PERIODIC TABLE OF THE ELEMENTS

Table of Selected Radioactive Isotopes

0n	1	(15.3 min) β^-	30Zn	67	(61.88 h) β^+	51Sb	124	(60.20 d) β^+	74W	181	(140 d) EC	91Pa	231	(3.28 x 10^4 y) α
1H	3	(12.26 y) β^-		65	(244.1 d) β^+, EC		125	(2.7 y) β^+		185	(75.1 d) β^+	92U	233	(1.59 x 10^5 y) α
4Be	7	(53.3 d) EC	31Ga	67	(78.2 h) EC	52Te	121 m	(1.54 d) IT		188	(69 d) β^-		234	(2.44 x 10^5 y) α
	10	(1.6 x 10^6 y) β^+		72	(14.10 h) β^-		123 m	(119.7 d) IT	75Re	187	(5 x 10^{10} y) β^-		235	(7.04 x 10^8 y) α
6C	11	(20.40 min) β^+	32Ge	68	(275 d) EC		127 m	(109 d) IT	76Os	194	(6.0 y) β^-		236	(2.34 x 10^7 y) α
	14	(5730 y) β^-	33As	73	(80.3 d) EC	53I	129	(1.6 x 10^7 y) β^-	77Ir	192	(74.2 d) β^-, β^+, EC		238	(4.47 x 10^9 y) α
9F	18	(109.8 min) β^+		74	(17.9 d) β^-, β^+, EC		131	(8.040 d) β^-	79Au	195	(183 d) EC	93Np	236	(1.1 x 10^5 y) EC, β^-
11Na	22	(2.602 y) β^+, EC	34Se	75	(118.5 d) β^+	54Xe	133	(5.25 d) β^-		196	(6.18 d) β^+, EC, β^-		237	(2.14 x 10^6 y) α
	24	(15.02 h) β^-		79	(6.5 x 10^4 y) β^-		135	(9.10 h) β^-		198	(2.696 d) β^-		239	(2.346 d) β^-
12Mg	28	(20.9 h) β^-	35Br	82	(35.34 h) β^-	55Cs	134	(2.06 y) β^-		199	(3.15 d) β^-	94Pu	238	(87.75 y) α
13Al	26	(7.2 x 10^5 y) β^+, EC	36Kr	81	(2.1 x 10^5 y) EC		135	(2.9 x 10^6 y) β-	80Hg	203	(46.8 d) β^-		239	(2.41 x 10^4 y) α
15P	32	(14.26 d) β^-		85	(10.72 y) β^-		137	(30.17 y) β^-	81Tl	204	(3.77 y) β^-		240	(6.54 x 10^3 y) α
16S	35	(87.2 d) β^-	37Rb	86	(18.7 d) β^-	56Ba	140	(12.8 d) β^-	82Pb	202	(3 x 10^5 y) EC		242	(3.8 x 10^5 y) α
17Cl	36	(3.01 x 10^5 y) β^-		87	(4.8 x 10^{10} y) β^-	57La	137	(6 x 10^4 y) EC		205	(3 x 10^7 y) EC		244	(8.3 x 10^7 y) α
	38	(37.2 min) β^-	38Sr	90	(28.8 y) β^-		140	(40.3 h) β^-		210	(22.3 y) β^-, α	95Am	241	(432 y) α
18Ar	37	(35.02 d) EC	39Y	88	(106.6 d) β^+, EC	58Ce	144	(284 d) β^-	83Bi	207	(38 y) EC		243	(7.37 x 10^3 y) α
	39	(265 y) β^-	40Zr	93	(1.5 x 10^6 y) β^+	59Pr	142	(19.1 h) β^-		208	(3.7 x 10^5 y) EC	96Cm	242	(163.2 d) α
19K	40	(1.28 x 10^9 y) EC		95	(64.0 d) β^-	60Nd	147	(11.1 d) β^-		210	(5.01 d) β^-, α		244	(18.12 y) α
	42	(12.36 h) β^-	41Nb	94	(2.0 x 10^4 y) β^+	61Pm	145	(18 y) EC		210 m	(3 x 10^6 y) α		247	(1.55 x 10^7 y) α
20Ca	45	(165 d) β^-		95	(35.15 d) β^-		147	(2.62 y) β^-	84Po	208	(2.90 y) α		248	(3.5 x 10^5 y) α, SF
21Sc	46	(83.80 d) β^-	42Mo	99	(66.02 h) β^-	62Sm	146	(7 x 10^7 y) α		209	(102 y) α	97Bk	247	(1.4 x 10^3 y) α
24Cr	51	(27.70 d) EC	43Tc	97	(2.6 x 10^6 y) EC		151	(93 y) β^-		210	(138.38 d) α	98Cf	249	(351 y) α
25Mn	53	(2 x 10^6 y) EC		98	(4.2 x 10^6 y) β^-	63Eu	152	(13 y) β^-, EC, β^-	85At	209	(5.4 h) EC, α		251	(900 y) α
	54	(313.0 d) EC		99	(2.13 x 10^5 y) β^-		154	(8.5 y) β^-		210	(8.1 h) EC	99Es	252	(472 d) α
	56	(2.578 h) β^-	44Ru	106	(367 d) β^-	64Gd	150	(2.1 x 10^6 y) α		211	(7.21 h) EC, α		253	(20.47 d) α
26Fe	59	(44.6 d) β^-	45Rh	101	(3.3 y) EC	65Tb	158	(1.2 x 10^5 y) EC, β^-	86Rn	222	(3.824 d) α		254	(276 d) α
27Co	56	(78.84) β^+, EC	46Pd	103	(17.0 d) EC		160	(72.3 d) β^-	87Fr	212	(19.3 min) EC, α	100Fm	255	(20.1 h) α
	57	(270 d) EC		107	(7 x 10^6 y) β^-	66Ho	166 m	(1.2 x 10^3 y) β^-		222	(15 min) β^-		257	(100.5 d) α
	58	(71.3 d) β^+, EC	47Ag	108	(127 y) EC	67Ho	170	(128.6 d) β^-		223	(21.8 min) β^-	101Md	258	(55 d) α
	60	(5.272 y) β^-		110	(252 d) β^-		171	(1.92 y) β^-	88Ra	226	(1.60 x 10^3 y) α	102No	256	(58 min) α
28Ni	57	(36.0 h) β^+, EC		111	(7.45 d) β^-	68Er	169	(32.0 d) EC	89Ac	227	(21.77 y) β^-	103Lr	260	(3.0 min) α
	59	(8 x 10^4 y) EC	48Cd	109	(453.6 d) EC		175	(4.19 d) β^-	90Th	228	(1.913 y) α	104	261	(65 s) α
	63	(92 y) β^-	49In	114	(49.51 d) IT	69Tm	171	(1.92 y) β^-		230	(7.7 x 10^4 y) α	105	262	(40 s) α
29Cu	64	(12.70 h) β^-, β^+, EC	50Sn	121	(76 y) β^-	70Yb	169	(32.0 d) EC		232	(1.40 x 10^{10} y) α	106	263	(0.9 d) α
						71Lu	176	(3.7 x 10^{10} y) β^-						
						72Ta	182	(115.0 d) β^-						

