the elements; the value given is the atomic mass number of the isotope of that element of longest known half-life, or, in some cases (undistinguished, in *Web Elements*, for elements 104+) that of the most common isotope.
d) The value given is the atomic mass number of the most stable or most common isotope.

Sources: Gillespie, et al., *Chemistry*. P.W. Atkins, *The Periodic Kingdom*. Electronic configurations for each element's ground state neutral gaseous atom, and miscellaneous information, from Mark Winter, *WebElements*, except elements 110+.