

PERIODIC TABLE

Atomic Properties of the Elements

NIST
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Standards and Technology
U.S. Department of Commerce

Group	1											18							
IA	2	VIII										VIIIA							
Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
	1s	2s	3s	4s	5s	6s	7s	8s	9s	10s	11s	12s	3s	4s	5s	6s	7s	8s	
1	H Hydrogen 1.008* 1s 13.5984																	He Helium 4.002602 1s ² 24.5874	
2	Li Lithium 6.94* 1s ² 2s 5.3917	Be Beryllium 9.0121831 1s ² 2s ² 9.3227																	Ne Neon 20.1797 1s ² 2s ² 2p ⁶ 21.5645
3	Na Sodium 22.98976928 [Ne]3s 5.1391	Mg Magnesium 24.305* [Ne]3s ² 7.6462																	Ar Argon 39.948 [Ne]3s ² 3p ⁶ 12.9676
4	K Potassium 39.0983 [Ar]4s 4.3407	Ca Calcium 40.078 [Ar]4s ² 6.1132	Sc Scandium 44.955908 [Ar]3d ¹ 4s ² 6.5615	Ti Titanium 47.867 [Ar]3d ² 4s ² 6.8281	V Vanadium 50.9415 [Ar]3d ³ 4s ² 6.7462	Cr Chromium 51.9961 [Ar]3d ⁵ 4s 6.7665	Mn Manganese 54.938044 [Ar]3d ⁵ 4s ² 7.4340	Fe Iron 55.845 [Ar]3d ⁶ 4s ² 7.9025	Co Cobalt 58.933194 [Ar]3d ⁷ 4s ² 7.8810	Ni Nickel 58.6934 [Ar]3d ⁸ 4s ² 7.6399	Cu Copper 63.546 [Ar]3d ¹⁰ 4s 7.7264	Zn Zinc 65.38 [Ar]3d ¹⁰ 4s ² 9.3942	Ga Gallium 69.723 [Ar]3d ¹⁰ 4s ² 4p 5.9993	Ge Germanium 72.630 [Ar]3d ¹⁰ 4s ² 4p ² 7.8994	As Arsenic 74.921595 [Ar]3d ¹⁰ 4s ² 4p ³ 9.7886	Se Selenium 78.971 [Ar]3d ¹⁰ 4s ² 4p ⁴ 9.7524	Br Bromine 79.904* [Ar]3d ¹⁰ 4s ² 4p ⁵ 11.8138	Kr Krypton 83.798 [Ar]3d ¹⁰ 4s ² 4p ⁶ 13.9996	
5	Rb Rubidium 85.4678 [Kr]5s 4.1771	Sr Strontium 87.62 [Kr]5s ² 5.6949	Y Yttrium 88.90584 [Kr]4d ⁵ 5s ² 6.2173	Zr Zirconium 91.224 [Kr]4d ² 5s ² 6.6339	Nb Niobium 92.90637 [Kr]4d ⁴ 5s 6.7589	Mo Molybdenum 95.95 [Kr]4d ⁵ 5s 7.0924	Tc Technetium (98) [Kr]4d ⁵ 5s ² 7.1194	Ru Ruthenium 101.07 [Kr]4d ⁷ 5s 7.3605	Rh Rhodium 102.90550 [Kr]4d ⁸ 5s 7.4589	Pd Palladium 106.42 [Kr]4d ¹⁰ 8.3369	Ag Silver 107.8682 [Kr]4d ¹⁰ 5s 7.5762	Cd Cadmium 112.414 [Kr]4d ¹⁰ 5s ² 8.9938	In Indium 114.818 [Kr]4d ¹⁰ 5s ² 5p 5.7864	Sn Tin 118.710 [Kr]4d ¹⁰ 5s ² 5p ² 7.3439	Sb Antimony 121.760 [Kr]4d ¹⁰ 5s ² 5p ³ 8.6084	Te Tellurium 127.60 [Kr]4d ¹⁰ 5s ² 5p ⁴ 9.0097	I Iodine 126.90447 [Kr]4d ¹⁰ 5s ² 5p ⁵ 10.4513	Xe Xenon 131.293 [Kr]4d ¹⁰ 5s ² 5p ⁶ 12.1298	
6	Cs Cesium 132.9054520 [Xe]6s 3.8939	Ba Barium 137.327 [Xe]6s ² 5.2117		Hf Hafnium 178.49 [Xe]4f ¹⁴ 5d ² 6s ² 6.8251	Ta Tantalum 180.94788 [Xe]4f ¹⁴ 5d ³ 6s ² 7.5496	W Tungsten 183.84 [Xe]4f ¹⁴ 5d ⁴ 6s ² 7.8640	Re Rhenium 186.207 [Xe]4f ¹⁴ 5d ⁵ 6s ² 7.8335	Os Osmium 190.23 [Xe]4f ¹⁴ 5d ⁶ 6s ² 8.4382	Ir Iridium 192.217 [Xe]4f ¹⁴ 5d ⁷ 6s ² 8.9670	Pt Platinum 195.084 [Xe]4f ¹⁴ 5d ⁹ 6s ¹ 8.9588	Au Gold 196.966569 [Xe]4f ¹⁴ 5d ¹⁰ 6s 9.2256	Hg Mercury 200.592 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 10.4375	Tl Thallium 204.38* [Hg]6p 6.1083	Pb Lead 207.2 [Hg]6p ² 7.4167	Bi Bismuth 208.98040 [Hg]6p ³ 7.2855	Po Polonium (209) [Hg]6p ⁴ 8.414	At Astatine (210) [Hg]6p ⁵ 9.31751	Rn Radon (222) [Hg]6p ⁶ 10.7485	
