

PERIODIC TABLE Atomic Properties of the Elements

U.S. DEPARTMENT OF COMMERCE
Technology Administration
National Institute of Standards and Technology

Group IA

1	² S _{1/2}
1	H Hydrogen 1.00794 ¹ s 13.5984
2	Li Lithium 6.941 ¹ s ² 2s 5.3917
2	Be Beryllium 9.01218 ¹ s ² 2s ² 7.6427
3	Na Sodium 22.98977 [Ne]3s 7.6462
3	Mg Magnesium 24.3050 [Ne]3s ² 7.6462
4	K Potassium 39.0983 [Ar]4s 4.3407
4	Ca Calcium 40.078 [Ar]4s ² 6.1132
5	Rb Rubidium 85.4678 [Kr]5s 4.1771
5	Sr Strontium 87.62 [Kr]5s ² 5.6949
6	Cs Cesium 132.90545 [Xe]6s 3.8939
6	Ba Barium 137.327 [Xe]6s ² 5.2117
7	Fr Francium (223) [Rn]7s 4.0727
7	Ra Radium (226) [Rn]7s ² 5.2784

3	² S _{1/2}
3	Li Lithium 6.941 ¹ s ² 2s 5.3917
4	¹ S ₀
4	Be Beryllium 9.01218 ¹ s ² 2s ² 7.6427
11	² S _{1/2}
11	Na Sodium 22.98977 [Ne]3s 7.6462
12	¹ S ₀
12	Mg Magnesium 24.3050 [Ne]3s ² 7.6462

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 c 299 792 458 m s⁻¹ (exact)

Planck constant h 6.6261 × 10⁻³⁴ J s ($h = h/2\pi$)

elementary charge e 1.6022 × 10⁻¹⁹ C

electron mass m_e 9.1094 × 10⁻³¹ kg

$m_e c^2$ 0.5110 MeV

proton mass m_p 1.6726 × 10⁻²⁷ kg

fine-structure constant α 1/137.036

Rydberg constant R_∞ 10 973 732 m⁻¹

$R_\infty c$ 3.289 84 × 10¹⁵ Hz

$R_\infty hc$ 13.6057 eV

Boltzmann constant k 1.3807 × 10⁻²³ J K⁻¹

5	² P° _{1/2}	6	³ P° ₀	7	⁴ S° _{3/2}	8	³ P° ₂	9	² P° _{3/2}	10	¹ S ₀
5	B Boron 10.811 ¹ s ² 2s ² 2p 8.2980	6	C Carbon 12.0107 ¹ s ² 2s ² 2p ² 8.1517	7	N Nitrogen 14.00674 ¹ s ² 2s ² 2p ³ 14.5341	8	O Oxygen 15.9994 ¹ s ² 2s ² 2p ⁴ 13.6181	9	F Fluorine 18.99840 ¹ s ² 2s ² 2p ⁵ 17.4228	10	Ne Neon 20.1797 ¹ s ² 2s ² 2p ⁶ 21.5646
13	² P° _{1/2}	14	³ P° ₀	15	⁴ S° _{3/2}	16	³ P° ₂	17	² P° _{3/2}	18	¹ S ₀
13	Al Aluminum 26.98154 [Ne]3s ² 3p 5.9858	14	Si Silicon 28.0855 [Ne]3s ² 3p ² 8.1517	15	P Phosphorus 30.97376 [Ne]3s ² 3p ³ 10.4867	16	S Sulfur 32.066 [Ne]3s ² 3p ⁴ 10.3600	17	Cl Chlorine 35.4527 [Ne]3s ² 3p ⁵ 12.9676	18	Ar Argon 39.948 [Ne]3s ² 3p ⁶ 15.7596

