$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^{10} 6p^6 7s^2 5f^{14} 6d^{10} 7p^6$

Periodic Table of Elements

$R_{\text{gas-law}} = 0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} = 62.4 \frac{\text{L} \cdot \text{mmHg}}{\text{mol} \cdot K} = 8.314 \frac{\text{L} \cdot \text{kPa} \vee \text{J}}{\text{mol} \cdot \text{K}}$

$\frac{453.6\ \text{g}}{1\ \text{lb}} = \frac{2.54\ \text{cm}}{1\ \text{in}} = \frac{0.946\ \text{L}}{1\ \text{qt}} = \frac{6.022 \times 10^{23}\ \text{units}}{\text{mol}} = \frac{22.4\ \text{L}}{\text{mol}}$

$\frac{1\ \text{g}_{\text{water}}}{1\ \text{mL}_{\text{water}}} = \frac{P_{\text{sea}}}{101325\ \text{Pa}} = \frac{1\ \text{atm}}{760\ \text{mmHg}} = \frac{1\ \text{atm}}{14.7\ \text{psi}} = \frac{1\ \text{kcal}}{4.184\ \text{kJ}}$

$°\text{C} = \frac{5}{9}(°\text{F} - 32)$ and $°\text{F} = \frac{9}{5}°\text{C} + 32$

$h = 6.626 \times 10^{-34}\text{Js} \vee \text{kgm}^2\text{s}^{-1}$ and $c = 3.00 \times 10^8\ \text{ms}^{-1}$

[J]= kg $m^2 s^{-2}$, [N] = kg m s^{-1},
[Pa] = N m^{-2} = kg $(ms)^{-1}$

$PV = nRT$ and $\left[P + \frac{an^2}{V^2}\right][V - nb] = nRT$
$PV \propto 1$ and $VT \propto 1$ (Boyle and Charle).
$M = \frac{\text{moles solute}}{\text{L solution}}$ and $m = \frac{\text{moles solute}}{\text{kg solvent}}$
$X_{\text{mol fraction}} = \frac{\text{mol component}}{\text{mol total}}$.

$k = Ae^{-\frac{E_a}{RT}}$
$[A]_t = [A]_0 - kt$
$[A]_t = [A]_0 e^{-kt}$
$[A]_t = \frac{1}{kt + \frac{1}{[A]_0}}$

Ion	Soluble with	Precipitates with
NO_3^- Nitrate	Most cations	No common cations
ClO_4^-	Most cations	No common cations
ClO_3^-	Most cations	No common cations
$C_2H_3O_2^-$	Most cations	Ag^+, Hg_2^{2+}
F^-	Most cations	Cr^{3+}
Cl^-	Most cations	$(Ag,\ Tl)^+, Pb^{2+,4+}, Hg_2^{2+}$
Br^-	Most cations	$(Ag,\ Tl)^+, Pb^{2+,4+}, Hg_2^{2+}$
I^-	Most cations	$(Ag,\ Tl)^+, Pb^{2+,4+}, Hg_2^{2+}$
SO_4^{2-}	Most cations	$Ag^+, Ba^{2+}, Sr^{2+}, Pb^{2+,4+}, Ca^{2+}, Hg_2^{2+}$
CrO_4^{2-}	Most cations	$Ba^{2+}, Sr^{2+}, Pb^{2+,4+}, Ca^{2+}, Hg_2^{2+}$
S^{2-}	$Na^+, K^+, NH_4^+, Li^+, Sr^{2+}$	Most other cations
OH^-	$Na^+, K^+, NH_4^+, Li^+, Sr^{2+}, Ba^{2+}, Ca^{2+}$	Most other cations
CO_3^{2-}	$(Na, K, NH_4, Li)^+$	Most other cations
PO_4^{3-}	Na^+, K^+, NH_4^+	Most other cations
O^{2-}	No_{common} cations	Most cations
$(Na,K,NH_4)^+$	Most Anions	$(NH_4)_2C_2O_4$
Bi^{3+}	Nothing	Most anions
As^{3+}	I^-	Most anions
Sb^{3+}	Cl^-	Most anions

$\triangle H_{\text{vap}} = 40.67\text{kJ mol}^{-1}$
$\triangle H_{\text{fus}} = 6.01\text{kJ mol}^{-1}$
$C_{\text{ice}} = 2.11\text{J (gK)}^{-1}$
$C_{\text{water}} = 4.184\text{J (gK)}^{-1}$
$C_{\text{steam}} = 1.865\text{J (gK)}^{-1}$
$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$
$v_{\text{rms}} = \sqrt{\frac{3RT}{M}}$

$K_a = \frac{[H_3O^+][A^-]}{[HA]}$ and $K_b = \frac{[HB][OH^-]}{[B^-]}$, in water, $K_aK_b = 1.0 \times 10^{-14}$
$\text{pH} = -\log_{10}[H^+]$, $\text{pOH} = -\log_{10}[OH^-]$, $\text{pK}_a = -\log_{10}[K_a]$
$\text{pH} + \text{pOH} = 14$, and $K_c = \frac{[\text{product}]}{[\text{reactant}]}$, K_{eq}, $K_{\text{sp}} \leftrightarrow K_p = K_c(RT)^{\triangle n}$
$K_{\text{a-acetic}} = 1.8 \times 10^{-5}$, and **in buffer** $\text{pH} = \text{pK}_a + \log_{10}\left(\frac{[A^-]}{[HA]}\right)$.