7	Fr Francium (223) [Rn]7s 4.0727	Ra Radium (226) [Rn]7s ² 5.2784		Rf Rutherfordium (267) [Rn]5f ¹⁴ 6d ² 7s ² 6.01	Db Dubnium (268) [Rn]5f ¹⁴ 6d ³ 7s ² 6.8	Sg Seaborgium (271) [Rn]5f ¹⁴ 6d ⁴ 7s ² 7.8	Bh Bohrium (272) [Rn]5f ¹⁴ 6d ⁵ 7s ² 7.7	Hs Hassium (270) [Rn]5f ¹⁴ 6d ⁶ 7s ² 7.6	Mt Meitnerium (276) [Rn]5f ¹⁴ 6d ⁷ 7s ² 7.6	Ds Darmstadtium (281) [Rn]5f ¹⁴ 6d ⁸ 7s ² 7.6	Rg Roentgenium (280) [Rn]5f ¹⁴ 6d ⁹ 7s ² 7.6	Cn Copernicium (285) [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7.6	Uut Ununtrium (284) [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7.6	Fl Flerovium (289) [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7.6	Uup Ununpentium (288) [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7.6	Lv Livermorium (293) [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7.6	Uus Ununseptium (294) [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7.6	Uuo Ununoctium (294) [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7.6	
				La Lanthanum 138.90547 [Xe]5d ¹ 6s ² 5.5769	Ce Cerium 140.116 [Xe]4f ¹ 5d ¹ 6s ² 5.5386	Pr Praseodymium 140.907 [Xe]4f ² 6s ² 5.473	Nd Neodymium 144.242 [Xe]4f ³ 6s ² 5.5250	Pm Promethium (145) [Xe]4f ⁴ 6s ² 5.582	Sm Samarium 150.36 [Xe]4f ⁵ 6s ² 5.6437	Eu Europium 151.964 [Xe]4f ⁶ 6s ² 5.6704	Gd Gadolinium 157.25 [Xe]4f ⁷ 6s ² 6.1498	Tb Terbium 158.92535 [Xe]4f ⁸ 6s ² 5.8638	Dy Dysprosium 162.500 [Xe]4f ⁹ 6s ² 5.9391	Ho Holmium 164.93033 [Xe]4f ¹⁰ 6s ² 6.0215	Er Erbium 167.259 [Xe]4f ¹¹ 6s ² 6.1077	Tm Thulium 168.93422 [Xe]4f ¹² 6s ² 6.1843	Yb Ytterbium 173.054 [Xe]4f ¹³ 6s ² 6.2542	Lu Lutetium 174.9668 [Xe]4f ¹⁴ 6s ² 5.4259	
				Ac Actinium (227) [Rn]5f ¹ 6d ¹ 7s ² 5.3802	Th Thorium 232.0377 [Rn]5f ¹ 6d ² 7s ² 6.3067	Pa Protactinium 231.03588 [Rn]5f ² 6d ¹ 7s ² 5.89	U Uranium 238.02891 [Rn]5f ³ 6d ¹ 7s ² 6.1941	Np Neptunium (237) [Rn]5f ⁴ 6d ¹ 7s ² 6.2655	Pu Plutonium (244) [Rn]5f ⁶ 7s ² 6.0258	Am Americium (243) [Rn]5f ⁷ 7s ² 5.9738	Cm Curium (247) [Rn]5f ⁸ 6d ¹ 7s ² 5.9914	Bk Berkelium (247) [Rn]5f ⁹ 7s ² 6.1978	Cf Californium (251) [Rn]5f ¹⁰ 7s ² 6.2817	Es Einsteinium (252) [Rn]5f ¹¹ 7s ² 6.3676	Fm Fermium (257) [Rn]5f ¹² 7s ² 6.50	Md Mendelevium (258) [Rn]5f ¹³ 7s ² 6.58	No Nobelium (259) [Rn]5f ¹⁴ 7s ² 6.65	Lr Lawrencium (262) [Rn]5f ¹⁴ 7s ² 7p 4.90	