Selected Radioactive Isotopes

Naturally occurring radioactive isotopes are designated by a mass number in blue (although some are also manufactured). Letter m indicates an isomer of another isotope of the same mass number. Half-lives follow in parentheses, where s, min, h, d, and y stand respectively for seconds, minutes, hours, days, and years. The table includes mainly the longer-lived radioactive isotopes; many others have been prepared. Isotopes known to be radioactive but with half-lives exceeding 10^{12} y have not been included. Symbols describing the principal mode (or modes) of decay are as follows (these processes are generally accompanied by gamma radiation):

- α alpha particle emission
- β^- beta particle (electron) emission
- β^+ positron emission
- EC orbital electron capture
- IT isomeric transition from upper to lower isomeric state
- SF spontaneous fission

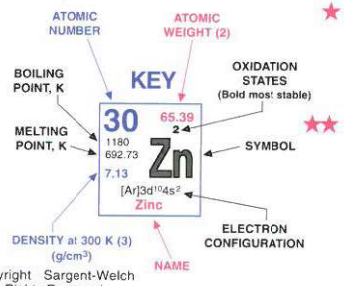
GROUP IA	IIA	IIIA	IVA	VA	VIA	VIIA	VIIIA			IB	IIB	IIIB	IVB	VB	VIB	VIIB	VIII
1 1.00794 1 20.28 13.81 0.0899 † **H** 1s¹ Hydrogen																	2 4.00260 4.216 0.95 at 26 atm 0.1785† **He** 1s² Helium
3 6.941 1 1615 453.7 0.53 **Li** 1s²2s¹ Lithium	4 9.01218 2 3243 1560 1.85 **Be** 1s²2s² Beryllium											5 10.811 3 4275 2365 2.34 **B** 1s²2s²2p¹ Boron	6 12.011 ±4,2 5100* 3825* 2.26 **C** 1s²2s²2p² Carbon	7 14.0067 ±3,5,4,2 77.344 63.15 1.251† **N** 1s²2s²2p³ Nitrogen	8 15.9994 -2 90.188 54.8 1.429† **O** 1s²2s²2p⁴ Oxygen	9 18.99840 -1 85.0 53.55 1.696† **F** 1s²2s²2p⁵ Fluorine	10 20.1797 27.10 24.55 0.900† **Ne** 1s²2s²2p⁶ Neon
11 22.98977 1 1156 371.0 0.97 **Na** [Ne]3s¹ Sodium	12 24.305 2 1380 922 1.74 **Mg** [Ne]3s² Magnesium											13 26.98154 3 2740 933.5 2.70 **Al** [Ne]3s²p¹ Aluminum	14 28.0855 4,2 2630 1683 2.33 **Si** [Ne]3s²p² Silicon	15 30.97376 ±3,5,4 553 317.3 1.82 **P** [Ne]3s²p³ Phosphorus	16 32.066 ±2,4,6 717.82 392.2 2.07 **S** [Ne]3s²p⁴ Sulfur	17 35.4527 ±1,3,5,7 239.18 172.17 3.214† **Cl** [Ne]3s²p⁵ Chlorine	18 39.948 87.45 83.95 1.784† **Ar** [Ne]3s²p⁶ Argon
19 39.0983 1 1033 336.8 0.86 **K** [Ar]4s¹ Potassium	20 40.078 2 1757 1112 1.55 **Ca** [Ar]4s² Calcium	21 44.9559 3 3109 1814 2.99 **Sc** [Ar]3d¹4s² Scandium	22 47.88 4,3 3560 1935 4.54 **Ti** [Ar]3d²4s² Titanium	23 50.9415 5,4,3,2 3650 2163 6.11 **V** [Ar]3d³4s² Vanadium	24 51.996 3,6,2 2945 2130 7.19 **Cr** [Ar]3d⁵4s¹ Chromium	25 54.9380 2,3,4,6,7 2235 1518 7.44 **Mn** [Ar]3d⁵4s² Manganese	26 55.847 3,2 3023 1808 7.874 **Fe** [Ar]3d⁶4s² Iron	27 58.9332 2,3 3143 1768 8.90 **Co** [Ar]3d⁷4s² Cobalt	28 58.6934 2,3 3005 1726 8.90 **Ni** [Ar]3d⁸4s² Nickel	29 63.546 2,1 2840 1356.6 8.96 **Cu** [Ar]3d¹⁰4s¹ Copper	30 65.39 2 1180 692.73 7.13 **Zn** [Ar]3d¹⁰4s² Zinc	31 69.723 3 2478 302.92 5.91 **Ga** [Ar]3d¹⁰4s²p¹ Gallium	32 72.61 4 3107 1211.5 5.32 **Ge** [Ar]3d¹⁰4s²p² Germanium	33 74.9216 ±3,5 876 (sub) 1090 (28 atm.) 5.78 **As** [Ar]3d¹⁰4s²p³ Arsenic	34 78.96 -2,4,6 958 494 4.79 **Se** [Ar]3d¹⁰4s²p⁴ Selenium	35 79.904 ±1,5,7 331.85 265.95 3.12 **Br** [Ar]3d¹⁰4s²p⁵ Bromine	36 83.80 0,2 120.85 116 3.75† **Kr** [Ar]3d¹⁰4s²p⁶ Krypton
