Appendix A: Tables and Mathematical Formulas

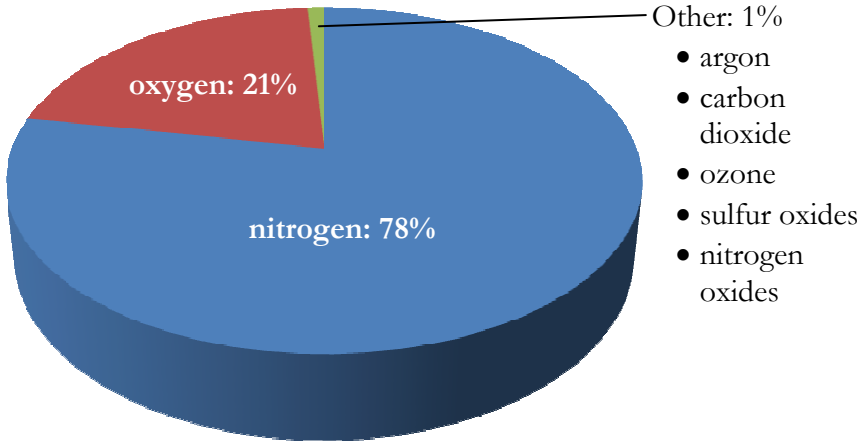
Tables

NOTE: The Periodic Table of the Elements and a table of element names are on the inside front cover of the book. The thermodynamic tables as well as the water vapor pressure table are on the inside back cover of the book.

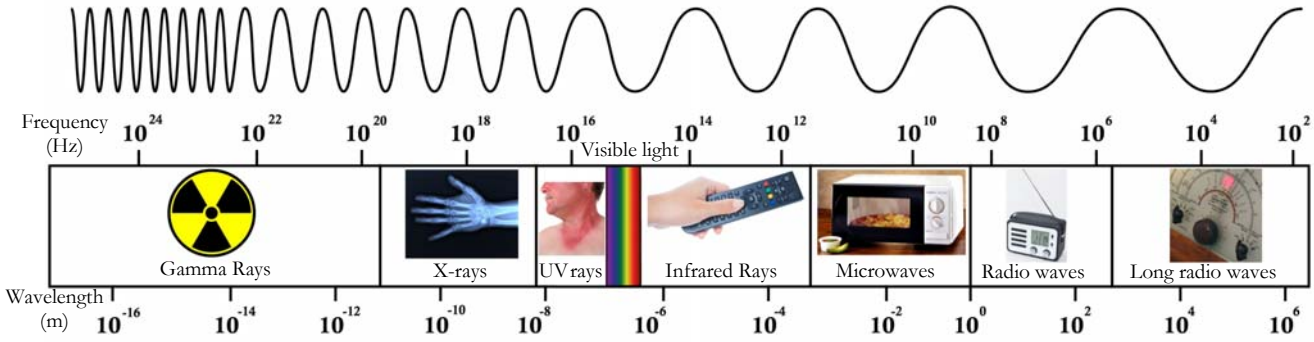
Metric Prefixes and Their Meanings

Prefix	Abbreviation	Meaning		Prefix	Abbreviation	Meaning
mega	M	1,000,000		**centi**	**c**	**0.01**
kilo	**k**	**1,000**		**milli**	**m**	**0.001**
hecto	H	100		micro	μ	0.000001
deca	Da	10		nano	n	0.000000001

