

PERIODIC TABLE

Atomic Properties of the Elements

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 ¹³³ Cs			
speed of light in vacuum	<i>c</i>	299 792 458 m s ⁻¹	(exact)
Planck constant	<i>h</i>	6.6261 × 10 ⁻³⁴ J s	(<i>h</i> = <i>h</i> /2 <i>π</i>)
elementary charge	<i>e</i>	1.6022 × 10 ⁻¹⁹ C	
electron mass	<i>m_e</i>	9.1094 × 10 ⁻³¹ kg	
	<i>m_ec²</i>	0.5110 MeV	
proton mass	<i>m_p</i>	1.6726 × 10 ⁻²⁷ kg	
fine-structure constant	<i>α</i>	1/137.036	
Rydberg constant	<i>R_∞</i>	10 973 732 m ⁻¹	
	<i>R_∞c</i>	3.289 842 × 10 ¹⁵ Hz	
	<i>R_∞hc</i>	13.6057 eV	
Boltzmann constant	<i>k</i>	1.3807 × 10 ⁻²³ J K ⁻¹	

- Solids
- Liquids
- Gases
- Artificially Prepared

Physics Laboratory physics.nist.gov		Standard Reference Data Group www.nist.gov/srd					2
13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18	18 VIIIa	
5 B Boron 10.811 1s ² 2s ² 2p 8.2980	6 C Carbon 12.0107 1s ² 2s ² 2p ² 11.2603	7 N Nitrogen 14.0067 1s ² 2s ² 2p ³ 14.5341	8 O Oxygen 15.9994 1s ² 2s ² 2p ⁴ 13.6181	9 F Fluorine 18.9984032 1s ² 2s ² 2p ⁵ 17.4228	10 Ne Neon 20.1797 1s ² 2s ² 2p ⁶ 21.5645	2 He Helium 4.002602 1s ² 24.5874	
13 Al Aluminum 26.981538 [Ne]3s ² 3p 5.9858	14 Si Silicon 28.0855 [Ne]3s ² 3p ² 8.1517	15 P Phosphorus 30.973761 [Ne]3s ² 3p ³ 10.4867	16 S Sulfur 32.065 [Ne]3s ² 3p ⁴ 10.3600	17 Cl Chlorine 35.453 [Ne]3s ² 3p ⁵ 12.9676	18 Ar Argon 39.948 [Ne]3s ² 3p ⁶ 15.7596		
31 Ga Gallium 69.723 [Ar]3d ¹⁰ 4s ² 4p 5.9993	32 Ge Germanium 72.64 [Ar]3d ¹⁰ 4s ² 4p ² 7.8994	33 As Arsenic 74.92160 [Ar]3d ¹⁰ 4s ² 4p ³ 9.7886	34 Se Selenium 78.96 [Ar]3d ¹⁰ 4s ² 4p ⁴ 9.7524	35 Br Bromine 79.904 [Ar]3d ¹⁰ 4s ² 4p ⁵ 11.8138	36 Kr Krypton 83.798 [Ar]3d ¹⁰ 4s ² 4p ⁶ 13.9996		
49 In Indium 114.818 [Kr]4d ¹⁰ 5s ² 5p 5.7864	50 Sn Tin 118.710 [Kr]4d ¹⁰ 5s ² 5p ² 7.3439	51 Sb Antimony 121.760 [Kr]4d ¹⁰ 5s ² 5p ³ 8.6084	52 Te Tellurium 127.60 [Kr]4d ¹⁰ 5s ² 5p ⁴ 9.0096	53 I Iodine 126.90447 [Kr]4d ¹⁰ 5s ² 5p ⁵ 10.4513	54 Xe Xenon 131.293 [Kr]4d ¹⁰ 5s ² 5p ⁶ 12.1298		
81 Tl Thallium 204.3833 [Hg]6p 6.1082	82 Pb Lead 207.2 [Hg]6p ² 7.4167	83 Bi Bismuth 208.98038 [Hg]6p ³ 7.2855	84 Po Polonium (209) [Hg]6p ⁴ 8.414	85 At Astatine (210) [Hg]6p ⁵	86 Rn Radon (222) [Hg]6p ⁶ 10.7485		
111 Uuu Ununium (272)	112 Uub Unubium (285)	114 Uuq Ununquadium (289)	116 Uuh Ununhexium (292)				

