Chemistry (Math Notes)

Module #3

Atomic Theory is still progressing.

Plum Pudding Model (JJ Thomson)

Rutherford Model

Neils Bohr Model

Quantum Mechanical Model

String Theory - This links the physics of the small -quantum mechanics of the atom- to the physics of the really large- the universe and Einstein's Theory of Relativity.

The main points of the Atomic Theory

1. A nucleus contains protons and neutrons
2. Electrons orbit in orbital areas around the nucleus, but are not on fixed orbital paths like planets and satellites.
3. The # of electrons and the # of protons are equal so the atom maintains a neutral charge (if the # of protons is not equal to the # of electrons, then it is an ion and not an atom)
4. Each orbit requires an exact amt. of energy called a quanta; the orbit won't absorb excess energy.
5. An atom loses or emits light when an electron moves from a higher level to a lower level.

Atomic Number – the number of protons in a atom

It is located above the element symbol on the Periodic Table.

Mass Number – the number of protons and neutrons in an atoms neucules

The Mass # when given is located in the left upper hand corner of the element symbol.

Isotopes- A relational term identifying atoms that have the same # of protons, but neutrons and mass #'s are different.

Light – Is light a wave or a particle? Theres evidence of both

Wave Nature of Light:

Visible Spectrum: The wave length is x 10^{-9}

ROY G BIV – red orange yellow green blue indigo violet

In this order, the waves actually move from meters to seconds.

Frequency is defined as how many times a wavelength passes a certain point in seconds.

Wavelength and frequency are inverse proportional.

ELECTROMAGNETIC SPECTRUM

G Gamma

R x ray

U ultraviolet

V visible spectrum

I infared

MTV microwave and tv

Radio

Equations: c= speed of light (3.0x108 m/sec)

f=frequency (Hz) λ=wavelength(m)

f=c/ λ

Note: Hz = 1 per second (1/sec) 1nm=$1x10^{-9}$m

There is also a relationship between frequency and

wavelength.

Equation: E=energy (J) f=frequency (Hz)

h=Planck's constant ($6.63x10^{-34}$ J/Hz) & is the energy in a light wave

Electron Configuration

Full Electron Configuration – Shows electrons located in each level and each orbital

There are seven levels.