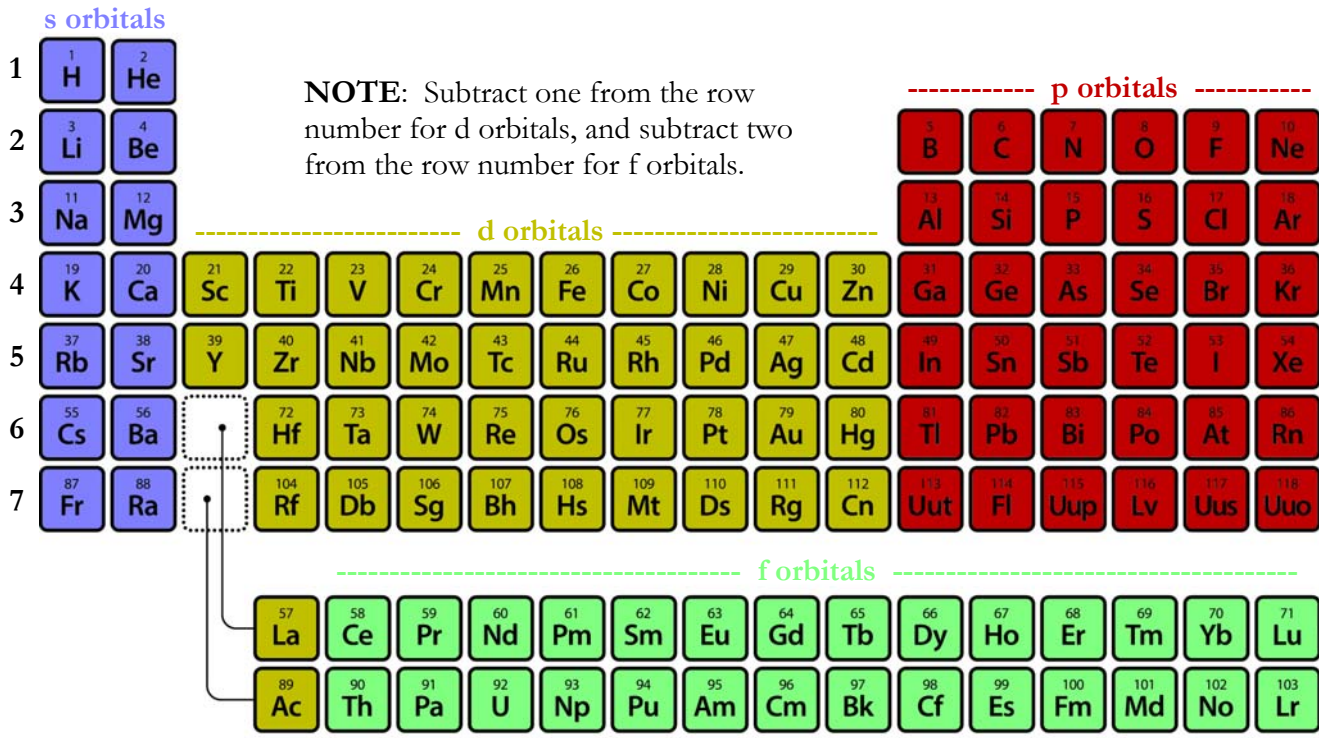
The Composition of Dry Air



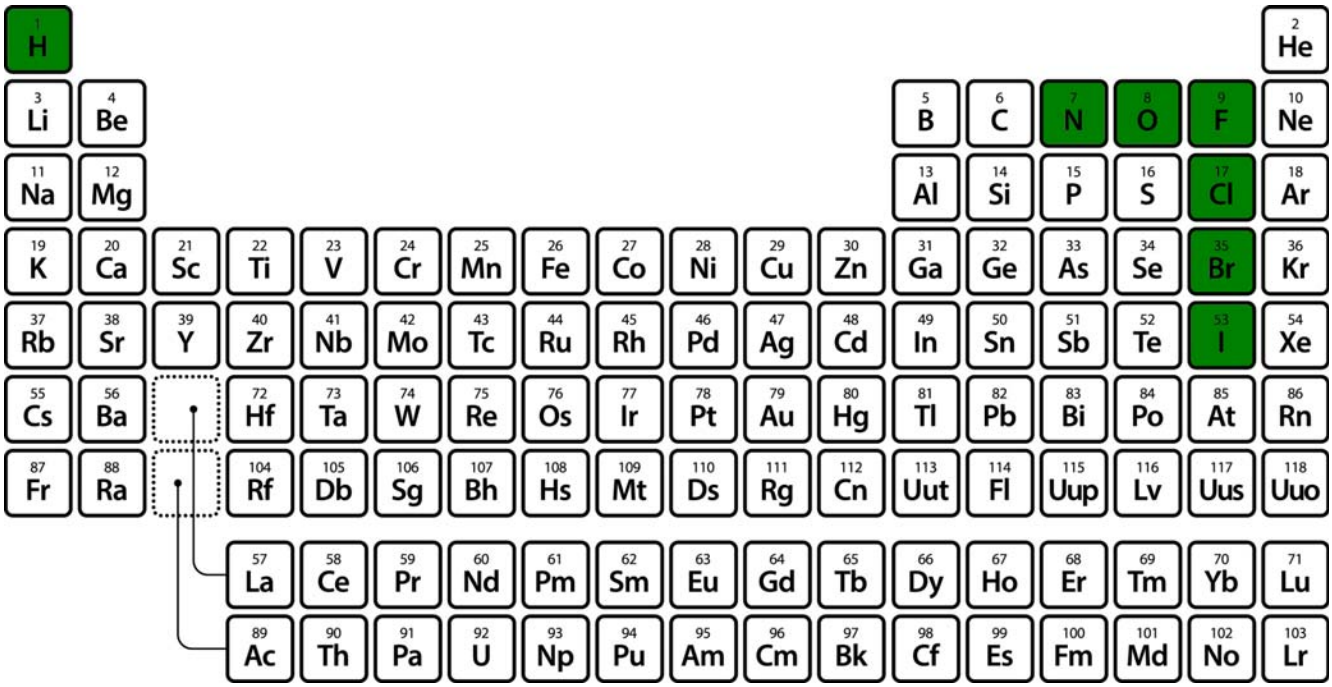
The Electromagnetic Spectrum



Atomic Orbitals and the Periodic Table of the Elements



