

# PERIODIC TABLE

## Atomic Properties of the Elements



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Period	1 1A <b>H</b> Hydrogen 1.00794 $1s$ 13.5984	2 2A <b>He</b> Helium 4.002602 $1s^2$ 24.5874
	2 3 <b>Li</b> Lithium 6.941 $1s^2 2s$ 5.3917	4 4A <b>Be</b> Beryllium 9.012182 $1s^2 2s^2$ 9.3227
	3 11 <b>Na</b> Sodium 22.98976928 [Ne]3s 5.1391	12 2A <b>Mg</b> Magnesium 24.3050 [Ne]3s <sup>2</sup> 7.6462
	4 19 <b>K</b> Potassium 39.0983 [Ar]4s 4.3407	20 2A <b>Ca</b> Calcium 40.078 [Ar]4s <sup>2</sup> 6.1132
	5 37 <b>Rb</b> Rubidium 85.4678 [Kr]5s 4.1771	38 2A <b>Sr</b> Strontium 87.62 [Kr]5s <sup>2</sup> 5.6949
	6 55 <b>Cs</b> Cesium 132.9054519 [Xe]6s 3.8939	56 2A <b>Ba</b> Barium 137.327 [Xe]6s <sup>2</sup> 5.2117
	7 87 <b>Fr</b> Francium (223) [Rn]7s 4.0727	88 2A <b>Ra</b> Radium (226) [Rn]7s <sup>2</sup> 5.2784

**Frequently used fundamental physical constants**  
For the most accurate values of these and other constants, visit [physics.nist.gov/constants](http://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 <sup>133</sup>Cs

speed of light in vacuum	$c$	299 792 458 m s <sup>-1</sup> (exact)
Planck constant	$h$	6.6261 x 10 <sup>-34</sup> J s ( $h = h/2\pi$ )
elementary charge	$e$	1.6022 x 10 <sup>-19</sup> C
electron mass	$m_e$	9.1094 x 10 <sup>-31</sup> kg
	$m_e c^2$	0.5110 MeV
proton mass	$m_p$	1.6726 x 10 <sup>-27</sup> kg
fine-structure constant	$\alpha$	1/137.036
Rydberg constant	$R_\infty$	10 973 732 m <sup>-1</sup>
	$R_\infty c$	3.289 842 x 10 <sup>15</sup> Hz
	$R_\infty hc$	13.6057 eV
Boltzmann constant	$k$	1.3807 x 10 <sup>-23</sup> J K <sup>-1</sup>