37 85.4678 1 961 312.63 1.532 **Rb** [Kr]5s¹ Rubidium	38 87.62 2 1655 1042 2.54 **Sr** [Kr]5s² Strontium	39 88.9059 3 3611 1795 4.47 **Y** [Kr]4d¹5s² Yttrium	40 91.224 4 4682 2128 6.51 **Zr** [Kr]4d²5s² Zirconium	41 92.9064 5,3 5015 2742 8.57 **Nb** [Kr]4d⁴5s¹ Niobium	42 95.94 6,5,4,3,2 4912 2896 10.22 **Mo** [Kr]4d⁵5s¹ Molybdenum	43 (98) 7 4538 2477 11.5 **Tc** [Kr]4d⁵5s² Technetium	44 101.07 2,3,4,6,8 4425 2610 12.37 **Ru** [Kr]4d⁷5s¹ Ruthenium	45 102.9055 2,3,4 3970 2236 12.41 **Rh** [Kr]4d⁸5s¹ Rhodium	46 106.42 2,4 3240 1825 12.0 **Pd** [Kr]4d¹⁰ Palladium	47 107.868 1 2436 1235.08 10.50 **Ag** [Kr]4d¹⁰5s¹ Silver	48 112.41 2 1040 594.26 8.65 **Cd** [Kr]4d¹⁰5s² Cadmium	49 114.82 3 2350 429.78 7.31 **In** [Kr]4d¹⁰5s²p¹ Indium	50 118.710 4,2 2876 505.12 7.31 **Sn** [Kr]4d¹⁰5s²p² Tin	51 121.757 ±3,5 1860 903.91 6.69 **Sb** [Kr]4d¹⁰5s²p³ Antimony	52 127.60 -2,4,6 1261 722.72 6.24 **Te** [Kr]4d¹⁰5s²p⁴ Tellurium	53 126.9045 ±1,5,7 457.5 386.7 4.93 **I** [Kr]4d¹⁰5s²p⁵ Iodine	54 131.29 0,2,4,6 165.1 161.39 5.90† **Xe** [Kr]4d¹⁰5s²p⁶ Xenon
55 132.9054 1 944 301.54 1.87 **Cs** [Xe]6s¹ Cesium	56 137.33 2 2078 1002 3.59 **Ba** [Xe]6s² Barium	57 138.9055 3 ★ 3737 1191 6.15 **La** [Xe]5d¹6s² Lanthanum	72 178.49 4 4875 2504 13.31 **Hf** [Xe]4f¹⁴5d²6s² Hafnium	73 180.9479 5 5730 3293 16.65 **Ta** [Xe]4f¹⁴5d³6s² Tantalum	74 183.85 6,5,4,3,2 5825 3695 19.3 **W** [Xe]4f¹⁴5d⁴6s² Tungsten	75 186.207 7,6,4,2 5870 3455 21.0 **Re** [Xe]4f¹⁴5d⁵6s² Rhenium	76 190.2 2,3,4,6,8 5300 3300 22.6 **Os** [Xe]4f¹⁴5d⁶6s² Osmium	77 192.22 2,3,4,6 4700 2720 22.6 **Ir** [Xe]4f¹⁴5d⁷6s² Iridium	78 195.08 2,4 4100 2042.1 21.45 **Pt** [Xe]4f¹⁴5d⁹6s¹ Platinum	79 196.9665 3,1 3130 1337.58 19.3 **Au** [Xe]4f¹⁴5d¹⁰6s¹ Gold	80 200.59 2,1 629.88 234.31 13.55 **Hg** [Xe]4f¹⁴5d¹⁰6s² Mercury	81 204.383 3,1 1746 577 11.85 **Tl** [Xe]4f¹⁴5d¹⁰6s²p¹ Thallium	82 207.2 4,2 2023 600.65 11.35 **Pb** [Xe]4f¹⁴5d¹⁰6s²p² Lead	83 208.9804 3,5 1837 544.59 9.75 **Bi** [Xe]4f¹⁴5d¹⁰6s²p³ Bismuth	84 (209) 4,2,6 — 527 9.3 **Po** [Xe]4f¹⁴5d¹⁰6s²p⁴ Polonium	85 (210) ±1,3,5,7 610* 575 — **At** [Xe]4f¹⁴5d¹⁰6s²p⁵ Astatine	86 (222) 0,2 211.4 202 9.73 **Rn** [Xe]4f¹⁴5d¹⁰6s²p⁶ Radon
87 (223) 1 950 300 — **Fr** [Rn]7s¹ Francium	88 226.0254 2 1413 973 5.0 **Ra** [Rn]7s² Radium	89 (227) 3 ★★ 3470* 1324 10.07 **Ac** [Rn]6d¹7s² Actinium	104 (261) — — — **Rf** [Rn]5f¹⁴6d²7s² (Rutherfordium)	105 (262) — — — **Ha** [Rn]5f¹⁴6d³7s² (Hahnium)	106 (263) — — — **Sg** [Rn]5f¹⁴6d⁴7s² (Seaborgium)	107 (262) — — — **Uns** [Rn]5f¹⁴6d⁵7s² (Unnilseptium)	108 (265) — — — **Uno** [Rn]5f¹⁴6d⁶7s² (Unniloctium)	109 (266) — — — **Une** [Rn]5f¹⁴6d⁷7s² (Unnilnonium)	110 (272) — — — **Uun** [Rn]5f¹⁴6d⁸7s² (Ununnilium)									