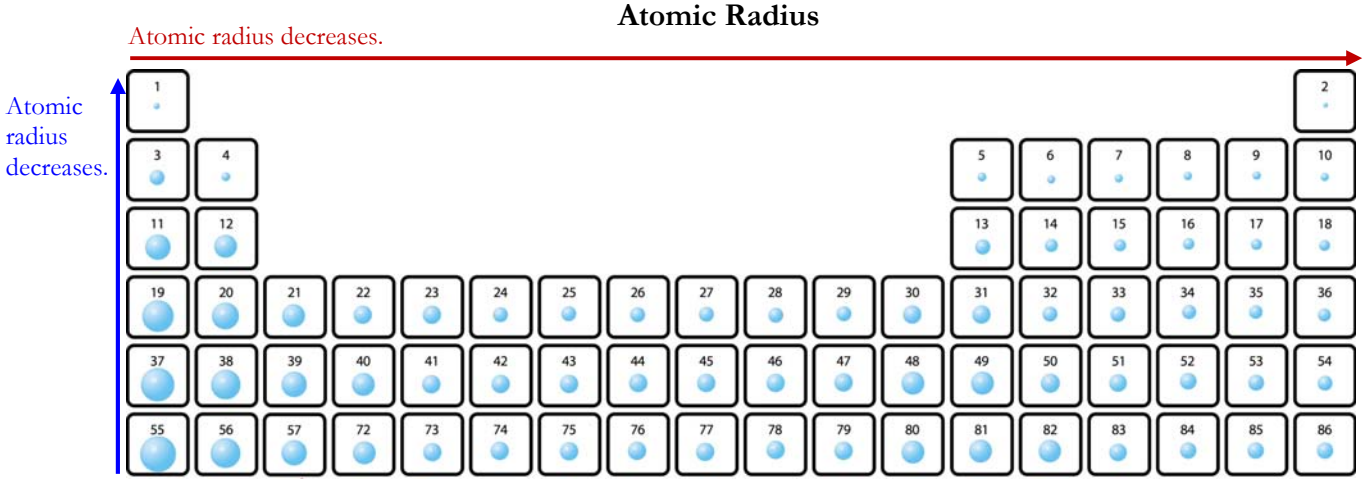
Homonuclear Diatomic Elements



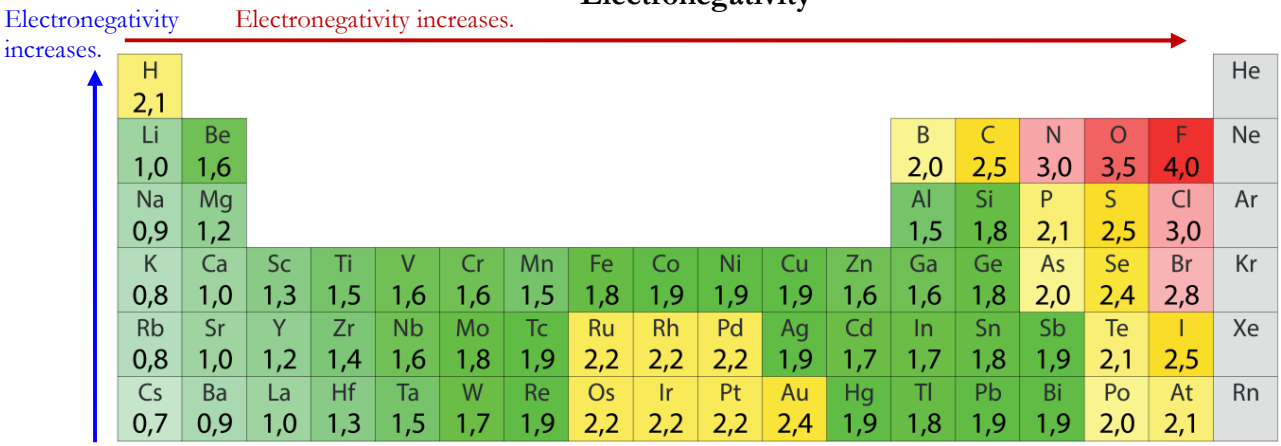
Prefixes Used to Name Covalent Compounds

Prefix	Meaning		Prefix	Meaning
mono	one		tetra	four
di	two		penta	five
