

CH101/102 Information Sheet, 2020–2021, Boston University

Selected Equations

$$E_k = mv^2/2$$

$$E_{\text{coul.}} = (231 \text{ aJ} \cdot \text{pm}) Q_1 Q_2 / d$$

$$[P_{\text{obs}} + a(n^2/V^2)][V_{\text{cont}} - bn] = nRT$$

$$l = RT/(\pi\sqrt{2}PN_A d^2)$$

$$\ln[A]_t = -kt + \ln[A]_0$$

$$1/[A]_t = kt + 1/[A]_0$$

$$\Delta G = RT \ln(Q/K)$$

$$\ln K = (-\Delta H^\circ/R)(1/T) + \Delta S^\circ/R$$

$$\text{At } 25^\circ\text{C: } E = -(0.0592 \text{ V})/n_e \log(Q/K)$$

$$x = (-b \pm \sqrt{b^2 - 4ac})/(2a)$$

$$E_p = mgh$$

$$\lambda = h/p = h/(mv)$$

$$r = (52.9 \text{ pm})n^2/Z_{\text{eff}}$$

$$V_{\text{sphere}} = (4/3)\pi r^3$$

$$P_1 = x_1 P_1^\circ$$

$$[A]_t = -kt + [A]_0$$

$$S = k_b \ln W$$

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$$

$$Z = It = n_e F$$

$$E = h\nu = hc/\lambda$$

$$H = U + PV$$

$$q = c\Delta T$$

$$A_{\text{sphere}} = 4\pi r^2$$

$$\Pi = RTM_c$$

$$(1/2)^n = [A]_t/[A]_0$$

$$\Delta S_{\text{surr}} = \Delta H_{\text{surr}}/T$$

$$\Delta G = -n_e FE$$

$$\bar{u} = \sqrt{3RT/M}$$

$$E_n = -(2.1799 \text{ aJ})Z_{\text{eff}}^2/n^2$$

$$w = -P_{\text{ext}}\Delta V$$

$$q = n\Delta H$$

$$\Delta T_{(f,b)} = m_c K_{(f,b)}$$

$$P_g = k_H M_g$$

$$k = Ae^{-E_a/RT}$$

$$\Delta G = -n_e FE$$

$$E = -(RT/n_e F)\ln(Q/K)$$

$$K_p = K_c(RT)^{\Delta \nu_{\text{gas}}}$$

Useful constants

$$c = 2.9979 \times 10^8 \text{ m/s}$$

$$1 \text{ u} = 1.66054 \times 10^{-27} \text{ kg}$$

$$1 \text{ atm} = 1.01325 \text{ bar} = 760 \text{ torr}$$

$$1 \text{ J} = 1 \text{ kg m}^2 \text{ s}^{-2} = 10^{-5} \text{ bar m}^3$$

$$F = 96,485 \text{ C/mol}$$

$$R = 8.314 \frac{\text{J}}{\text{mol} \cdot \text{K}} = 8.314 \frac{\text{L kPa}}{\text{mol K}} = 0.08206 \frac{\text{L atm}}{\text{mol K}} = 0.08314 \frac{\text{L bar}}{\text{mol K}} = 62.364 \frac{\text{L torr}}{\text{mol K}}$$

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

$$N_A = 6.022141 \times 10^{23} \text{ mol}^{-1}$$

$$R = 1.09737316 \times 10^7 \text{ m}^{-1}$$

$$1 \text{ bar} = 100 \text{ kPa} = 10^5 \text{ Pa}$$

$$1 \text{ V} = 1 \text{ J/C}$$

$$g = 9.807 \text{ m/s}^2$$

$$1 \text{ aJ} = 1 \times 10^{-18} \text{ J}$$

$$1 \text{ L} \cdot \text{bar} = 100 \text{ J}$$

$$k_b = 1.38 \times 10^{-23} \text{ J/K}$$

$$Z_{e^-} = 1.602 \times 10^{-19} \text{ C}$$

$$k_{\text{coul}} = 231 \text{ aJ pm}$$

$$c_{\text{sp}}(\text{H}_2\text{O}) = 4.184 \text{ J} \cdot \text{g}^{-1} \text{K}^{-1}$$