* Estimated Values

The A & B subgroup designations, applicable to elements in rows 4, 5, 6 and 7, are those recommended by the International Union of Pure and Applied Chemistry.

The names for elements 104-106 have been proposed, but not formally accepted by the IUPAC.

★ 58 140.12 3,4 3715 1071 6.77 **Ce** [Xe]4f¹5d¹6s² Cerium	59 140.9077 3,4 3785 1204 6.77 **Pr** [Xe]4f³6s² Praseodymium	60 144.24 3 3347 1294 7.01 **Nd** [Xe]4f⁴6s² Neodymium	61 (145) 3 3273 1315 7.22 **Pm** [Xe]4f⁵6s² Promethium	62 150.36 3,2 2067 1347 7.52 **Sm** [Xe]4f⁶6s² Samarium	63 151.965 3,2 1800 1095 5.24 **Eu** [Xe]4f⁷6s² Europium	64 157.25 3 3545 1585 7.90 **Gd** [Xe]4f⁷5d¹6s² Gadolinium	65 158.9253 3,4 3500 1629 8.23 **Tb** [Xe]4f⁹6s² Terbium	66 162.50 3 2840 1685 8.55 **Dy** [Xe]4f¹⁰6s² Dysprosium	67 164.9303 3 2968 1747 8.80 **Ho** [Xe]4f¹¹6s² Holmium	68 167.26 3 3140 1802 9.07 **Er** [Xe]4f¹²6s² Erbium	69 168.9342 3,2 2223 1818 9.32 **Tm** [Xe]4f¹³6s² Thulium	70 173.04 3,2 1469 1092 6.97 **Yb** [Xe]4f¹⁴6s² Ytterbium	71 174.967 3 3668 1936 9.84 **Lu** [Xe]4f¹⁴5d¹6s² Lutetium
90 232.0381 4 5060 2028 11.72 **Th** [Rn]6d²7s² Thorium	91 231.0359 5,4 4300* 1845 15.4 **Pa** [Rn]5f²6d¹7s² Protactinium	92 238.029 6,5,4,3 4407 1408 18.95 **U** [Rn]5f³6d¹7s² Uranium	93 237.0482 6,5,4,3 4175* 912 20.2 **Np** [Rn]5f⁴6d¹7s² Neptunium	94 (244) 6,5,4,3 3505 913 19.84 **Pu** [Rn]5f⁶7s² Plutonium	95 (243) 6,5,4,3 2880 1449 13.7 **Am** [Rn]5f⁷7s² Americium	96 (247) 3 — 1620 13.5 **Cm** [Rn]5f⁷6d¹7s² Curium	97 (247) 4,3 — — 14* **Bk** [Rn]5f⁹7s² Berkelium	98 (251) 3 — 1170* — **Cf** [Rn]5f¹⁰7s² Californium	99 (252) 3 — 1130* — **Es** [Rn]5f¹¹7s² Einsteinium	100 (257) 3 — 1800* — **Fm** [Rn]5f¹²7s² Fermium	101 (258) 3 — 1100* — **Md** [Rn]5f¹³7s² Mendelevium	102 (259) 2,3 — 1100* — **No** [Rn]5f¹⁴7s² Nobelium	103 (260) 3 — 1900* — **Lr** [Rn]5f¹⁴6d¹7s² Lawrencium



NOTES:
(1) Black — solid. Red — gas. Blue — liquid. Outline — synthetically prepared.
(2) Based upon carbon-12. ( ) indicates most stable or best known isotope.
(3) Entries marked with daggers refer to the gaseous state at 273 K and 1 atm and are given in units of g/l.