tri	three		hexa	six

Atomic Radius



Electronegativity

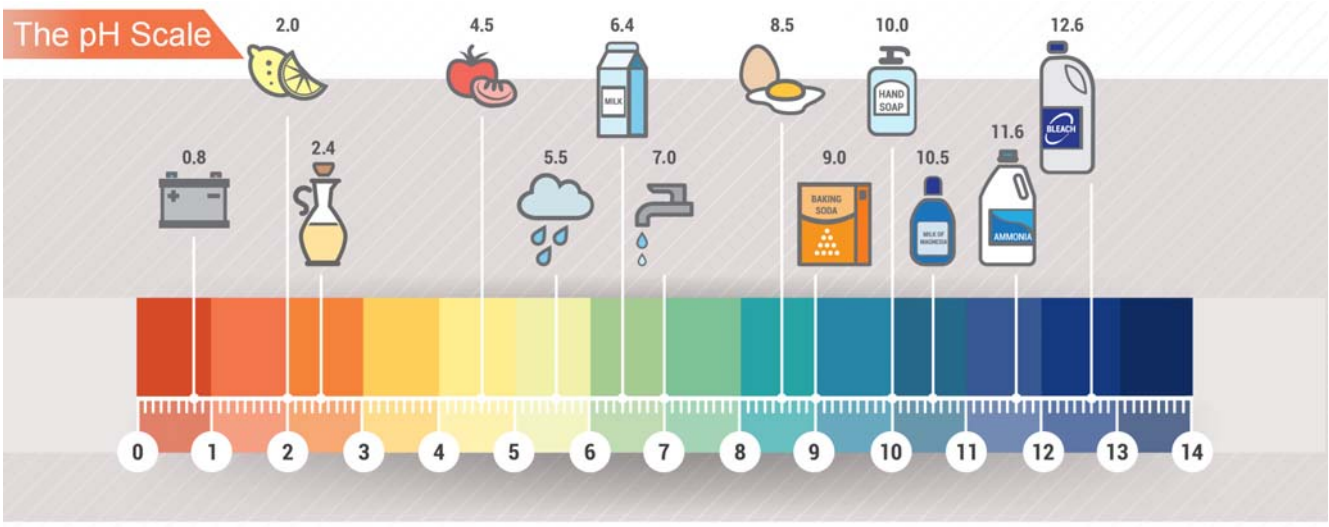


In this table, green boxes represent low electronegativity, yellow represents medium, and red represents high.