$E_{\text{photon}} = hf = \frac{hc}{\lambda}$ and $\lambda = \frac{h}{mv}$
$E_n = -\frac{R_H}{n^2}$
$R_{H_{\text{Rydberg}}} = 2.18 \times 10^{-18}$ J
$\triangle E = R_H\left(\frac{1}{n_i^2} - \frac{1}{n_f^2}\right)$

i = Van't Hoff
$(K_b, K_f) = (0.512, 1.86)°\text{C/m}$
$\triangle T_f = K_f mi$ and $\triangle T_b = K_b mi$
$\Pi = iMRT$ and $S_g = kP_g$

$\triangle E = q + w = q - P\triangle V$ and $\triangle H = \triangle E + P\triangle V$
Isotherm, $\triangle S = \frac{q_{\text{rif-reverse}}}{T}$, or $S = k \ln W$ (micro-state)
$k = 1.38 \times 10^{-23}$ JK^{-1}
$\triangle S = k \ln\left(\frac{W_{\text{final}}}{W_{\text{initial}}}\right)$ and $\triangle S_{\text{surr.}} = -\frac{\triangle H^\circ}{T}$
$-T\triangle S_{\text{universe}} = \triangle H_{\text{system}} - T\triangle S_{\text{system}}$
$\triangle G := -T\triangle S_{\text{universe}} = \triangle H - T\triangle S$
$\triangle G = \triangle G^\circ + RT\ln(Q)$, so at eq., $K_{\text{eq}} = e^{-\triangle G^\circ / RT}$

$Li^+, K^+, Ba^{2+}, Ca^{2+}, Na^+, Mg^{2+}, Al^{3+}, Mn^{+2}, Zn^{2+}, Cr^{3+,2+}, Fe^{3+,2+}, Co^{2+}, Ni^+, Sn^{2+}, Pb^{2+}, 2H^+, Cu^{2+,+}, Ag^+, Hg^{2+}, Pt^{2+}, Au^{3+,+}$