- Solids
- Liquids
- Gases
- Artificially Prepared

13 3A <b>B</b> Boron 10.811 $1s^2 2s^2 2p$ 8.2980	14 4A <b>C</b> Carbon 12.0107 $1s^2 2s^2 2p^2$ 11.2603	15 5A <b>N</b> Nitrogen 14.0067 $1s^2 2s^2 2p^3$ 14.5341	16 6A <b>O</b> Oxygen 15.9994 $1s^2 2s^2 2p^4$ 13.6181	17 7A <b>F</b> Fluorine 18.9984032 $1s^2 2s^2 2p^5$ 17.4228	18 8A <b>Ne</b> Neon 20.1797 $1s^2 2s^2 2p^6$ 21.5645
13 3A <b>Al</b> Aluminum 26.9815386 [Ne]3s <sup>2</sup> 3p 5.9858	14 4A <b>Si</b> Silicon 28.0855 [Ne]3s <sup>2</sup> 3p <sup>2</sup> 8.1517	15 5A <b>P</b> Phosphorus 30.973762 [Ne]3s <sup>2</sup> 3p <sup>3</sup> 10.4867	16 6A <b>S</b> Sulfur 32.065 [Ne]3s <sup>2</sup> 3p <sup>4</sup> 10.3600	17 7A <b>Cl</b> Chlorine 35.453 [Ne]3s <sup>2</sup> 3p <sup>5</sup> 12.9676	18 8A <b>Ar</b> Argon 39.948 [Ne]3s <sup>2</sup> 3p <sup>6</sup> 15.7596
19 3A <b>K</b> Potassium 39.0983 [Ar]4s 4.3407	20 4A <b>Ca</b> Calcium 40.078 [Ar]4s <sup>2</sup> 6.1132	21 3B <b>Sc</b> Scandium 44.955912 [Ar]3d4s 6.5615	22 4B <b>Ti</b> Titanium 47.867 [Ar]3d <sup>2</sup> 4s 6.8281	23 5B <b>V</b> Vanadium 50.9415 [Ar]3d <sup>3</sup> 4s 6.7462	24 6B <b>Cr</b> Chromium 51.9961 [Ar]3d <sup>5</sup> 4s 6.7665
25 7B <b>Mn</b> Manganese 54.938045 [Ar]3d <sup>5</sup> 4s 7.4340	26 8B <b>Fe</b> Iron 55.845 [Ar]3d <sup>6</sup> 4s 7.9024	27 9B <b>Co</b> Cobalt 58.933195 [Ar]3d <sup>7</sup> 4s 7.8810	28 10B <b>Ni</b> Nickel 58.6934 [Ar]3d <sup>8</sup> 4s 7.6399	29 11B <b>Cu</b> Copper 63.546 [Ar]3d <sup>10</sup> 4s 7.7264	30 12B <b>Zn</b> Zinc 65.38 [Ar]3d <sup>10</sup> 4s 9.3942
31 13B <b>Ga</b> Gallium 69.723 [Ar]3d <sup>10</sup> 4s <sup>2</sup> 4p 5.9993	32 14B <b>Ge</b> Germanium 72.64 [Ar]3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>2</sup> 7.8994	33 15B <b>As</b> Arsenic 74.92160 [Ar]3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>3</sup> 9.7886	34 16B <b>Se</b> Selenium 78.96 [Ar]3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>4</sup> 9.7524	35 17B <b>Br</b> Bromine 79.904 [Ar]3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>5</sup> 11.8138	36 18B <b>Kr</b> Krypton 83.798 [Ar]3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>6</sup> 13.9996
47 11B <b>Ag</b> Silver 107.8682 [Kr]4d <sup>10</sup> 5s 7.5762	48 12B <b>Cd</b> Cadmium 112.411 [Kr]4d <sup>10</sup> 5s 8.9938	49 13B <b>In</b> Indium 114.818 [Kr]4d <sup>10</sup> 5s <sup>2</sup> 5p 7.3439	50 14B <b>Sn</b> Tin 118.710 [Kr]4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>2</sup> 7.4639	51 15B <b>Sb</b> Antimony 121.760 [Kr]4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>3</sup> 8.6084	52 16B <b>Te</b> Tellurium 127.60 [Kr]4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>4</sup> 9.0096
53 17B <b>I</b> Iodine 126.90447 [Kr]4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>5</sup> 10.4513	54 18B <b>Xe</b> Xenon 131.293 [Kr]4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>6</sup> 12.1298	72 6B <b>Hf</b> Hafnium 178.49 [Xe]4f <sup>14</sup> 5d <sup>2</sup> 6s <sup>2</sup> 6.8251	73 7B <b>Ta</b> Tantalum 180.94788 [Xe]4f <sup>14</sup> 5d <sup>3</sup> 6s <sup>2</sup> 7.5496	74 8B <b>W</b> Tungsten 193.84 [Xe]4f <sup>14</sup> 5d <sup>4</sup> 6s <sup>2</sup> 7.8640	75 9B <b>Re</b> Rhenium 186.207 [Xe]4f <sup>14</sup> 5d <sup>5</sup> 6s <sup>2</sup> 7.8335
76 10B <b>Os</b> Osmium 192.22 [Xe]4f <sup>14</sup> 5d <sup>6</sup> 6s <sup>2</sup> 8.4382	77 11B <b>Ir</b> Iridium 192.217 [Xe]4f <sup>14</sup> 5d <sup>7</sup> 6s <sup>2</sup> 8.9670	78 12B <b>Pt</b> Platinum 195.084 [Xe]4f <sup>14</sup> 5d <sup>9</sup> 6s 8.9588	79 13B <b>Au</b> Gold 196.966569 9.2255	80 14B <b>Hg</b> Mercury 200.59 10.4375	81 15B <b>Tl</b> Thallium 204.3833 [Hg]6p 6.1082
82 16B <b>Pb</b> Lead 207.2 [Hg]6p <sup>2</sup> 7.4167	83 17B <b>Bi</b> Bismuth 208.98040 [Hg]6p <sup>3</sup> 7.2855	84 18B <b>Po</b> Polonium (209) [Hg]6p <sup>4</sup> 8.414	85 19B <b>At</b> Astatine (210) [Hg]6p <sup>5</sup>	86 18B <b>Rn</b> Radon (222) [Hg]6p <sup>6</sup> 10.7485	
104 6B <b>Rf</b> Rutherfordium (261) [Rn]5f <sup>14</sup> 6d <sup>2</sup> 7s <sup>2</sup> 6.0?	105 7B <b>Db</b> Dubnium (268)	106 8B <b>Sg</b> Seaborgium (271)	107 9B <b>Bh</b> Bohrium (272)	108 10B <b>Hs</b> Hassium (277)	109 11B <b>Mt</b> Meitnerium (276)
110 12B <b>Ds</b> Darmstadtium (281)	111 13B <b>Rg</b> Roentgenium (280)	112 14B <b>Cn</b> Copernicium (285)	113 15B <b>Uut</b> Ununtrium (284)	114 16B <b>Uuq</b> Ununquadium (289)	115 17B <b>Uup</b> Ununpentium (288)
116 18B <b>Uuh</b> Ununhexium (293)	117 19B <b>Uus</b> Ununseptium (294)	118 18B <b>Uuo</b> Ununoctium (294)			