Characteristics of Acids and Bases

Acids
1. Tend to taste sour
2. Are covalent electrolytes
3. Turn blue litmus paper red

Bases
1. Tend to taste bitter
2. Tend to feel slippery when mixed with water
3. Turn red litmus paper blue



The Rules For Determining Oxidation States

<u>These rules are always true</u>:

1. **For ions composed of only one atom, the oxidation state is equal to the charge of the ion.**
2. **For all elements and homonuclear molecules, the oxidation state of each atom is 0.**
3. **For molecules and polyatomic ions, the sum of the oxidation states must equal the total charge.**
4. **The oxidation state of fluorine in any compound is 1-.**
5. **In covalent compounds and polyatomic ions, H has an oxidation state of 1+.**

<u>These rules are usually true</u>:

6. **In most compounds, oxygen has an oxidation state of 2-.**
7. **Group 7A elements (especially chlorine) usually have an oxidation state of 1-.**

Specific Heat Capacities of Different Substances

Substance	Specific Heat J/g°C	Substance	Specific Heat J/g°C	Substance	Specific Heat J/g°C
Water (l)	**4.184**	Potassium (s)	0.757	Sand	0.290
Water (s)	2.093	Calcium (s)	0.650	Silver (s)	0.240
Vegetable Oil	2.000	Iron (s)	0.444	Tin (s)	0.210
Air	1.020	Nickel (s)	0.440	Lead (s)	0.160
Magnesium (s)	1.020	Zinc (s)	0.387	Mercury (l)	0.140
Aluminum (s)	0.900	Copper (s)	0.386	Tungsten (s)	0.134
Glass	0.840	Brass (s)	0.380	Gold (s)	0.126

Mathematical Formulas

(1.1) $\text{density} = \dfrac{\text{mass}}{\text{volume}}$

(3.1) $f = \dfrac{c}{\lambda}$

(3.2) $E = h \cdot f$

(6.1) $°F = \dfrac{9}{5}(°C) + 32$ (**NOTE:** The 9, 5, and 32 are all exact.)

(8.1) Percent Yield = (Actual Yield ÷ Theoretical Yield)×100% (**NOTE**: The 100 is exact.)

(9.1) $\text{Molarity} = \dfrac{\text{moles of solute}}{\text{liters of solution}}$

(9.2) $\text{Molality} = \dfrac{\text{moles of solute}}{\text{kilograms of solvent}}$

(9.3) $\Delta T = -i \cdot K_f \cdot m$

(9.4) $\Delta T = i \cdot K_b \cdot m$

(10.1) $\text{Pressure} = \dfrac{\text{Force}}{\text{Area}}$

(10.2) $P_1 \cdot V_1 = P_2 \cdot V_2$

(10.3) $\dfrac{V_1}{T_1} = \dfrac{V_2}{T_2}$

(10.4) $K = °C + 273.15$

(10.5) $\dfrac{P_1 \cdot V_1}{T_1} = \dfrac{P_2 \cdot V_2}{T_2}$

(10.6) $PV = nRT$

(10.7) $P_{total} = P_a + P_b + P_c + \ldots$

(10.8) $X_a = \dfrac{\text{moles of component a}}{\text{total moles in the mixture}}$

(10.9) $X_a = \frac{P_a}{P_{total}}$

(13.1) $q = m \cdot c \cdot \Delta T$

(13.2) $\Delta T = T_{final} - T_{initial}$

(13.3) $-q_{object} = q_{liquid} + q_{calorimeter}$

(13.4) $q = C \cdot \Delta T$

(13.5) $q = m \cdot L$

(14.1) ΔH = (Energy for breaking bonds) − (Energy from making bonds)

(14.3) $\Delta S_{system} + \Delta S_{surroundings} \geq 0$

(14.5) $\Delta G = \Delta H - T \cdot \Delta S$

The final seven equations refer to the following generic reaction:

$$\mathbf{aA + bB \rightarrow cC + dD}$$

(14.2) $\Delta H = c \cdot \Delta H_f^o(C) + d \cdot \Delta H_f^o(D) - a \cdot \Delta H_f^o(A) - b \cdot \Delta H_f^o(B)$

(14.4) $\Delta S = c \cdot S^o(C) + d \cdot S^o(D) - a \cdot S^o(A) - b \cdot S^o(B)$

(14.6) $\Delta G = c \cdot \Delta G_f^o(C) + d \cdot \Delta G_f^o(D) - a \cdot \Delta G_f^o(A) - b \cdot \Delta G_f^o(B)$

(15.1) $\text{Rate} = \frac{\Delta[C]}{\Delta t}$

(15.2) $\text{Rate} = \frac{-\Delta[A]}{\Delta t}$

(15.3) $\text{Rate} = k[A]^x[B]^y$

(16.1) $K = \frac{[C]_{eq}^c [D]_{eq}^d}{[A]_{eq}^a [B]_{eq}^b}$