	1 IA	2 IIA	3 IIIA	4 IVB	5 VB	6 VIB	7 VIIB	8 VIIIB	9 VIIIB	10 VIIIB	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1	**1** 2.20 **H_2** Hydrogen 1.01																	**2** **He** Helium 4.00
2	**3** 0.98 **Li** Lithium 6.94	**4** 1.57 **Be** Beryllium 9.01											**5** 2.04 **B** Boron 10.81	**6** 2.55 **C** Carbon 12.01	**7** 3.14 **N_2** Nitrogen 14.01	**8** 3.44 **O_2** Oxygen 16.00	**9** 3.98 **F_2** Fluorine 19.00	**10** **Ne** Neon 20.18
3	**11** 0.93 **Na** Sodium 22.99	**12** 1.31 **Mg** Magnesium 24.31											**13** 1.61 **Al** Aluminium 26.98	**14** 1.90 **Si** Silicon 28.09	**15** 2.19 **P** Phosphorus 30.97	**16** 2.38 **S** Sulphur 32.10	**17** 3.16 **Cl_2** Chlorine 35.45	**18** **Ar** Argon 39.95
4	**19** 0.82 **K** Potassium 39.10	**20** 1.00 **Ca** Calcium 40.08	**21** 1.36 **Sc** Scandium 44.96	**22** 1.54 **Ti** Titanium 47.87	**23** 1.63 **V** Vanadium 50.94	**24** 1.66 **Cr★** Chromium 52.00	**25** 1.55 **Mn** Manganese 54.94	**26** 1.83 **Fe** Iron 55.85	**27** 1.88 **Co** Cobalt 58.93	**28** 1.91 **Ni** Nickel 58.69	**29** 1.90 **Cu★** Copper 63.55	**30** 1.65 **Zn** Zinc$^{(2+)}$ 65.38	**31** 1.81 **Ga** Gallium 69.72	**32** 2.01 **Ge** Germanium 72.63	**33** 2.18 **As** Arsenic 74.92	**34** 2.55 **Se** Selenium 78.97	**35** 2.96 **Br_2** Bromine 79.90	**36** 3.00 **Kr** Krypton 83.80
5	**37** 0.82 **Rb** Rubidium 85.47	**38** 0.95 **Sr** Strontium 87.62	**39** 1.22 **Y** Yttrium 88.91	**40** 1.33 **Zr** Zirconium 91.22	**41** 1.6 **Nb★** Niobium 92.91	**42** 2.16 **Mo★** Molybdenum 95.95	**43** 1.9 **Tc** Technetium (98)	**44** 2.2 **Ru★** Ruthenium 101.07	**45** 2.28 **Rh★** Rhodium 102.91	**46** 2.20 **Pd★★** Palladium 106.42	**47** 1.93 **Ag** Silver$^{(1+)}$ 107.87	**48** 1.69 **Cd** Cadmium 112.41	**49** 1.78 **In** Indium 114.82	**50** 1.96 **Sn★** Tin 118.71	**51** 2.05 **Sb** Antimony 121.76	**52** 2.1 **Te** Tellurium 127.60	**53** 2.86 **I_2** Iodine 126.90	**54** 2.60 **Xe** Xenon 131.29
6	**55** 0.79 **Cs** Caesium 132.91	**56** 0.89 **Ba** Barium 137.33	**57-71** **La-Lu** Lanthanide	**72** 1.3 **Hf** Hafnium 178.49	**73** 1.5 **Ta** Tantalum 180.95	**74** 2.36 **W** Tungsten 183.84	**75** 1.9 **Re** Rhenium 186.21	**76** 2.2 **Os** Osmium 190.23	**77** 2.20 **Ir** Iridium 192.22	**78** 2.28 **Pt** Platinum 195.08	**79** 2.54 **Au★** Gold 196.97	**80** 2.00 **Hg** Mercury 200.59	**81** 1.62 **Tl** Thallium 204.38	**82** 1.87 **Pb** Lead 207.2	**83** 2.02 **Bi** Bismuth 208.98	**84** 2.0 **Po** Polonium (209)	**85** 2.2 **At** Astatine (210)	**86** 2.2 **Rn** Radon (222)
7	**87** 0.7 **Fr** Francium (223)	**88** 0.9 **Ra** Radium (226)	**89-103** **Ac-Lr** Actinide	**104** **Rf** Rutherfordium (267)	**105** **Db** Dubnium (268)	**106** **Sg** Seaborgium (269)	**107** **Bh** Bohrium (270)	**108** **Hs** Hassium (277)	**109** **Mt** Meitnerium (278)	**110** **Ds** Darmstadtium (281)	**111** **Rg** Roentgenium (282)	**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** Oganneson (294)

			57 1.1 **La** Lanthanum 138.91	**58** 1.12 **Ce** Cerium 140.12	**59** 1.13 **Pr** Praseodymium 140.91	**60** 1.14 **Nd** Neodymium 144.24	**61** 1.13 **Pm** Promethium (145)	**62** 1.17 **Sm** Samarium 150.36	**63** 1.2 **Eu** Europium 151.96	**64** 1.2 **Gd** Gadolinium 157.25	**65** 1.1 **Tb** Terbium 158.93	**66** 1.22 **Dy** Dysprosium 162.50	**67** 1.23 **Ho** Holmium 164.93	**68** 1.24 **Er** Erbium 167.26	**69** 1.25 **Tm** Thulium 168.93	**70** 1.1 **Yb** Ytterbium 173.05	**71** 1.27 **Lu** Lutetium 174.97
			89 1.1 **Ac** Actinium (227)	**90** 1.3 **Th** Thorium 232.04	**91** 1.5 **Pa** Protactinium 231.04	**92** 1.38 **U** Uranium 238.03	**93** 1.36 **Np** Neptunium (237)	**94** 1.28 **Pu** Plutonium (244)	**95** 1.13 **Am** Americium (243)	**96** 1.28 **Cm** Curium (247)	**97** 1.3 **Bk** Berkelium (247)	**98** 1.3 **Cf** Californium (251)	**99** 1.3 **Es** Einsteinium (252)	**100** 1.3 **Fm** Fermium (257)	**101** 1.3 **Md** Mendelevium (258)	**102** 1.3 **No** Nobelium (259)	**103** 1.3 **Lr** Lawrencium (266)

Z E.N. **Sym** Name mass

Alkali Metal
Alkaline-Earth
Metal
Metalloid
Non-metal
Halogen
Noble Gas
Lanthanide/Actinide

EN, IE, EA, & $\mathbb{Z}_{eff}$ increase →↑
Radius & Metallic increase ←↓

Super[7]
HI
HBr
HCl
HNO_3
H_2SO_4
$HClO_3$
$HClO_4$

Gas
CO
CO_2
CH_4
C_2H_6
C_3H_8
C_4H_{10}
NO NO_2
N_2O NH_3
SO_3 SO_2
H_2S HCl