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Catalog Number S-18806

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TABLE OF PERIODIC PROPERTIES OF THE ELEMENTS

Percent Ionic Character of a Single Chemical Bond

Difference in electronegativity	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2
Percent ionic character %	0.5	1	2	4	6	9	12	15	19	22	26	30	34	39	43	47	51	55	59	63	67	70	74	76	79	82	84	86	88	89	91	92

DATA CONCERNING THE MORE STABLE ELEMENTARY (SUBATOMIC) PARTICLES

	Neutron	Proton	Electron*	Neutrino*	Photon
Symbol	n	P	e (e-)	ν	γ
Rest mass (kg)	1.67495×10^{-27}	1.67265×10^{-27}	9.1095×10^{-31}	~0	0
Relative atomic mass (^{12}C=12)	1.008665	1.007276	5.48580×10^{-4}	~0	0
Charge (C)	0	1.60219×10^{-19}	-1.60219×10^{-19}	0	0
Radius (m)	8×10^{-16}	8×10^{-16}	$<1\times10^{-16}$	~0	0
Spin quantum number	1/2	1/2	1/2	1/2	1
Magnetic Moment†	-1.913 μ_N	2.793 μ_N	1.001 μ_B	0	0

* The positron (e^+) has properties similar to those of the (negative) electron or beta particle except that its charge has opposite sign (+). The antineutrino ($\bar{\nu}$) has properties similar to those of the neutrino except that its spin (or rotation) is opposite in relation to its direction of propagation.

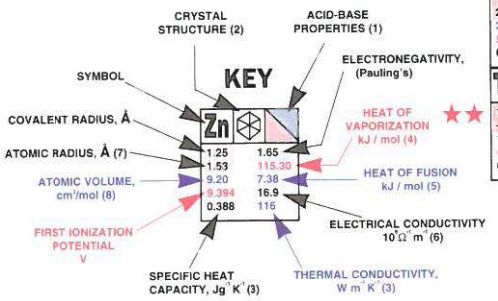
An antineutrino accompanies release of an electron in radioactive β (particle) decay, whereas a neutrino accompanies the release of a positron in β^+ decay.

†μ_B=Bohr magneton and μ_N=Nuclear magneton.

