

## Equations, Constants, and Conversion Factors

$$\text{Molarity} = \frac{n}{V}$$

$$E_K = \frac{1}{2}mv^2$$

$$E_K = \frac{3RT}{N_A}$$

$$E_p = mgh$$

$$E_{el} = V(\text{voltage}) = \frac{\kappa Q_1 Q_2}{d}$$

$$\Delta E = q + w$$

$$w = F \times d = F \times \Delta x$$

$$w = -P\Delta V$$

$$\Delta H = \Delta E + P\Delta V$$

$$q_{cal} = C\Delta T = mC_s\Delta T$$

$$\Delta H_{rxn}^{\circ} = \Sigma_{prod.} \Delta H_f^{\circ} - \Sigma_{react.} \Delta H_f^{\circ}$$

$$PV = nRT$$

$$d = \frac{PM}{RT}$$

$$P_T = P_1 + P_2 + P_3 + P_4 + \dots$$

$$P_1 = \frac{n_1}{n_T} P_T = \chi_1 P_T$$

$$u_{rms} = \sqrt{\frac{3RT}{M}}$$

$$u_{mp} = \sqrt{\frac{2RT}{M}}$$

$$\lambda\nu = c$$

$$E_{photon} = h\nu$$

$$E = \frac{hc}{\lambda}$$

$$\lambda = \frac{h}{p} = \frac{h}{mv}$$

$$\Delta E_n = (-2.178 \times 10^{-18} \text{ J}) \left( \frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$$

$$E_n = (-2.178 \times 10^{-18} \text{ J}) \left( \frac{1}{n^2} \right)$$

$$\Delta p \times \Delta x \geq \frac{h}{4\pi} \quad \text{or} \quad m\Delta v \times \Delta x \geq \frac{h}{4\pi}$$

$$R = 0.08206 \frac{\text{L atm}}{\text{mol K}} = 8.314 \frac{\text{J}}{\text{mol K}} = 8.314 \frac{\text{m}^3 \text{Pa}}{\text{mol K}}$$

$$R = 1.987 \frac{\text{cal}}{\text{mol K}} = 62.36 \frac{\text{L torr}}{\text{mol K}}$$

$$101.325 \text{ J} = 1 \text{ L} \cdot \text{atm}$$

$$1 \text{ J} = 1 \text{ kg m}^2 \cdot \text{s}^{-2}$$

$$4.184 \text{ J} = 1 \text{ cal}$$

$$1 \text{ atm} = 760. \text{mmHg} = 760. \text{torr}$$

$$= 1.01325 \times 10^5 \text{ Pa}$$

$$= 101.325 \text{ kPa} = 1.01325 \text{ bar}$$

$$1 \text{ L} = 1.0567 \text{ qt} = 0.2642 \text{ gal}$$

$$1 \text{ kg} = 2.2046 \text{ lb}$$

$$1 \text{ amu} = 1.6605 \times 10^{-27} \text{ kg}$$

$$1 \text{ km} = 0.62137 \text{ mi}$$

$$1 \text{ \AA} = 1 \times 10^{-10} \text{ m} = 0.1 \text{ nm}$$

$$\text{K} = {}^{\circ}\text{C} + 273.15 \quad {}^{\circ}\text{C} = \frac{5}{9}({}^{\circ}\text{F} - 32)$$

