


# Periodic Table of the Elements

1 <b>H</b> Hydrogen 1.01																	2 <b>He</b> Helium 4.00
3 <b>Li</b> Lithium 6.94	4 <b>Be</b> Beryllium 9.01											5 <b>B</b> Boron 10.81	6 <b>C</b> Carbon 12.01	7 <b>N</b> Nitrogen 14.01	8 <b>O</b> Oxygen 16.00	9 <b>F</b> Fluorine 19.00	10 <b>Ne</b> Neon 20.18
11 <b>Na</b> Sodium 22.99	12 <b>Mg</b> Magnesium 24.31											13 <b>Al</b> Aluminum 26.98	14 <b>Si</b> Silicon 28.09	15 <b>P</b> Phosphorus 30.97	16 <b>S</b> Sulfur 32.06	17 <b>Cl</b> Chlorine 35.45	18 <b>Ar</b> Argon 39.95
19 <b>K</b> Potassium 39.10	20 <b>Ca</b> Calcium 40.08	21 <b>Sc</b> Scandium 44.96	22 <b>Ti</b> Titanium 47.88	23 <b>V</b> Vanadium 50.94	24 <b>Cr</b> Chromium 51.99	25 <b>Mn</b> Manganese 54.94	26 <b>Fe</b> Iron 55.85	27 <b>Co</b> Cobalt 58.93	28 <b>Ni</b> Nickel 58.69	29 <b>Cu</b> Copper 63.55	30 <b>Zn</b> Zinc 65.38	31 <b>Ga</b> Gallium 69.72	32 <b>Ge</b> Germanium 72.63	33 <b>As</b> Arsenic 74.92	34 <b>Se</b> Selenium 78.97	35 <b>Br</b> Bromine 79.90	36 <b>Kr</b> Krypton 84.80
37 <b>Rb</b> Rubidium 85.47	38 <b>Sr</b> Strontium 87.62	39 <b>Y</b> Yttrium 88.91	40 <b>Zr</b> Zirconium 91.22	41 <b>Nb</b> Niobium 92.91	42 <b>Mo</b> Molybdenum 95.95	43 <b>Tc</b> Technetium 98.91	44 <b>Ru</b> Ruthenium 101.07	45 <b>Rh</b> Rhodium 102.91	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.87	48 <b>Cd</b> Cadmium 112.41	49 <b>In</b> Indium 114.82	50 <b>Sn</b> Tin 118.71	51 <b>Sb</b> Antimony 121.76	52 <b>Te</b> Tellurium 127.6	53 <b>I</b> Iodine 126.90	54 <b>Xe</b> Xenon 131.29
55 <b>Cs</b> Cesium 132.91	56 <b>Ba</b> Barium 137.33	57-71 Lanthanides	72 <b>Hf</b> Hafnium 178.49	73 <b>Ta</b> Tantalum 180.95	74 <b>W</b> Tungsten 183.85	75 <b>Re</b> Rhenium 186.21	76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.22	78 <b>Pt</b> Platinum 195.08	79 <b>Au</b> Gold 196.97	80 <b>Hg</b> Mercury 200.59	81 <b>Tl</b> Thallium 204.38	82 <b>Pb</b> Lead 207.20	83 <b>Bi</b> Bismuth 208.98	84 <b>Po</b> Polonium [208.98]	85 <b>At</b> Astatine 209.98	86 <b>Rn</b> Radon 222.02
87 <b>Fr</b> Francium 223.02	88 <b>Ra</b> Radium 226.03	89-103 Actinides	104 <b>Rf</b> Rutherfordium [261]	105 <b>Db</b> Dubnium [262]	106 <b>Sg</b> Seaborgium [266]	107 <b>Bh</b> Bohrium [264]	108 <b>Hs</b> Hassium [269]	109 <b>Mt</b> Meitnerium [278]	110 <b>Ds</b> Darmstadtium [281]	111 <b>Rg</b> Roentgenium [280]	112 <b>Cn</b> Copernicium [285]	113 <b>Nh</b> Nihonium [286]	114 <b>Fl</b> Flerovium [289]	115 <b>Mc</b> Moscovium [289]	116 <b>Lv</b> Livermorium [293]	117 <b>Ts</b> Tennessine [294]	118 <b>Og</b> Oganesson [294]

## IR absorption bands of different functional groups.

Type of bond	Wavenumber (cm <sup>-1</sup> )	Intensity
C≡N	2260–2220	medium
C≡C	2260–2100 ( <b>~3300 if terminal</b> )	medium to weak
C=C	1680–1600	medium
C=N	1650–1550	medium
	~1600 and ~1500–1430	strong to weak
C=O	1780–1650	strong
C—O	1250–1050	strong
C—N	1230–1020	medium
O—H (alcohol)	3650–3200	strong, broad
O—H (carboxylic acid)	3300–2500	strong, very broad

acid	approximate pK <sub>a</sub>	conjugate base
H <sub>2</sub> SO <sub>4</sub>	-10	HSO <sub>4</sub> <sup>-</sup>
HCl	-7	Cl <sup>-</sup>
H <sub>3</sub> O <sup>+</sup>	-1.74	H <sub>2</sub> O
HNO <sub>3</sub>	-1.4	NO <sub>3</sub> <sup>-</sup>
CH <sub>3</sub> COOH	4.75	CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup>
NH <sub>4</sub> <sup>+</sup>	9.2	NH <sub>3</sub>
H <sub>2</sub> O	15.7	HO <sup>-</sup>
CH <sub>3</sub> CH <sub>2</sub> OH	16	CH <sub>3</sub> CH <sub>2</sub> O <sup>-</sup>
HC≡CH	25	HC≡C: <sup>-</sup>
NH <sub>3</sub>	38	NH <sub>2</sub> <sup>-</sup>
CH <sub>2</sub> =CH <sub>2</sub>	44	H <sub>2</sub> C=CH <sup>-</sup>
CH <sub>3</sub> CH <sub>3</sub>	>50	CH <sub>3</sub> CH <sub>2</sub> <sup>-</sup>

# Substitution/Elimination Flow Chart