GROUP IA	IIA	IIIA	IVA	VA	VIA	VIIA	VIIIA	IB	IIB	IIIB	IVB	VB	VIB	VIIB	VIII
H															He
0.32 2.10 0.79 0.4581 14.10 0.0585 13.598 — 14.304 0.1815															0.93 — 0.49 0.084 31.80 0.021 24.587 — 5.193 0.152
Li	Be									B	C	N	O	F	Ne
1.23 0.98 2.05 147.1 13.10 3.0 5.392 11.7 3.582 84.7	0.90 1.57 1.40 297 5.0 11.71 0.322 25 1.825 200									0.82 2.04 1.17 507.8 4.60 22.6 8.298 5×10^{-12} 1.026 27.0	0.77 2.55 0.91 ~715 5.30 — 11.260 0.07 0.709 80-230	0.75 3.04 0.75 2.7928 17.30 0.36 14.534 — 1.042 0.02598	0.73 3.44 0.65 3.4109 14.0 0.222 13.618 — 0.92 0.2674	0.72 3.98 0.57 3.2698 17.10 0.26 17.422 — 0.824 0.0279	0.71 — 0.51 1.77 16.90 0.34 21.564 — 1.030 0.0493
Na	Mg									Al	Si	P	S	Cl	Ar
1.54 0.93 2.23 98.01 23.70 2.601 5.139 20.1 1.23 141	1.36 1.31 1.72 127.6 14.0 8.95 7.646 22.4 1.02 156									1.18 1.61 1.82 260.8 10.0 10.7 5.986 37.7 0.90 237	1.11 1.90 1.46 359 12.1 50.2 8.151 4×10^{-5} 0.70 148	1.06 2.19 1.23 12.4 17.0 0.63 10.486 10^{-16} 0.769 0.235	1.02 2.58 1.09 10 15.50 1.73 10.360 5×10^{-16} 0.710 0.269	0.99 3.16 0.97 10.20 18.7 3.21 12.967 — 0.48 0.0089	0.98 — 0.88 6.506 24.2 1.188 15.759 — 0.520 0.0177
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
2.03 0.82 2.77 76.9 45.30 2.33 4.341 16.4 0.757 102.5	1.74 1.00 2.23 154.67 29.90 8.53 6.113 31.3 0.647 200	1.44 1.36 2.09 304.80 15.0 16.11 6.54 1.5 0.568 15.8	1.32 1.54 2.00 425.2 10.60 18.6 6.82 2.6 0.523 21.9	1.22 1.63 1.92 446.7 8.35 22.8 6.74 4.0 0.489 30.7	1.18 1.66 1.85 339.5 7.23 20 6.766 7.9 0.449 93.7	1.17 1.55 1.79 219.74 7.39 14.64 7.435 0.5 0.48 7.82	1.17 1.83 1.72 349.5 7.10 13.8 7.870 11.2 0.449 80.2	1.16 1.88 1.67 373.3 6.70 16.19 7.86 17.9 0.421 100	1.15 1.91 1.62 377.5 6.60 17.2 7.635 14.6 0.444 90.7	1.17 1.90 1.57 300.5 7.10 13.14 7.725 60.7 0.385 401	1.25 1.65 1.53 115.30 9.20 7.38 9.394 16.9 0.388 116	1.26 1.81 1.81 256.06 11.80 5.59 5.999 1.8 0.371 40.6	1.22 2.01 1.52 334.3 13.60 31.8 7.899 3×10^{-9} 0.32 59.9	1.20 2.18 1.33 32.4 13.10 27.7 9.81 3.8 0.33 50	1.16 2.55 1.22 26.32 16.50 5.54 9.752 8 0.32 2.04	1.14 2.96 1.12 14.725 23.5 5.286 11.814 10^{-16} 0.226 0.122	1.89 — 1.03 9.329 32.2 1.638 13.999 — 0.248 0.00949
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