**58** <sup>1</sup>G<sub>4</sub>  
**Ce**  
Cerium  
140.116  
[Xe]4f<sup>1</sup>5d<sup>1</sup>6s<sup>2</sup>  
5.5387

Atomic Number: 58  
Ground-state Level: <sup>1</sup>G<sub>4</sub>  
Symbol: Ce  
Name: Cerium  
Atomic Weight: 140.116  
Ground-state Configuration: [Xe]4f<sup>1</sup>5d<sup>1</sup>6s<sup>2</sup>  
Ionization Energy (eV): 5.5387

57 <b>La</b> Lanthanum 138.90547 [Xe]5d <sup>1</sup> 6s <sup>2</sup> 5.5769	58 <b>Ce</b> Cerium 140.116 [Xe]4f <sup>1</sup> 5d <sup>1</sup> 6s <sup>2</sup> 5.5387	59 <b>Pr</b> Praseodymium 140.90765 [Xe]4f <sup>3</sup> 6s <sup>2</sup> 5.473	60 <b>Nd</b> Neodymium 144.242 [Xe]4f <sup>4</sup> 6s <sup>2</sup> 5.5250	61 <b>Pm</b> Promethium (145) [Xe]4f <sup>5</sup> 6s <sup>2</sup> 5.582	62 <b>Sm</b> Samarium 150.36 [Xe]4f <sup>6</sup> 6s <sup>2</sup> 5.6437	63 <b>Eu</b> Europium 151.964 [Xe]4f <sup>7</sup> 6s <sup>2</sup> 5.6704	64 <b>Gd</b> Gadolinium 157.25 [Xe]4f <sup>7</sup> 5d <sup>1</sup> 6s <sup>2</sup> 6.1498	65 <b>Tb</b> Terbium 158.92535 [Xe]4f <sup>9</sup> 6s <sup>2</sup> 5.8638	66 <b>Dy</b> Dysprosium 162.500 [Xe]4f <sup>10</sup> 6s <sup>2</sup> 5.9389	67 <b>Ho</b> Holmium 164.93032 [Xe]4f <sup>11</sup> 6s <sup>2</sup> 6.0215	68 <b>Er</b> Erbium 167.259 [Xe]4f <sup>12</sup> 6s <sup>2</sup> 6.1077	69 <b>Tm</b> Thulium 168.93421 [Xe]4f <sup>13</sup> 6s <sup>2</sup> 6.1843	70 <b>Yb</b> Ytterbium 173.054 [Xe]4f <sup>14</sup> 6s <sup>2</sup> 6.2542	71 <b>Lu</b> Lutetium 174.9668 [Xe]4f <sup>14</sup> 5d <sup>1</sup> 6s <sup>2</sup> 5.4259
89 <b>Ac</b> Actinium (227) [Rn]6d <sup>1</sup> 7s <sup>2</sup> 5.3807	90 <b>Th</b> Thorium 232.03806 [Rn]6d <sup>2</sup> 7s <sup>2</sup> 6.3067	91 <b>Pa</b> Protactinium 231.03588 [Rn]5f <sup>1</sup> 6d <sup>1</sup> 7s <sup>2</sup> 5.89	92 <b>U</b> Uranium 238.02891 [Rn]5f <sup>3</sup> 6d <sup>1</sup> 7s <sup>2</sup> 6.1939	93 <b>Np</b> Neptunium (237) [Rn]5f <sup>4</sup> 6d <sup>1</sup> 7s <sup>2</sup> 6.2657	94 <b>Pu</b> Plutonium (244) [Rn]5f <sup>6</sup> 7s <sup>2</sup> 6.0260	95 <b>Am</b> Americium (243) [Rn]5f <sup>7</sup> 7s <sup>2</sup> 5.9738	96 <b>Cm</b> Curium (247) [Rn]5f <sup>8</sup> 6d <sup>1</sup> 7s <sup>2</sup> 5.9914	97 <b>Bk</b> Berkelium (247) [Rn]5f <sup>9</sup> 7s <sup>2</sup> 6.1979	98 <b>Cf</b> Californium (251) [Rn]5f <sup>10</sup> 7s <sup>2</sup> 6.2817	99 <b>Es</b> Einsteinium (252) [Rn]5f <sup>11</sup> 7s <sup>2</sup> 6.3676	100 <b>Fm</b> Fermium (257) [Rn]5f <sup>12</sup> 7s <sup>2</sup> 6.50	101 <b>Md</b> Mendelevium (258) [Rn]5f <sup>13</sup> 7s <sup>2</sup> 6.58	102 <b>No</b> Nobelium (259) [Rn]5f <sup>14</sup> 7s <sup>2</sup> 6.65	103 <b>Lr</b> Lawrencium (262) [Rn]5f <sup>14</sup> 7s <sup>2</sup> 7p <sup>1</sup> 4.9?

