CHEM101 Final Exam – Formula Sheet

Gases, Liquids, and Solutions

$$PV = nRT$$

$$P_{\text{total}} = P_A + P_B + P_C + \cdots$$

$$\text{Kelvin} = \text{°C} + 273$$

$$P_1V_1 = P_2V_2$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$d = \frac{m}{V}$$

$$KE_{\text{per molecule}} = \frac{mV^2}{2}$$

$$\frac{r_1}{r_2} = \frac{(M_1)^{\frac{1}{2}}}{(M_2)^{\frac{1}{2}}}$$

$$M_{(\text{molarity})} = \frac{\text{moles solute}}{\text{liter of solution}}$$

P = pressure, V = volume, T = temperature, n = number of moles, d = density, m = mass, v = velocity, KE = kinetic energy, r = rate of effusion, M = molar mass, Q = reaction quotient, E^O = standard reduction potential, K = equilibrium constant

$$R, \text{ gas constant} = \frac{8.31 \text{ joules}}{\text{mole·kelvin}} = 0.0821\frac{\text{liter·atm}}{\text{mole·kelvin}} = 8.31\frac{\text{volts·coulombs}}{\text{mole·kelvin}}$$

Atomic Structure

$$\Delta E = h\nu \text{ or } \Delta E = hf$$

$$c = \nu\lambda \text{ or } c = f\lambda$$

E = energy, ν = frequency or f = frequency, λ = wavelength, v = velocity, c = speed of light = 3.00×10^8 m/s,
h = Planck's constant = 6.63×10^{-34}joule·s, Avogadro's Number = 6.02×10^{23} molecules per mole

Equilibrium

$$K_w = 1 \times 10^{-14} \text{ at } 25\text{°C}$$

pH=-log[H^+], pOH=-log[OH^-]

pH+pOH = 14

Thermochemistry

$$q = mc\Delta T$$

$$C_p = \frac{\Delta H}{\Delta T}$$

H^o = standard enthalpy, E^o = standard reduction potential, T = temperature, q = heat, c = specific heat capacity,
$c_{\text{water}} = \frac{4.18 \text{ joule}}{\text{g K}}$, $H_f = \frac{330 \text{ joule}}{\text{gram}}$ for water, $H_v = \frac{2260 \text{ joule}}{\text{gram}}$ for water

Periodic Table of the Elements

hydrogen 1 H 1.00794																	helium 2 He 4.002602
lithium 3 Li 6.941	beryllium 4 Be 9.012182											boron 5 B 10.811	carbon 6 C 12.0107	nitrogen 7 N 14.00674	oxygen 8 O 15.9994	fluorine 9 F 18.9984	neon 10 Ne 20.1797
sodium 11 Na 22.98977	magnesium 12 Mg 24.3050											aluminum 13 Al 26.981538	silicon 14 Si 28.0855	phosphorus 15 P 30.97376	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.984
potassium 19 K 39.0983	calcium 20 Ca 40.078	scandium 21 Sc 44.95591	titanium 22 Ti 47.867	vanadium 23 V 50.9415	chromium 24 Cr 51.9961	manganese 25 Mn 54.93805	iron 26 Fe 55.845	cobalt 27 Co 58.9332	nickel 28 Ni 58.6934	copper 29 Cu 63.546	zinc 30 Zn 65.409	gallium 31 Ga 69.723	germanium 32 Ge 72.64	arsenic 33 As 74.9216	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.798
rubidium 37 Rb 85.4678	strontium 38 Sr 87.62	yttrium 39 Y 88.90585	zirconium 40 Zr 91.225	niobium 41 Nb 92.90638	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.9055	palladium 46 Pd 106.42	silver 47 Ag 107.8682	cadmium 48 Cd 112.411	indium 49 In 114.818	tin 50 Sn 118.710	antimony 51 Sb 121.760	tellurium 52 Te 127.60	iodine 53 I 126.9045	xenon 54 Xe 131.293
cesium 55 Cs 132.90545	barium 56 Ba 137.327	lutetium 71 Lu 174.967	hafnium 72 Hf 178.49	tantalum 73 Ta 180.9479	tungsten 74 W 183.84	rhenium 75 Re 186.207	osmium 76 Os 190.23	iridium 77 Ir 192.217	platinum 78 Pt 195.078	gold 79 Au 196.96655	mercury 80 Hg 200.59	thallium 81 Tl 204.3833	lead 82 Pb 207.2	bismuth 83 Bi 208.980	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]
francium 87 Fr [223]	radium 88 Ra [226]	lawrencium 103 Lr [262]	rutherfordium 104 Rf [267]	dubnium 105 Db [268]	seaborgium 106 Sg [271]	bohrium 107 Bh [272]	hassium 108 Hs [270]	meitnerium 109 Mt [276]	darmstadtium 110 Ds [281]	roentgenium 111 Rg [280]	copernicium 112 Cn [285]	ununtrium 113 Uut [284]	flerovium 114 Fl [289]	ununpentium 115 Uup [288]	livermorium 116 Lv [293]	ununseptium 117 Uus [294]	ununoctium 118 Uuo [294]

lanthanum 57 La 138.906	cerium 58 Ce 140.115	praseodymium 59 Pr 140.908	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.966	gadolinium 64 Gd 157.25	terbium 65 Tb 158.925	dysprosium 66 Dy 162.50	holmium 67 Ho 164.930	erbium 68 Er 167.26	thulium 69 Tm 168.934	ytterbium 70 Yb 173.04
actinium 89 Ac [227]	thorium 90 Th 232.038	protactinium 91 Pa 231.036	uranium 92 U 238.029	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]