2.16 0.82 2.98 69.2 55.9 2.34 4.177 47.8 0.363 58.2	1.91 0.95 2.45 136.9 33.7 8.2 5.695 5.0 0.30 35.3	1.62 1.22 2.27 393.3 19.80 17.15 6.38 1.8 0.30 17.2	1.45 1.33 2.16 590.5 14.10 21 6.84 2.3 0.278 22.7	1.34 1.6 2.08 690.1 10.80 26.9 6.88 6.6 0.265 53.7	1.30 2.16 2.01 590.4 9.40 36 7.099 17.3 0.25 138	1.27 1.9 1.95 502.0 8.5 23 7.28 0.001 0.24 50.6	1.25 2.2 1.89 567.77 8.30 25.52 7.37 14.9 0.238 117	1.25 2.28 1.83 495.39 8.30 21.76 7.46 23 0.242 150	1.28 2.20 1.79 393.3 8.90 16.74 8.34 10.0 0.244 71.8	1.34 1.93 1.75 250.63 10.30 11.30 7.576 62.9 0.235 429	1.41 1.69 1.71 99.37 13.10 6.07 8.993 14.7 0.232 96.8	1.44 1.78 2.00 226.35 15.70 3.26 5.786 3.4 0.233 81.6	1.41 1.96 1.72 293.37 16.30 7.2 7.344 8.7 0.228 66.6	1.40 2.05 1.53 67.97 18.40 19.83 8.641 2.6 0.207 24.3	1.36 2.1 1.42 50.63 20.50 17.49 9.009 2×10^{-4} 0.202 2.35	1.33 2.66 1.32 20.9 25.70 7.76 10.451 10^{-11} 0.145 0.449	1.31 2.6 1.24 12.64 42.9 2.30 12.130 — 0.158 0.00569
Cs	Ba	La*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
2.35 0.79 3.34 67.740 70 2.092 3.894 5.3 0.24 35.9	1.98 0.89 2.78 140.2 39.0 8.01 5.212 2.8 0.204 18.4	1.25 1.10 2.74 398.57 22.5 11.3 5.58 1.9 0.19 13.5	1.44 1.3 2.16 661.07 13.6 21.76 6.65 3.4 0.14 23.0	1.34 1.5 2.09 737.0 10.90 36 7.89 8.1 0.14 57.5	1.30 2.36 2.02 422.58 9.53 35.40 7.98 18.2 0.13 174	1.28 1.9 1.97 707.1 8.85 33.05 7.88 5.8 0.137 47.9	1.26 2.2 1.92 627.6 8.43 29.29 8.7 12.3 0.13 87.6	1.27 2.20 1.87 563.58 8.54 26.36 9.1 21.3 0.130 147	1.30 2.28 1.83 510.45 9.10 19.66 9.0 9.4 0.13 71.6	1.34 2.54 1.79 324.43 10.20 12.36 9.225 48.8 0.128 317	1.49 2.00 1.76 59.30 14.80 2.232 10.437 1.0 0.140 8.34	1.48 2.04 2.08 162.09 17.20 4.27 6.108 5.6 0.129 46.1	1.47 2.33 1.81 177.8 18.30 4.77 7.416 4.8 0.129 35.3	1.46 2.02 1.63 179 21.3 11.0 7.289 0.9 0.122 7.87	1.53 2.0 1.53 120 22.70 13 8.42 0.7 — 20	1.47 2.2 1.43 30* — 12* — — — 1.7	— — 1.34 16.40 50.5 2.9 10.748 — 0.094 0.00364*
Fr	Ra	Ac**	Rf	Ha	Sg	Uns	Uno	Une	Uun								
— 0.7 — 64* — 2.1* — — — 15	— 0.39 — 136.82 45.2 8.37 5.279 1.0 0.094 18.6	— 1.1 — — 22.5 — 5.17 — 0.120 12	— — — — — — — — — —	— — — — — — — — — —	— — — — — — — — — —	— — — — — — — — — —	— — — — — — — — — —	— — — — — — — — — —	— — — — — — — — — —								