<sup>1</sup>Based upon <sup>12</sup>C. ( ) indicates the mass number of the longest-lived isotope.

For a description of the data, visit [physics.nist.gov/data](http://physics.nist.gov/data)

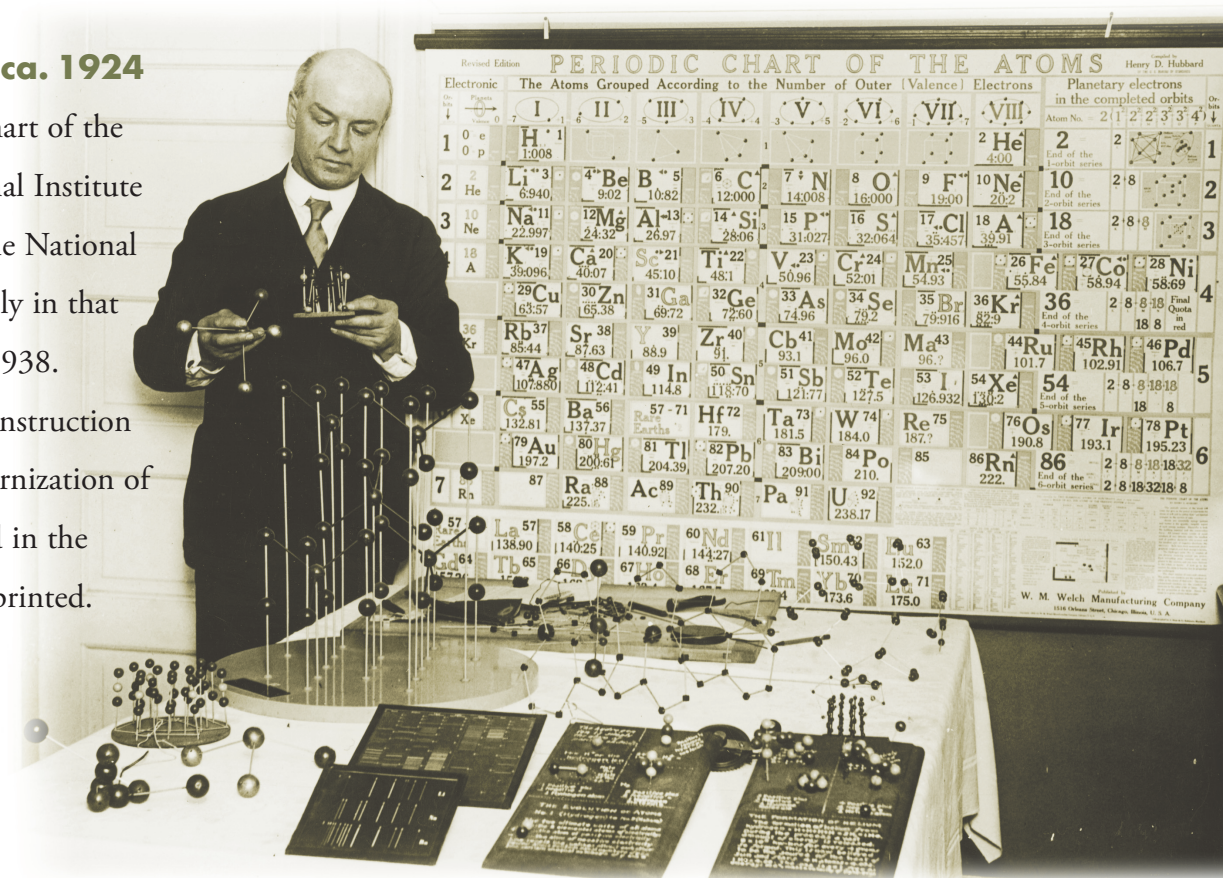
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## National Institute of Standards and Technology Serving the Nation Since 1901


### 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.



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