$$\text{Proton Mass: } m_p = 1.673 \times 10^{-27} \text{ kg}$$

$$\text{Neutron Mass: } m_N = 1.675 \times 10^{-27} \text{ kg}$$

$$\text{Electron Mass: } m_e = 9.10939 \times 10^{-31} \text{ kg}$$

$$\text{electron charge: } e = 1.602 \times 10^{-19} \text{ C}$$

$$N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$$

$$\kappa = 8.99 \times 10^9 \text{ J m C}^2$$

$$g = 9.81 \text{ m/s}^2$$

$$c = 2.998 \times 10^8 \frac{\text{m}}{\text{s}}$$

$$h = 6.626 \times 10^{-34} \text{ J s}$$

$$1D = 3.336 \times 10^{-30} \text{ C m}$$

$$S_g = k P_g$$

$$P_{soln} = X_{solvent} P_{solvent}^{\circ}$$

$$\Delta T_b = K_b m_{molality} (\text{particles})$$

$$\Delta T_f = -K_f m_{molality} (\text{particles})$$

$$\Pi = i \frac{n}{V} RT = iMRT$$

# PERIODIC TABLE OF THE ELEMENTS

PERIOD	GROUP	1A	2A	3A	4A	5A	6A	7A	8A	9	10	11	12	13A	14A	15A	16A	17A	18
		GROUP NUMBERS IUPAC RECOMMENDATION (1985)		GROUP NUMBERS CHEMICAL ABSTRACT SERVICE (1986)		ATOMIC NUMBER		RELATIVE ATOMIC MASS (1)		SYMBOL		ELEMENT NAME							
1	1	1.008 <b>H</b> HYDROGEN																	2 4.0026 <b>He</b> HELIUM
2	2	6.94 <b>Li</b> LITHIUM	4 9.0122 <b>Be</b> BERYLLIUM					5 10.811 <b>B</b> BORON						6 12.011 <b>C</b> CARBON	7 14.007 <b>N</b> NITROGEN	8 15.999 <b>O</b> OXYGEN	9 18.998 <b>F</b> FLUORINE	10 20.180 <b>Ne</b> NEON	
3	3	11 22.990 <b>Na</b> SODIUM	12 24.305 <b>Mg</b> MAGNESIUM					13 26.982 <b>Al</b> ALUMINIUM						14 28.085 <b>Si</b> SILICON	15 30.974 <b>P</b> PHOSPHORUS	16 32.06 <b>S</b> SULPHUR	17 35.45 <b>Cl</b> CHLORINE	18 39.948 <b>Ar</b> ARGON	
4	4	19 39.098 <b>K</b> POTASSIUM	20 40.078 <b>Ca</b> CALCIUM	21 44.956 <b>Sc</b> SCANDIUM	22 47.867 <b>Ti</b> TITANIUM	23 50.942 <b>V</b> VANADIUM	24 51.996 <b>Cr</b> CHROMIUM	25 54.938 <b>Mn</b> MANGANESE	26 55.845 <b>Fe</b> IRON	27 58.933 <b>Co</b> COBALT	28 58.693 <b>Ni</b> NICKEL	29 63.546 <b>Cu</b> COPPER	30 65.38 <b>Zn</b> ZINC	31 69.723 <b>Ga</b> GALLIUM	32 72.64 <b>Ge</b> GERMANIUM	33 74.922 <b>As</b> ARSENIC	34 78.971 <b>Se</b> SELENIUM	35 79.904 <b>Br</b> BROMINE	36 83.798 <b>Kr</b> KRYPTON
5	5	37 85.468 <b>Rb</b> RUBIDIUM	38 87.62 <b>Sr</b> STRONTIUM	39 88.906 <b>Y</b> YTTORIUM	40 91.224 <b>Zr</b> ZIRCONIUM	41 92.906 <b>Nb</b> NIOBIUM	42 95.95 <b>Mo</b> MOLYBDENUM	43 101.07 <b>Tc</b> TECHNETIUM	44 102.91 <b>Ru</b> RUTHENIUM	45 106.42 <b>Rh</b> RHODIUM	46 106.42 <b>Pd</b> PALLADIUM	47 107.87 <b>Ag</b> SILVER	48 112.41 <b>Cd</b> CADMIUM	49 114.82 <b>In</b> INDIUM	50 118.71 <b>Sn</b> TIN	51 121.76 <b>Sb</b> ANTIMONY	52 127.60 <b>Te</b> TELLURIUM	53 126.90 <b>I</b> IODINE	54 131.29 <b>Xe</b> XENON
6	6	55 132.91 <b>Cs</b> CAESIUM	56 137.33 <b>Ba</b> BARIUM	57-71 <b>La-Lu</b> Lanthanide	72 178.49 <b>Hf</b> HAFNIUM	73 180.95 <b>Ta</b> TANTALUM	74 183.84 <b>W</b> TUNGSTEN	75 186.21 <b>Re</b> RHENIUM	76 190.23 <b>Os</b> OSMIUM	77 192.22 <b>Ir</b> IRIDIUM	78 195.08 <b>Pt</b> PLATINUM	79 196.97 <b>Au</b> GOLD	80 200.59 <b>Hg</b> MERCURY	81 204.38 <b>Tl</b> THALLIUM	82 207.2 <b>Pb</b> LEAD	83 208.98 <b>Bi</b> BISMUTH	84 (209) <b>Po</b> POLONIUM	85 (210) <b>At</b> ASTATINE	86 (222) <b>Rn</b> RADON
7	7	87 (223) <b>Fr</b> FRANCIUM	88 (226) <b>Ra</b> RADIUM	89-103 <b>Ac-Lr</b> Actinide	104 (267) <b>Rf</b> RUTHERFORDIUM	105 (268) <b>Db</b> DUBNIUM	106 (271) <b>Sg</b> SEABORGIUM	107 (272) <b>Bh</b> BOHRIUM	108 (277) <b>Hs</b> HASSIUM	109 (276) <b>Mt</b> MEITNERIUM	110 (281) <b>Ds</b> DARWINSTADIUM	111 (280) <b>Rg</b> ROENTGENIUM	112 (285) <b>Cn</b> COPERNICIUM	113 (285) <b>Nh</b> NIHONIUM	114 (287) <b>Fl</b> FLEROVIUM	115 (289) <b>Mc</b> MOSCOWIUM	116 (291) <b>Lv</b> LIVERMORIUM	117 (294) <b>Ts</b> TENNESSE	118 (294) <b>Og</b> OGANESSON