Group	1	2
Period	1	2
1	1 H Hydrogen 1.00794 1s 13.5984	2 He Helium 4.002602 1s ² 24.5874
2	3 Li Lithium 6.941 1s ² 2s 5.3917	4 Be Beryllium 9.012182 1s ² 2s ² 9.3227
3	11 Na Sodium 22.989770 [Ne]3s 5.1391	12 Mg Magnesium 24.3050 [Ne]3s ² 7.6462
4	19 K Potassium 39.0983 [Ar]4s 4.3407	20 Ca Calcium 40.078 [Ar]4s ² 6.1132
5	37 Rb Rubidium 85.4678 [Kr]5s 4.1771	38 Sr Strontium 87.62 [Kr]5s ² 5.6949
6	55 Cs Cesium 132.90545 [Xe]6s 3.8939	56 Ba Barium 137.327 [Xe]6s ² 5.2117
7	87 Fr Francium (223) [Rn]7s 4.0727	88 Ra Radium (226) [Rn]7s ² 5.2784

3	4	5	6	7	8	9	10	11	12
IIIB	IVB	VB	VIB	VIIB	VIII	VIII	VIII	IB	IIB
21 Sc Scandium 44.955910 [Ar]3d4s ² 6.5615	22 Ti Titanium 47.867 [Ar]3d ² 4s ² 6.8281	23 V Vanadium 50.9415 [Ar]3d ³ 4s ² 6.7462	24 Cr Chromium 51.9961 [Ar]3d ⁵ 4s 6.7665	25 Mn Manganese 54.938049 [Ar]3d ⁵ 4s ² 7.4340	26 Fe Iron 55.845 [Ar]3d ⁶ 4s ² 7.9024	27 Co Cobalt 58.933200 [Ar]3d ⁷ 4s ² 7.8810	28 Ni Nickel 58.6934 [Ar]3d ⁸ 4s ² 7.6398	29 Cu Copper 63.546 [Ar]3d ¹⁰ 4s 7.7264	30 Zn Zinc 65.409 [Ar]3d ¹⁰ 4s ² 9.3942
39 Y Yttrium 88.90585 [Kr]4d5s ² 6.2173	40 Zr Zirconium 91.224 [Kr]4d ² 5s ² 6.6339	41 Nb Niobium 92.90638 [Kr]4d ⁴ 5s 6.7589	42 Mo Molybdenum 95.94 [Kr]4d ⁵ 5s 7.0924	43 Tc Technetium (98) [Kr]4d ⁵ 5s ² 7.28	44 Ru Ruthenium 101.07 [Kr]4d ⁷ 5s 7.3605	45 Rh Rhodium 102.90550 [Kr]4d ⁸ 5s 7.4589	46 Pd Palladium 106.42 [Kr]4d ¹⁰ 8.3369	47 Ag Silver 107.8682 [Kr]4d ¹⁰ 5s 7.5762	48 Cd Cadmium 112.411 [Kr]4d ¹⁰ 5s ² 8.9938
72 Hf Hafnium 178.49 [Xe]4f ¹⁴ 5d ² 6s ² 6.8251	73 Ta Tantalum 180.9479 [Xe]4f ¹⁴ 5d ³ 6s ² 7.5496	74 W Tungsten 183.84 [Xe]4f ¹⁴ 5d ⁴ 6s ² 7.8640	75 Re Rhenium 186.207 [Xe]4f ¹⁴ 5d ⁵ 6s ² 7.8335	76 Os Osmium 190.23 [Xe]4f ¹⁴ 5d ⁶ 6s ² 8.4382	77 Ir Iridium 192.217 [Xe]4f ¹⁴ 5d ⁷ 6s ² 8.9670	78 Pt Platinum 195.078 [Xe]4f ¹⁴ 5d ⁹ 6s ¹ 8.9588	79 Au Gold 196.96655 [Xe]4f ¹⁴ 5d ¹⁰ 6s 9.2255	80 Hg Mercury 200.59 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 10.4375	
104 Rf Rutherfordium [Rn]5f ¹⁴ 6d ² 7s ² ? 6.0 ?	105 Db Dubnium (262)	106 Sg Seaborgium (266)	107 Bh Bohrium (264)	108 Hs Hassium (277)	109 Mt Meitnerium (268)	110 Uun Ununnilium (281)	111 Uuu Unununium (272)	112 Uub Unubium (285)	