The A & B subgroup designations, applicable to elements in rows 4, 5, 6 and 7, are those recommended by the International Union of Pure and Applied Chemistry.

★	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
	1.65 1.12 2.70 313.8 21.0 9.20 5.47 1.4 0.19 11.4	1.65 1.13 2.67 332.63 20.8 10.04 5.42 1.5 0.193 12.5	1.64 1.14 2.64 283.68 20.6 10.88 5.49 1.6 0.190 16.5	1.63 1.13 2.62 — 22.4 — 5.55 2 — 17.9*	1.62 1.17 2.59 191.63 19.90 11.09 5.63 1.1 0.197 13.3	1.85 1.2 2.56 175.73 28.9 10.46 5.67 1.1 0.182 13.9	1.61 1.20 2.54 311.71 19.9 15.48 6.15 0.8 0.236 10.6	1.59 1.1 2.51 — 19.2 — 5.86 0.9 0.18 11.1	1.59 1.22 2.49 230 19.0 11.06 5.93 1.1 0.173 10.7	1.58 1.23 2.47 261.04 18.7 17.15 6.02 1.1 0.165 16.2	1.57 1.24 2.45 292.88 18.4 17.15 6.101 1.2 0.168 14.3	1.56 1.25 2.42 191* 18.1 16.8* 6.184 1.3 0.16 16.8	1.70 1.1 2.40 128* 24.8 7.7* 6.254 3.7 0.155 34.9	1.56 1.27 2.25 355* 17.8 18.6* 5.43 1.5 0.15 16.4
	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
	1.65 1.3 — 543.92 19.90 15.65 6.08 7.1 0.113 54	— 1.5 — — 15.0 — 5.88 5.6 — 47	1.42 1.38 — 422.58 12.50 15.48 6.05 3.6 0.12 27.6	— 1.36 — — 21.1 — 6.19 0.8 — 6.3	1.08 1.28 — — 12.32 — 6.06 0.7 0.13* 6.74	— 1.3 — — 20.8 — 6.0 0.7 — 10*	— 1.3 — — 18.3 — 6.02 — — 10*	— 1.3 — — — — 6.23 — — 10*	— 1.3 — — — — 6.3 — — 10*	— 1.3 — — — — 6.42 — — 10*	— 1.3 — — — — 6.50 — — 10*	— 1.3 — — — — 6.58 — — 10*	— 1.3 — — — — 6.65 — — 10*	— 1.3 — — — — — — — 10*



NOTES: (1) For representative oxides (higher valence) of group. Oxide is acidic if color is red, basic if color is blue and amphoteric if both colors are shown. Intensity of color indicates relative strength.

(2) Cubic, face centered; cubic, body centered; cubic; hexagonal; rhombohedral; tetragonal; orthorhombic; monoclinic.

(3) At 300 K (27°C)
(4) At boiling point
(5) At melting point
(6) Generally at 293 K (20°C) for polycrystalline material
(7) Quantum mechanical value for free atom
(8) From density at 300 K (27°C) for liquid and solid elements; values for gaseous elements refer to liquid state at boiling point

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SIDE 2