

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 ¹³³Cs

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> /2π)
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

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
	IA	IIA	IIIB	IVB	VB	VIB	VII B	VIII			IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA	
1	1 ² S _{1/2} H Hydrogen 1.00794 1s 13.5984																	2 ¹ S ₀ He Helium 4.002602 1s ² 24.5874	
2	3 ² S _{1/2} Li Lithium 6.941 1s ² 2s 5.3917	4 ¹ S ₀ Be Beryllium 9.012182 1s ² 2s ² 9.3227											5 ² P _{1/2} B Boron 10.811 1s ² 2s ² 2p 8.2980	6 ³ P ₀ C Carbon 12.0107 1s ² 2s ² 2p ² 11.2603	7 ⁴ S _{3/2} N Nitrogen 14.0067 1s ² 2s ² 2p ³ 14.5341	8 ³ P ₂ O Oxygen 15.9994 1s ² 2s ² 2p ⁴ 13.6181	9 ² P _{3/2} F Fluorine 18.9984032 1s ² 2s ² 2p ⁵ 17.4228	10 ¹ S ₀ Ne Neon 20.1797 1s ² 2s ² 2p ⁶ 21.5645	
3	11 ² S _{1/2} Na Sodium 22.989770 [Ne]3s 5.1391	12 ¹ S ₀ Mg Magnesium 24.3050 [Ne]3s ² 7.6462											13 ² P _{1/2} Al Aluminum 26.981538 [Ne]3s ² 3p 5.9858	14 ³ P ₀ Si Silicon 28.0855 [Ne]3s ² 3p ² 8.1517	15 ⁴ S _{3/2} P Phosphorus 30.973761 [Ne]3s ² 3p ³ 10.4867	16 ³ P ₂ S Sulfur 32.065 [Ne]3s ² 3p ⁴ 10.3600	17 ² P _{3/2} Cl Chlorine 35.453 [Ne]3s ² 3p ⁵ 12.9676	18 ¹ S ₀ Ar Argon 39.948 [Ne]3s ² 3p ⁶ 15.7596	
4	19 ² S _{1/2} K Potassium 39.0983 [Ar]4s 6.4307	20 ¹ S ₀ Ca Calcium 40.078 [Ar]4s ² 6.1132	21 ² D _{3/2} Sc Scandium 44.955910 [Ar]3d4s ² 6.5615	22 ³ F ₂ Ti Titanium 47.867 [Ar]3d ² 4s ² 6.8281	23 ⁴ F _{3/2} V Vanadium 50.9415 [Ar]3d ³ 4s ² 6.7462	24 ⁷ S ₃ Cr Chromium 51.9961 [Ar]3d ⁵ 4s 6.7665	25 ⁶ S _{5/2} Mn Manganese 54.938049 [Ar]3d ⁵ 4s ² 7.4340	26 ⁵ D ₄ Fe Iron 55.845 [Ar]3d ⁶ 4s ² 7.9024	27 ⁴ F _{9/2} Co Cobalt 58.933200 [Ar]3d ⁷ 4s ² 7.8810	28 ³ F ₄ Ni Nickel 58.6934 [Ar]3d ⁸ 4s ² 7.6398	29 ² S _{1/2} Cu Copper 63.546 [Ar]3d ¹⁰ 4s 7.7264	30 ¹ S ₀ Zn Zinc 65.409 [Ar]3d ¹⁰ 4s ² 9.3942	31 ² P _{1/2} Ga Gallium 69.723 [Ar]3d ¹⁰ 4s ² 4p 5.9993	32 ³ P ₀ Ge Germanium 72.64 [Ar]3d ¹⁰ 4s ² 4p ² 7.8994	33 ⁴ S _{3/2} As Arsenic 74.92160 [Ar]3d ¹⁰ 4s ² 4p ³ 9.7886	34 ³ P ₂ Se Selenium 78.96 [Ar]3d ¹⁰ 4s ² 4p ⁴ 9.7524	35 ² P _{3/2} Br Bromine 79.904 [Ar]3d ¹⁰ 4s ² 4p ⁵ 11.8138	36 ¹ S ₀ Kr Krypton 83.798 [Ar]3d ¹⁰ 4s ² 4p ⁶ 13.9996	
5	37 ² S _{1/2} Rb Rubidium 85.4678 [Kr]5s 4.1771	38 ¹ S ₀ Sr Strontium 87.62 [Kr]5s ² 5.6949	39 ² D _{3/2} Y Yttrium 88.90585 [Kr]4d5s ² 6.2173	40 ³ F ₂ Zr Zirconium 91.224 [Kr]4d ² 5s ² 6.6339	41 ⁶ D _{1/2} Nb Niobium 92.90638 [Kr]4d ⁴ 5s 6.7589	42 ⁷ S ₃ Mo Molybdenum 95.94 [Kr]4d ⁵ 5s 7.0924	43 ⁶ S _{5/2} Tc Technetium (98) [Kr]4d ⁵ 5s ² 7.28	44 ⁵ F ₅ Ru Ruthenium 101.07 [Kr]4d ⁷ 5s 