Prefixes

z=10^{-21}, zepto,	a=10^{-18}, atto,	f=10^{-15}, femto,	p=10^{-12}, pico,	n=10^{-9}, nano,	$\mu = 10^{-6}$, micro,	m=10^{-3}, milli,	c=10^{-2}, centi,	k=10^{3}, kilo,	M=10^{6}, mega,	G=10^{9}, giga,	T=10^{12}, tera,	P=10^{15}, peta,	E=10^{18}, exa,	Z=10^{21} zeta

Physical Constants

$k = 1/4\pi\epsilon_0 = 8.988$ GNm^2/C^2 (Coulomb's Law)
$e = 1.602 \times 10^{-19}$ C (proton charge)
$c = 3.00 \times 10^8$ m/s (speed of light)
$m_e = 9.1094 \times 10^{-31}$ kg (electron mass)
$m_n = 1.67493 \times 10^{-27}$ kg = (neutron mass)
$h = 6.62607 \times 10^{-34}$ J·s (Planck's constant)

$\epsilon_0 = 1/4\pi k = 8.854$ pF/m (permittivity of space)
$\mu_0 = 4\pi \times 10^{-7}$ T·m/A (permeability of space)
$c = 2.99792458 \times 10^8$ m/s (exact value in vacuum)
$m_p = 1.67262 \times 10^{-27}$ kg (proton mass)
$hc = 1239.84$ eV·nm (photon energy = hc/λ)
$\hbar = 1.05457 \times 10^{-34}$ J·s (Planck's constant/2π)

Units

$N_A = 6.022 \times 10^{23}$/mole (Avogadro's #)
1.0 eV = 1.602×10^{-19} J (electron-volt)
1 F = 1 C/V = 1 farad = 1 C^2/J
1 A = 1 C/s = 1 ampere = 1 coulomb/second
1 T = 1 N/A·m = 1 tesla = 1 newton/ampere·meter
1 Bq = 1 becquerel = 1 decay/s

1 u = 1 g/$N_A = 1.6605 \times 10^{-27}$ kg = 931.5 MeV/c^2 (mass unit)
1 V = 1 J/C = 1 volt = 1 joule/coulomb
1 H = 1 V·s/A = 1 henry = 1 J/A^2
1 Ω = 1 V/A = 1 ohm = 1 J·s/C^2
1 G = 10^{-4} T = 1 gauss = 10^{-4} tesla
1 Ci = 1 curie = 3.70×10^{10} decays/s = 37.0 GBq

Some Masses (for neutral atoms)

electron = ${}^{0}_{-1}$e = 0.00054858 u = 0.51100 MeV/c^2
neutron = ${}^{1}_{0}$n = n = 1.008665 u = 939.57 MeV/c^2
deuterium = ${}^{2}_{1}$H = d = 2.014102 u
helium-3 = ${}^{3}_{2}$He = 3.016029 u

proton = ${}^{1}_{1}$p = p =1.007276 u = 938.27 MeV/c^2
hydrogen = ${}^{1}_{1}$H = 1.007825 u = 938.78 MeV/c^2
tritium = ${}^{3}_{1}$H = t = 3.016049 u
helium-4 = ${}^{4}_{2}$He = α = 4.002603 u

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Bohr Model:

$hf = E_n - E_{n'}$ (quantum jump)
$r_n = \frac{n^2}{Z} r_1$ (Bohr radii)
$E_n = -(13.6 \text{ eV})\frac{Z^2}{n^2}$ (Bohr energies)
$n = 1, 2, 3, ...$ (Bohr's quantum number)

$L = mvr = n\frac{h}{2\pi}$ (Bohr's quantization)
$r_1 = \frac{h^2}{4\pi^2 mke^2} = 52.9$ pm (1^{st} Bohr radius)
$E_n = \frac{1}{2}mv^2 - \frac{kZe^2}{r_n}$ (total energy)
$E = hc/\lambda = (1240 \text{ eV} \cdot \text{nm})/\lambda$ (photons)

Quantum numbers for atoms:

principle quantum number $n = 0, 1, 2, 3...$
orbital quantum number $l = 0, 1, 2...(n-1)$
magnetic quantum number $m_l = -l$ to $+l$
spin quantum number $m_s = -\frac{1}{2}, +\frac{1}{2}$
shell ($2n^2$ states) = a value of (n) is given.
orbital (2 states) = particular (n, l, m_l) are given.