$$0^\circ\text{C} = 273.15 \text{ K}$$

$$\ln x = 2.303 \log x$$

$$m_{e^-} = 9.10938 \times 10^{-31} \text{ kg}$$

																13 3A		14 4A		15 5A		16 6A		17 7A		18 8A																			
1 1A H Hydrogen 1.00794 2 2A He Helium 4.002602																																													
3 Li Lithium 6.941		4 Be Beryllium 9.012182																5 B Boron 10.81		6 C Carbon 12.0107		7 N Nitrogen 14.0067		8 O Oxygen 15.9994		9 F Fluorine 18.998403		10 Ne Neon 20.1797																	
11 Na Sodium 22.989769		12 Mg Magnesium 24.3050																13 Al Aluminum 26.98		14 Si Silicon 28.0855		15 P Phosphorus 30.973762		16 S Sulfur 32.065		17 Cl Chlorine 35.453		18 Ar Argon 39.948																	
19 K Potassium 39.0983		20 Ca Calcium 40.078		21 Sc Scandium 44.955912		22 Ti Titanium 47.867		23 V Vanadium 50.9415		24 Cr Chromium 51.9961		25 Mn Manganese 54.938045		26 Fe Iron 55.845		27 Co Cobalt 58.933195		28 Ni Nickel 58.6934		29 Cu Copper 63.546		30 Zn Zinc 65.38		31 Ga Gallium 69.723		32 Ge Germanium 72.64		33 As Arsenic 74.92160		34 Se Selenium 78.96		35 Br Bromine 79.904		36 Kr Krypton 83.798											
37 Rb Rubidium 85.4678		38 Sr Strontium 87.62		39 Y Yttrium 88.90585		40 Zr Zirconium 91.224		41 Nb Niobium 92.90638		42 Mo Molybdenum 95.96		43 Tc Technetium 98		44 Ru Ruthenium 101.07		45 Rh Rhodium 102.90550		46 Pd Palladium 106.42		47 Ag Silver 107.8682		48 Cd Cadmium 112.411		49 In Indium 114.818		50 Sn Tin 118.710		51 Sb Antimony 121.760		52 Te Tellurium 127.60		53 I Iodine 126.90447		54 Xe Xenon 131.203											
55 Cs Cesium 132.90545		56 Ba Barium 137.33		57 La Lanthanum 138.90547		72 Hf Hafnium 178.49		73 Ta Tantalum 180.94788		74 W Tungsten 183.84		75 Re Rhenium 186.207		76 Os Osmium 190.23		77 Ir Iridium 192.217		78 Pt Platinum 195.084		79 Au Gold 196.96657		80 Hg Mercury 200.59		81 Tl Thallium 204.3833		82 Pb Lead 207.2		83 Bi Bismuth 208.9804		84 Po Polonium (209)		85 At Astatine (210)		86 Rn Radon (222)											
87 Fr Francium (223)		88 Ra Radium (226)		89 Ac Actinium (227)		104 Rf Rutherfordium 261.11		105 Db Dubnium (268)		106 Sg Seaborgium (271)		107 Bh Bohrium (270)		108 Hs Hassium (269)		109 Mt Meitnerium (278)		110 Ds Darmstadtium (281)		111 Rg Roentgenium (281)		112 Cn Copernicium (285)		113 Nh Nihonium (286)		114 Fl Flerovium (289)		115 Mc Moscovium (290)		116 Lv Livermorium (293)		117 Ts Tennessine (294)		118 Og Oganesson (294)											
Lanthanide series																		58 Ce Cerium 140.116		59 Pr Praseodymium 140.90765		60 Nd Neodymium 144.242		61 Pm Promethium (145)		62 Sm Samarium 150.36		63 Eu Europium 151.964		64 Gd Gadolinium 157.25		65 Tb Terbium 158.92535		66 Dy Dysprosium 162.500		67 Ho Holmium 164.93032		68 Er Erbium 167.259		69 Tm Thulium 168.93421		70 Yb Ytterbium 173.054		71 Lu Lutetium 174.9668	
Actinide series																		90 Th Thorium 232.0381		91 Pa Protactinium 231.03588		92 U Uranium 238.02891		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)	

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