7.3605	45 ⁴ F _{9/2} Rh Rhodium 102.90550 [Kr]4d ⁸ 5s 7.4589	46 ¹ S ₀ Pd Palladium 106.42 [Kr]4d ¹⁰ 8.3369	47 ² S _{1/2} Ag Silver 107.8682 [Kr]4d ¹⁰ 5s 7.5762	48 ¹ S ₀ Cd Cadmium 112.411 [Kr]4d ¹⁰ 5s ² 8.9938	49 ² P _{1/2} In Indium 114.818 [Kr]4d ¹⁰ 5s ² 5p 5.7864	50 ³ P ₀ Sn Tin 118.710 [Kr]4d ¹⁰ 5s ² 5p ² 7.3439	51 ⁴ S _{3/2} Sb Antimony 121.760 [Kr]4d ¹⁰ 5s ² 5p ³ 8.6084	52 ³ P ₂ Te Tellurium 127.60 [Kr]4d ¹⁰ 5s ² 5p ⁴ 9.0096	53 ² P _{3/2} I Iodine 126.90447 [Kr]4d ¹⁰ 5s ² 5p ⁵ 10.4513	54 ¹ S ₀ Xe Xenon 131.293 [Kr]4d ¹⁰ 5s ² 5p ⁶ 12.1298	
6	55 ² S _{1/2} Cs Cesium 132.90545 [Xe]6s 3.8939	56 ¹ S ₀ Ba Barium 137.327 [Xe]6s ² 5.2117	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Lanthanides</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Actinides</div> </div>		72 ³ F ₂ Hf Hafnium 178.49 [Xe]4f ¹⁴ 5d ² 6s ² 6.8251	73 ⁴ F _{3/2} Ta Tantalum 180.9479 [Xe]4f ¹⁴ 5d ³ 6s ² 7.5496	74 ⁵ D ₀ W Tungsten 183.84 [Xe]4f ¹⁴ 5d ⁴ 6s ² 7.8640	75 ⁶ S _{5/2} Re Rhenium 186.207 [Xe]4f ¹⁴ 5d ⁵ 6s ² 7.8335	76 ⁵ D ₄ Os Osmium 190.23 [Xe]4f ¹⁴ 5d ⁶ 6s ² 8.4382	77 ⁴ F _{9/2} Ir Iridium 192.217 [Xe]4f ¹⁴ 5d ⁷ 6s ² 8.9670	78 ³ D ₃ Pt Platinum 195.078 [Xe]4f ¹⁴ 5d ⁹ 6s ¹ 8.9588	79 ² S _{1/2} Au Gold 196.96655 [Xe]4f ¹⁴ 5d ¹⁰ 6s 9.2255	80 ¹ S ₀ Hg Mercury 200.59 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 10.4375	81 ² P _{1/2} Tl Thallium 204.3833 [Hg]6p 6.1082	82 ³ P ₀ Pb Lead 207.2 [Hg]6p ² 7.4167	83 ⁴ S _{3/2} Bi Bismuth 208.98038 [Hg]6p ³ 7.2855	84 ³ P ₂ Po Polonium (209) [Hg]6p ⁴ 8.414	85 ² P _{3/2} At Astatine (210) [Hg]6p ⁵	86 ¹ S ₀ Rn Radon (222) [Hg]6p ⁶ 10.7485
7	87 ² S _{1/2} Fr Francium (223) [Rn]7s 4.0727	88 ¹ S ₀ Ra Radium (226) [Rn]7s ² 5.2784			89 ² D _{3/2} Ac Actinium (227) [Rn]6d7s ² 5.17	90 ³ F ₂ Th Thorium 232.0381 [Rn]6d ² 7s ² 6.3067	91 ⁴ K _{11/2} Pa Protactinium 231.03588 [Rn]5f ² 6d7s ² 5.89	92 ⁵ L ₆ U Uranium 238.02891 [Rn]5f ³ 6d7s ² 6.1941	93 ⁶ L _{11/2} Np Neptunium (237) [Rn]5f ⁴ 6d7s ² 6.2657	94 ⁷ F ₀ Pu Plutonium (244) [Rn]5f ⁶ 7s ² 6.0260	95 ⁸ S _{7/2} Am Americium (243) [Rn]5f ⁷ 7s ² 5.9738	96 ⁹ D ₂ Cm Curium (247) [Rn]5f ⁸ 6d7s ² 5.9914	97 ⁶ H _{15/2} Bk Berkelium (247) [Rn]5f ⁹ 7s ² 6.1979	98 ⁵ I ₈ Cf Californium (251) [Rn]5f ¹⁰ 7s ² 6.2817	99 ⁴ I _{15/2} Es Einsteinium (252) [Rn]5f ¹¹ 7s ² 6.42	100 ³ H ₆ Fm Fermium (257) [Rn]5f ¹² 7s ² 6.50	101 ² F _{7/2} Md Mendelevium (258) [Rn]5f ¹³ 7s ² 6.58	102 ¹ S ₀ No Nobelium (259) [Rn]5f ¹⁴ 7s ² 6.65	103 ² P _{1/2} [?] Lr Lawrencium (262) [Rn]5f ¹⁴ 7s ² 7p [?] 4.9 ?

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

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