IIIA

IIIA **IVA** **VA** **VIA** **VIIA** **VIIIA** **IB** **IIB**

19	² S _{1/2}	20	¹ S ₀	21	² D _{3/2}	22	³ F ₂	23	⁴ F _{3/2}	24	⁷ S ₃	25	⁶ S _{5/2}	26	⁵ D ₄	27	⁴ F _{9/2}	28	³ F ₄	29	² S _{1/2}	30	¹ S ₀	31	² P° _{1/2}	32	³ P° ₀	33	⁴ S° _{3/2}	34	³ P° ₂	35	² P° _{3/2}	36	¹ S ₀
19	K Potassium 39.0983 [Ar]4s 4.3407	20	Ca Calcium 40.078 [Ar]4s ² 6.1132	21	Sc Scandium 44.95591 [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 54.93805 [Ar]3d ⁵ 4s ² 7.4340	26	Fe Iron 55.845 [Ar]3d ⁶ 4s ² 7.9024	27	Co Cobalt 58.93320 [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 65.39 [Ar]3d ¹⁰ 4s ² 9.3942	31	Ga Gallium 69.723 [Ar]3d ¹⁰ 4s ² 4p 5.9993	32	Ge Germanium 72.61 [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 83.80 [Ar]3d ¹⁰ 4s ² 4p ⁶ 13.9996
37	² S _{1/2}	38	¹ S ₀	39	² D _{3/2}	40	³ F ₂	41	⁶ D _{1/2}	42	⁷ S ₃	43	⁶ S _{5/2}	44	⁵ F ₅	45	⁴ F _{9/2}	46	¹ S ₀	47	² S _{1/2}	48	¹ S ₀	49	² P° _{1/2}	50	³ P° ₀	51	⁴ S° _{3/2}	52	³ P° ₂	53	² P° _{3/2}	54	¹ S ₀
37	Rb Rubidium 85.4678 [Kr]5s 4.1771	38	Sr Strontium 87.62 [Kr]5s ² 5.6949	39	Y Yttrium 88.90585 [Kr]4d5s ² 6.2171	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	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 131.29 [Kr]4d ¹⁰ 5s ² 5p ⁶ 12.1298
55	² S _{1/2}	56	¹ S ₀	72	³ F ₂	73	⁴ F _{3/2}	74	⁵ D ₀	75	⁶ S _{5/2}	76	⁵ D ₄	77	⁴ F _{9/2}	78	³ D ₃	79	² S _{1/2}	80	¹ S ₀	81	² P° _{1/2}	82	³ P° ₀	83	⁴ S° _{3/2}	84	³ P° ₂	85	² P° _{3/2}	86	¹ S ₀		
55	Cs Cesium 132.90545 [Xe]6s 3.8939	56	Ba Barium 137.327 [Xe]6s ² 5.2117	72	Hf Hafnium 178.49 [Xe]4f ¹⁴ 5d ⁴ 6s ² 6.8251	73	Ta Tantalum 180.9479 [Xe]4f ¹⁴ 5d ⁵ 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 192.221 [Xe]4f ¹⁴ 5d ⁷ 6s ² 8.9670	78	Pt Platinum 195.078 [Xe]4f ¹⁴ 5d ⁹ 6s 8.9587	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	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 7.2856	84	Po Polonium (209) [Hg]6p ⁴ 8.417 ?	85	At Astatine (210) [Hg]6p ⁵ 8.417 ?	86	Rn Radon (222) [Hg]6p ⁶ 10.7485		
87	² S _{1/2}	88	¹ S ₀	104	³ F ₂ ?	105	⁴ F _{3/2}	106	⁵ D ₀	107	⁶ S _{5/2}	108	⁵ D ₄	109	⁴ F _{9/2}	110	³ D ₃	111	² S _{1/2}	112	¹ S ₀	111	² P° _{1/2}	112	³ P° ₀	113	⁴ S° _{3/2}	114	³ P° ₂	115	² P° _{3/2}	116	¹ S ₀		
87	Fr Francium (223) [Rn]7s 4.0727	88	Ra Radium (226) [Rn]7s ² 5.2784	104	Rf Rutherfordium (261) [Rn]5f ¹⁴ 6d ⁷ 7s ² 6.0 ?	105	Db Dubnium (262) [Rn]5f ¹⁴ 6d ⁷ 7s ² 6.0 ?	106	Sg Seaborgium (263) [Rn]5f ¹⁴ 6d ⁶ 7s ² 6.0 ?	107	Bh Bohrium (264) [Rn]5f ¹⁴ 6d ⁵ 7s ² 6.0 ?	108	Hs Hassium (265) [Rn]5f ¹⁴ 6d ⁴ 7s ² 6.0 ?	109	Mt Meitnerium (268) [Rn]5f ¹⁴ 6d ³ 7s ² 6.0 ?	110	Uun Ununnilium (269) [Rn]5f ¹⁴ 6d ² 7s ² 6.0 ?	111	Uuu Unununium (272) [Rn]5f ¹⁴ 6d ¹ 7s ² 6.0 ?	112	Uub Ununbium (272) [Rn]5f ¹⁴ 6d ⁰ 7s ² 6.0 ?														

Solids
 Liquids
 Gases
 Artificially Prepared

For a description of the atomic data, visit physics.nist.gov/atomic

Atomic Number: **58** Ground-state Level: ¹G₄

Symbol: **Ce**

Name: **Cerium**

Atomic Weight: **140.116**

Ground-state Configuration: [Xe]4f5d6s²

Ionization Energy (eV): **5.5387**

57	² D _{3/2}	58	¹ G ₄	59	⁴ I _{9/2}	60	⁵ I ₄	61	⁶ H _{5/2}	62	⁷ F ₀	63	⁸ S _{7/2}	64	⁹ D ₂	65	⁶ H _{5/2}	66	⁵ I ₈	67	⁴ I _{15/2}	68	³ H ₆	69	² F _{7/2}	70	¹ S ₀	71	² D _{3/2}
57	La Lanthanum 138.9055 [Xe]5d6s ² 5.5769	58	Ce Cerium 140.116 [Xe]4f5d6s ²																										