

Constants	Notation and value
Avogadro number	$N_A = 6 \times 10^{23} \text{ mol}^{-1}$
Boltzmann constant	$k_B = 1.38 \times 10^{-23} \text{ J/K}$
Gas constant	$R = k_B N_A = 8.3 \text{ J/(mol}\cdot\text{K)}$
Planck constant	$h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}$
Atomic mass unit	$m_u = 1.66 \times 10^{-27} \text{ kg}$
Standard temperature and pressure (STP)	T=273.15 K, P= 1 atm
Molar volume of ideal gas at STP	22.4 litre
”Room temperature”	300 K
Conversions	
	1 atm = $1. \times 10^5$ Pa= 760 mm Hg
	1 Pa = 1 N/m ² ,
	1 bar= 10^5 Pa =750 mm Hg
	1 cal = 4.19 J
	1 litre = 10^{-3} m ³
	1 eV \approx 11000 K
Thermodynamic potentials	Notation, definition, fundamental equation
Internal energy	$U = TS + XY + \mu N$
Enthalpy	$H = U - XY = TS + \mu N$
Free energy	$F = U - TS = XY + \mu N$
Gibbs potential	$G = U - TS - XY = \mu N$
Grand potential	$\Omega = U - TS - N\mu = XY$
Useful math	
Stirling formula	$\ln n! \approx n \ln n - n, \quad n \gg 1$
Jacobians	$\frac{D(x_1, x_2, \dots, x_n)}{D(y_1, y_2, \dots, y_n)} = \det \left(\frac{\partial x_i}{\partial y_j} \right)$ $\frac{D(x_1, x_2, \dots, x_n)}{D(y_1, y_2, \dots, y_n)} = \left(\frac{D(x_1, x_2, \dots, x_n)}{D(z_1, z_2, \dots, z_n)} \right) \left(\frac{D(z_1, z_2, \dots, z_n)}{D(y_1, y_2, \dots, y_n)} \right)$

The Periodic Table of Elements

1 H HYDROGEN 1	2 He HELIUM 4	NON-METALS																																																																																																		
3 Li LITHIUM 7	4 Be BERYLLIUM 9	5 B BORON 11	6 C CARBON 12	7 N NITROGEN 14	8 O OXYGEN 16	9 F FLUORINE 19	10 Ne NEON 20	11 Na SODIUM 23	12 Mg MAGNESIUM 24	13 Al ALUMINUM 27	14 Si SILICON 28	15 P PHOSPHORUS 31	16 S SULFUR 32	17 Cl CHLORINE 35	18 Ar ARGON 40	19 K POTASSIUM 39	20 Ca CALCIUM 40	21 Sc SCANDIUM 45	22 Ti TITANIUM 48	23 V VANADIUM 51	24 Cr CHROMIUM 52	25 Mn MANGANESE 55	26 Fe IRON 56	27 Co COBALT 59	28 Ni NICKEL 59	29 Cu COPPER 64	30 Zn ZINC 65	31 Ga GALLIUM 70	32 Ge GERMANIUM 73	33 As ARSENIC 75	34 Se SELENIUM 79	35 Br BROMINE 80	36 Kr KRYPTON 84	37 Rb RUBIDIUM 85	38 Sr STRONTIUM 88	39 Y YTRITIUM 89	40 Zr ZIRCONIUM 91	41 Nb NIOBIUM 93	42 Mo MOLYBDENUM 96	43 Tc TECHNETIUM 98	44 Ru RUTHENIUM 101	45 Rh RHODIUM 103	46 Pd PALLADIUM 106	47 Ag SILVER 108	48 Cd CADMIUM 112	49 In INDIUM 115	50 Sn TIN 119	51 Sb ANTIMONY 122	52 Te TELLURIUM 128	53 I IODINE 127	54 Xe XENON 131	55 Cs CESIUM 133	56 Ba BARIUM 137	57 La LANTHANUM 139	58 Ce CERIUM 140	59 Pr PRASEODYMIUM 141	60 Nd NEODYMIUM 144	61 Pm PROMETHIUM 145	62 Sm SAMARIUM 150	63 Eu EUROPIUM 152	64 Gd GADOLINIUM 157	65 Tb TERBIUM 159	66 Dy DYSPROSIUM 163	67 Ho HOLMIUM 165	68 Er ERBIUM 167	69 Tm THULIUM 169	70 Yb YTTERIUM 173	71 Lu LUTETIUM 175	72 Hf HAFNIUM 178	73 Ta TANTALUM 181	74 W TUNGSTEN 184	75 Re RHENIUM 186	76 Os OSMIUM 190	77 Ir IRIDIUM 192	78 Pt PLATINUM 195	79 Au GOLD 197	80 Hg MERCURY 201	81 Tl THALLIUM 204	82 Pb LEAD 207	83 Bi BISMUTH 209	84 Po POLONIUM 209	85 At ASTATINE 210	86 Rn RADON 222	87 Fr FRANCIUM 223	88 Ra RADIUM 226	89 Ac ACTINIUM 227	90 Th THORIUM 232	91 Pa PROTACTINIUM 231	92 U URANIUM 238	93 Np NEPTUNIUM 237	94 Pu PLUTONIUM 244	95 Am AMERICIUM 243	96 Cm CURIUM 247	97 Bk BERKELIUM 247	98 Cf CALIFORNIUM 251	99 Es EINSTEINIUM 252	100 Fm FERMIUM 257	101 Md MENDELEVIUM 258	102 No NOBELIUM 259	103 Lr LAWRENCIUM 262
METALS																		117 Ts TENNESSE 294	118 Og OGANESSON 294																																																																																	

Atomic Number = Number of Protons = Number of Electrons

Chemical Symbol

Chemical Name

Atomic Weight = Number of Protons + Number of Neutrons*

KEY

- = Solid at room temperature
- = Liquid at room temperature
- = Gas at room temperature
- = Radioactive
- = Artificially Made

* The atomic weights listed on this Table of Elements have been rounded to the nearest whole number. As a result, this chart actually displays the mass number of a specific isotope for each element. An element's complete, unrounded atomic weight can be found on the It's Elemental website: <http://education.jlab.org/itselemental/>