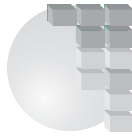
  

57 138.91 <b>La</b> LANTHANUM	58 140.12 <b>Ce</b> CERIUM	59 140.91 <b>Pr</b> PRASEODYMIUM	60 144.24 <b>Nd</b> NEODYMIUM	61 (145) <b>Pm</b> PROMETHIUM	62 150.36 <b>Sm</b> SAMARIUM	63 151.96 <b>Eu</b> EUROPIUM	64 157.25 <b>Gd</b> GADOLINIUM	65 158.93 <b>Tb</b> TERBIUM	66 162.50 <b>Dy</b> DYSPROSIUM	67 164.93 <b>Ho</b> HOLMIUM	68 167.26 <b>Er</b> ERBIUM	69 168.93 <b>Tm</b> THULIUM	70 173.05 <b>Yb</b> YTTERIUM	71 174.97 <b>Lu</b> LUTETIUM
89 (227) <b>Ac</b> ACTINIUM	90 232.04 <b>Th</b> THORIUM	91 231.04 <b>Pa</b> PROTACTINIUM	92 238.03 <b>U</b> URANIUM	93 (237) <b>Np</b> NEPTUNIUM	94 (244) <b>Pu</b> PLUTONIUM	95 (243) <b>Am</b> AMERICIUM	96 (247) <b>Cm</b> CURIUM	97 (247) <b>Bk</b> BERKELIUM	98 (251) <b>Cf</b> CALIFORNIUM	99 (252) <b>Es</b> EINSTEINIUM	100 (257) <b>Fm</b> FERMIUM	101 (258) <b>Md</b> MENDELEVIUM	102 (259) <b>No</b> NOBELIUM	103 (262) <b>Lr</b> LAWRENCIUM

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LANTHANIDE

ACTINIDE



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(1) Atomic weights of the elements 2013, Pure Appl. Chem., 88, 265-291 (2016)