$E_n = -(13.6 \text{ eV})/n^2$ (energy of hydrogen states)
$L = \sqrt{l(l+1)}\,\hbar$ (angular momentum magnitude)
$L_z = m_l\hbar$ (z-component of $\vec{L}$)
$S_z = m_s\hbar$ (z-comp., spin angular momentum)
sub-shell [$2(2\ell+1)$ states] = values of (n, l) are given.
state = particular (n, l, m_l, m_s) are given.

$l = 0, 1, 2, 3, 4, 5, 6...$ are indicated with respective letters: s, p, d, f, g, h,...

Pauli exclusion principle: *No two electrons in an atom can occupy the same quantum state.*

Subshells in order of increasing energy: 1s, 2s, 2p, 3s, 3p, 4s, 3d, 4p, 5s, 4d, 5p, 6s, 4f, 5d, 6p, 7s, 5f, 6d, 7p
(They fill in order of increasing $n + l$, but higher n is higher energy if there is a tie.)

Nuclides:

$A = N + Z$, (mass, neutron, proton numbers)

$\Delta E =$[(mass of parts) - (mass of nuclide)]c^2 ← (binding energy)

$Q = [M_{\text{parent}} - M_{\text{products}}]c^2$ ← (disintegration energy)

1 u = 1 gram / 6.02×10^{23} (atomic mass unit)

$r = (1.2 \text{ fm})\ A^{1/3}$ (nuclear radius)

1 u $\cdot\ c^2 = 931.5$ MeV (energy unit)

Half-life $T_{1/2}$ and decay constant λ

$N = N_0 e^{-\lambda t}$ (decay of parent nuclei)

$t = \frac{-1}{\lambda} \ln(N/N_0)$ (time when N nuclei remain)

$\lambda T_{\frac{1}{2}} = \ln 2$ (decay constant, half-life)

$\#(^{14}_{6}C)/\#(^{12}_{6}C) = 1.3 \times 10^{-12}$ (live carbon ratio)

$N = N_0 \left(\frac{1}{2}\right)^{t/T_{1/2}}$ (decay by half-lives)

$\mathcal{A} = |\frac{\Delta N}{\Delta t}| = N\lambda$ (radio-activity)

$M = Nm =$ mass = (# of nuclei)×(nuclear mass)

1 year = 3.156×10^7 seconds

Periodic Table of the Elements[§]