Frequently used fundamental physical constants

For the most accurate values of these and other constants, visit physics.nist.gov/constants

1 second = 9 192 631 770 periods of radiation corresponding to the transition between the two hyperfine levels of the ground state of ¹³³Cs

speed of light in vacuum	<i>c</i>	299 792 458 m s ⁻¹	(exact)
Planck constant	<i>h</i>	6.626 07 × 10 ⁻³⁴ J s	(<i>h</i> = <i>h</i> /2π)
elementary charge	<i>e</i>	1.602 177 × 10 ⁻¹⁹ C	
electron mass	<i>m_e</i>	9.109 38 × 10 ⁻³¹ kg	
	<i>m_ec²</i>	0.510 999 MeV	
proton mass	<i>m_p</i>	1.672 622 × 10 ⁻²⁷ kg	
fine-structure constant	<i>α</i>	1/137.035 999	
Rydberg constant	<i>R_∞</i>	10 973 731.569 m ⁻¹	
	<i>R_∞c</i>	3.289 841 960 × 10 ¹⁵ Hz	
	<i>R_∞hc</i>	13.605 69 eV	
Boltzmann constant	<i>k</i>	1.380 6 × 10 ⁻²³ J K ⁻¹	

- Solids
- Liquids
- Gases
- Artificially Prepared

Physical Measurement Laboratory www.nist.gov/pml		Standard Reference Data www.nist.gov/srd	
13	14	15	16
IIIA	IVA	VA	VIA
5 B Boron 10.81* 1s ² 2s ² 2p 8.2980	6 C Carbon 12.011* 1s ² 2s ² 2p ² 11.2603	7 N Nitrogen 14.007* 1s ² 2s ² 2p ³ 14.5341	8 O Oxygen 15.999* 1s ² 2s ² 2p ⁴ 13.6181
13 Al Aluminum 26.9815385 [Ne]3s ² 3p 5.9858	14 Si Silicon 28.085* [Ne]3s ² 3p ² 8.1517	15 P Phosphorus 30.97376200 [Ne]3s ² 3p ³ 10.4867	16 S Sulfur 32.06* [Ne]3s ² 3p ⁴ 10.3600

Atomic Number: 58
Ground-state Level: 1G₄
Symbol: Ce
Name: Cerium
Standard Atomic Weight: 140.116
Ground-state Configuration: [Xe]4f¹5d¹6s²
Ionization Energy (eV): 5.5386

*IUPAC conventional atomic weights; standard atomic weights for these elements are expressed in intervals; see iupac.org for an explanation and values.

†Based upon ¹²C. () indicates the mass number of the longest-lived isotope.

For a description of the data, visit physics.nist.gov/data
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The Hubbard Chart of the Atoms, ca. 1924

Henry D. Hubbard, the designer of the “Chart of the Atoms,” was the first secretary of the National Institute of Standards and Technology (then-called the National Bureau of Standards) and served continuously in that capacity from 1901 until his retirement in 1938. Secretary Hubbard made a contribution to instruction in physics that is still in use today, his modernization of Mendeleev’s periodic table. First constructed in the 1920s, it has been frequently revised and reprinted.