Atomic Number: **58**

Ground-state Level: **1G₄^o**

Symbol: **Ce**

Name: **Cerium**

Atomic Weight: **140.116**

Ground-state Configuration: **[Xe]4f5d6s²**

Ionization Energy (eV): **5.5387**

Lanthanides	Actinides	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
Lanthanides	Actinides	57 La Lanthanum 138.9055 [Xe]5d6s ² 5.5769	58 Ce Cerium 140.116 [Xe]4f5d6s ² 5.5387	59 Pr Praseodymium 140.90765 [Xe]4f ³ 6s ² 5.473	60 Nd Neodymium 144.24 [Xe]4f ⁴ 6s ² 5.5250	61 Pm Promethium (145) [Xe]4f ⁵ 6s ² 5.582	62 Sm Samarium 150.36 [Xe]4f ⁶ 6s ² 5.6437	63 Eu Europium 151.964 [Xe]4f ⁷ 6s ² 5.6704	64 Gd Gadolinium 157.25 [Xe]4f ⁷ 5d6s ² 6.1498	65 Tb Terbium 158.92534 [Xe]4f ⁹ 6s ² 5.8638	66 Dy Dysprosium 162.500 [Xe]4f ¹⁰ 6s ² 5.9389	67 Ho Holmium 164.93032 [Xe]4f ¹¹ 6s ² 6.0215	68 Er Erbium 167.259 [Xe]4f ¹² 6s ² 6.1077	69 Tm Thulium 168.93421 [Xe]4f ¹³ 6s ² 6.1843	70 Yb Ytterbium 173.04 [Xe]4f ¹⁴ 6s ² 6.2542	71 Lu Lutetium 174.967 [Xe]4f ¹⁴ 5d6s ² 5.4259
		89 Ac Actinium (227) [Rn]6d7s ² 5.17	90 Th Thorium 232.0381 [Rn]6d ² 7s ² 6.3067	91 Pa Protactinium 231.03588 [Rn]5f ² 6d7s ² 5.89	92 U Uranium 238.02891 [Rn]5f ³ 6d7s ² 6.1941	93 Np Neptunium (237) [Rn]5f ⁴ 6d7s ² 6.2657	94 Pu Plutonium (244) [Rn]5f ⁶ 7s ² 6.0260	95 Am Americium (243) [Rn]5f ⁷ 7s ² 5.9738	96 Cm Curium (247) [Rn]5f ⁸ 6d7s ² 5.9914	97 Bk Berkelium (247) [Rn]5f ⁹ 7s ² 6.1979	98 Cf Californium (251) [Rn]5f ¹⁰ 7s ² 6.2817	99 Es Einsteinium (252) [Rn]5f ¹¹ 7s ² 6.42	100 Fm Fermium (257) [Rn]5f ¹² 7s ² 6.50	101 Md Mendelevium (258) [Rn]5f ¹³ 7s ² 6.58	102 No Nobelium (259) [Rn]5f ¹⁴ 7s ² 6.65	103 Lr Lawrencium (262) [Rn]5f ¹⁴ 7s ² ? 4.9 ?

[†]Based upon ¹²C. () indicates the mass number of the most stable isotope.