Group I	Group II	Transition Elements										Group III	Group IV	Group V	Group VI	Group VII	Group VIII
H 1 1.00794 $1s^1$																	He 2 4.002602 $1s^2$
Li 3 6.941 $2s^1$	Be 4 9.012182 $2s^2$											B 5 10.811 $2p^1$	C 6 12.0107 $2p^2$	N 7 14.00674 $2p^3$	O 8 15.9994 $2p^4$	F 9 18.9984032 $2p^5$	Ne 10 20.1797 $2p^6$
Na 11 22.989770 $3s^1$	Mg 12 24.3050 $3s^2$											Al 13 26.981538 $3p^1$	Si 14 28.0855 $3p^2$	P 15 30.973761 $3p^3$	S 16 32.066 $3p^4$	Cl 17 35.4527 $3p^5$	Ar 18 39.948 $3p^6$
K 19 39.0983 $4s^1$	Ca 20 40.078 $4s^2$	Sc 21 44.955910 $3d^1 4s^2$	Ti 22 47.867 $3d^2 4s^2$	V 23 50.9415 $3d^3 4s^2$	Cr 24 51.9961 $3d^5 4s^1$	Mn 25 54.938049 $3d^5 4s^2$	Fe 26 55.845 $3d^6 4s^2$	Co 27 58.933200 $3d^7 4s^2$	Ni 28 58.6934 $3d^8 4s^2$	Cu 29 63.546 $3d^{10} 4s^1$	Zn 30 65.39 $3d^{10} 4s^2$	Ga 31 69.723 $4p^1$	Ge 32 72.61 $4p^2$	As 33 74.92160 $4p^3$	Se 34 78.96 $4p^4$	Br 35 79.904 $4p^5$	Kr 36 83.80 $4p^6$
Rb 37 85.4678 $5s^1$	Sr 38 87.62 $5s^2$	Y 39 88.90585 $4d^1 5s^2$	Zr 40 91.224 $4d^2 5s^2$	Nb 41 92.90638 $4d^4 5s^1$	Mo 42 95.94 $4d^5 5s^1$	Tc 43 (98) $4d^5 5s^2$	Ru 44 101.07 $4d^7 5s^1$	Rh 45 102.90550 $4d^8 5s^1$	Pd 46 106.42 $4d^{10} 5s^0$	Ag 47 107.8682 $4d^{10} 5s^1$	Cd 48 112.411 $4d^{10} 5s^2$	In 49 114.818 $5p^1$	Sn 50 118.710 $5p^2$	Sb 51 121.760 $5p^3$	Te 52 127.60 $5p^4$	I 53 126.90447 $5p^5$	Xe 54 131.29 $5p^6$
Cs 55 132.90545 $6s^1$	Ba 56 137.327 $6s^2$	57–71†	Hf 72 178.49 $5d^2 6s^2$	Ta 73 180.9479 $5d^3 6s^2$	W 74 183.84 $5d^4 6s^2$	Re 75 186.207 $5d^5 6s^2$	Os 76 190.23 $5d^6 6s^2$	Ir 77 192.217 $5d^7 6s^2$	Pt 78 195.078 $5d^9 6s^1$	Au 79 196.96655 $5d^{10} 6s^1$	Hg 80 200.59 $5d^{10} 6s^2$	Tl 81 204.3833 $6p^1$	Pb 82 207.2 $6p^2$	Bi 83 208.98038 $6p^3$	Po 84 (209) $6p^4$	At 85 (210) $6p^5$	Rn 86 (222) $6p^6$
Fr 87 (223) $7s^1$	Ra 88 (226) $7s^2$	89–103‡	Rf 104 (261) $6d^2 7s^2$	Db 105 (262) $6d^3 7s^2$	Sg 106 (266) $6d^4 7s^2$	Bh 107 (264) $6d^5 7s^2$	Hs 108 (269) $6d^6 7s^2$	Mt 109 (268) $6d^7 7s^2$	Ds 110 (271) $6d^9 7s^1$	111 (272) $6d^{10} 7s^1$	112 (277) $6d^{10} 7s^2$						

†Lanthanide Series	La 57 138.9055 $5d^1 6s^2$	Ce 58 140.115 $4f^1 5d^1 6s^2$	Pr 59 140.90765 $4f^3 5d^0 6s^2$	Nd 60 144.24 $4f^4 5d^0 6s^2$	Pm 61 (145) $4f^5 5d^0 6s^2$	Sm 62 150.36 $4f^6 5d^0 6s^2$	Eu 63 151.964 $4f^7 5d^0 6s^2$	Gd 64 157.25 $4f^7 5d^1 6s^2$	Tb 65 158.92534 $4f^9 5d^0 6s^2$	Dy 66 162.50 $4f^{10} 5d^0 6s^2$	Ho 67 164.93032 $4f^{11} 5d^0 6s^2$	Er 68 167.26 $4f^{12} 5d^0 6s^2$	Tm 69 168.93421 $4f^{13} 5d^0 6s^2$	Yb 70 173.04 $4f^{14} 5d^0 6s^2$	Lu 71 174.967 $4f^{14} 5d^1 6s^2$
‡Actinide Series	Ac 89 (227.02775) $6d^1 7s^2$	Th 90 232.0381 $6d^2 7s^2$	Pa 91 (231) $5f^2 6d^1 7s^2$	U 92 238.0289 $5f^3 6d^1 7s^2$	Np 93 (237) $5f^4 6d^1 7s^2$	Pu 94 (244) $5f^6 6d^0 7s^2$	Am 95 (243) $5f^7 6d^0 7s^2$	Cm 96 (247) $5f^7 6d^1 7s^2$	Bk 97 (247) $5f^9 6d^0 7s^2$	Cf 98 (251) $5f^{10} 6d^0 7s^2$	Es 99 (252) $5f^{11} 6d^0 7s^2$	Fm 100 (257) $5f^{12} 6d^0 7s^2$	Md 101 (258) $5f^{13} 6d^0 7s^2$	No 102 (259) $5f^{14} 6d^0 7s^2$	Lr 103 (262) $5f^{14} 6d^1 7s^2$

§ Atomic mass values averaged over isotopes in the percentages they occur on Earth's surface. For unstable elements, mass of the longest-lived known isotope is given in parentheses. 2003 revisions. (See also Appendix B.)