Orbitals: s-can hold a max of 2 electrons

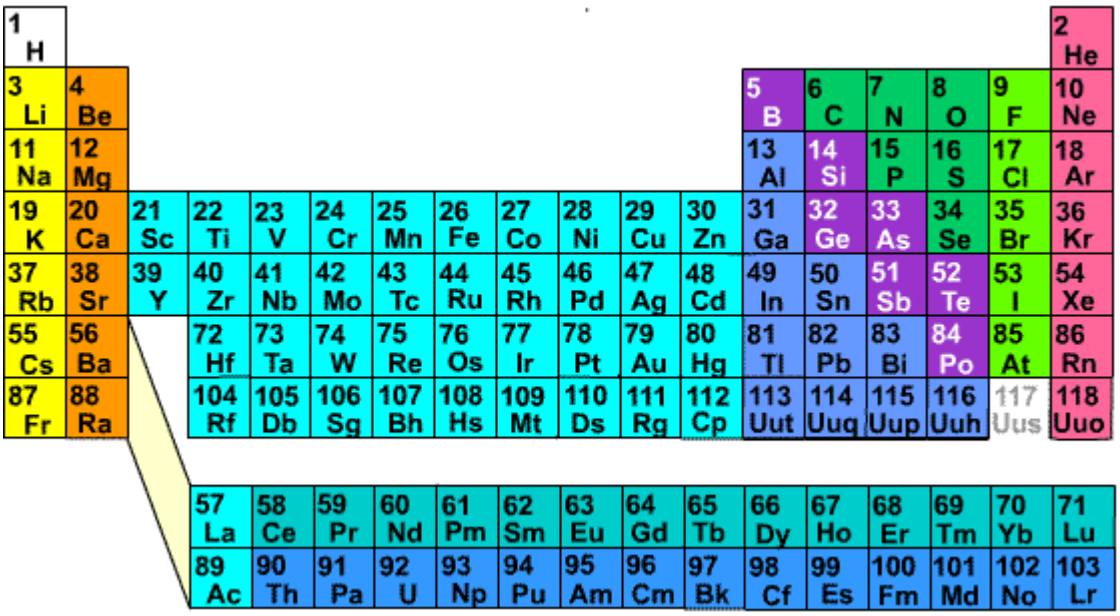
p-can hold a max of 6 electrons

d-can hold a max of 10 electrons

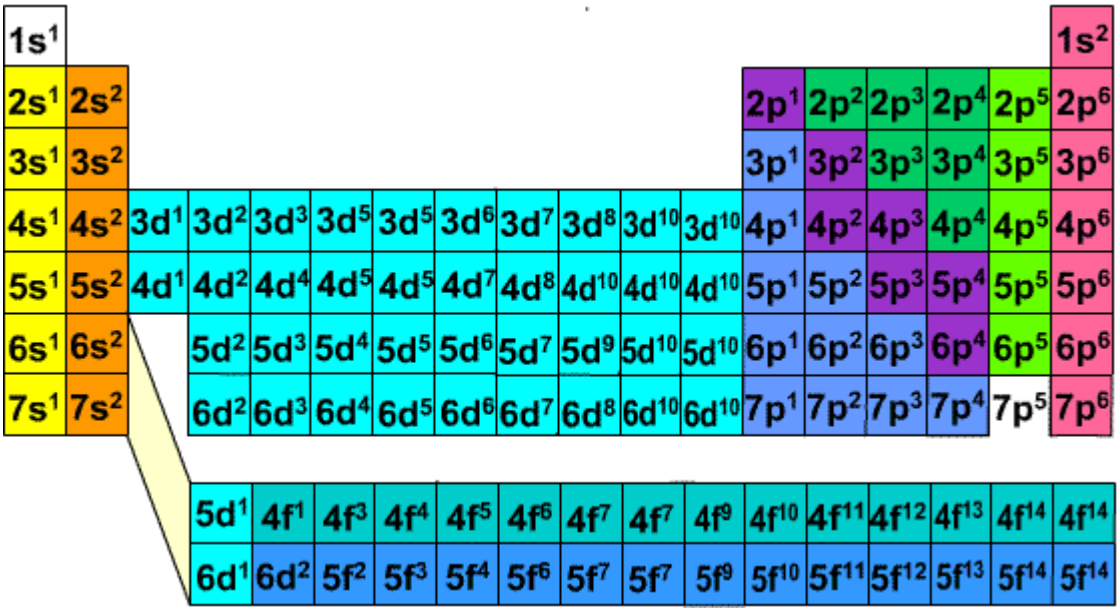
f-can hold a max of 14 electrons

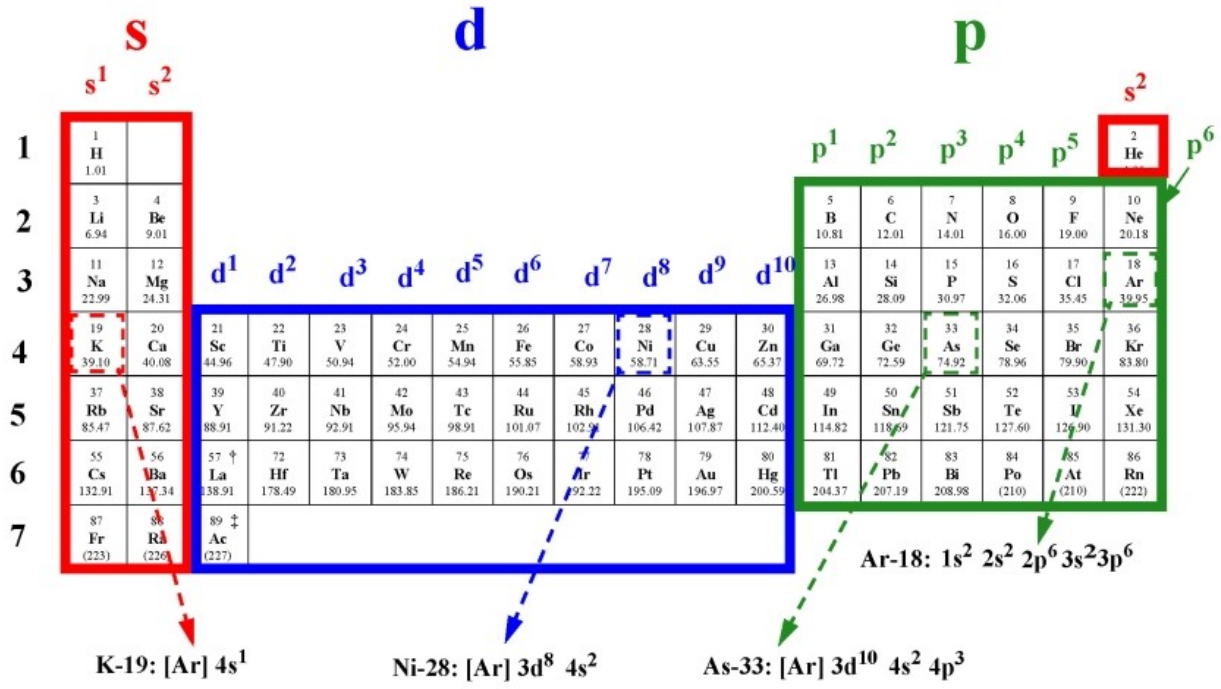
Abbreviated Electron Configuration – Shows electrons located only in each level and each orbital after the last noble gas filled. The element's distance is measured based on how far it is from the noble gas. Noble gases are found in column 8A on the Periodic Table.

Let's look now at the Periodic Table.



As we study electron configuration (the arrangement of electrons in atoms), we discover a pattern. Study the periodic table below and see what you can discover.




s
d
p
s1 s2
d1 d2 d3 d4 d5 d6 d7 d8 d9 d10
p1 p2 p3 p4 p5 s2 p6
1 H 1.01
2 He
3 Li 6.94
4 Be 9.01
5 B 10.81
6 C 12.01
7 N 14.01
8 O 16.00
9 F 19.00
10 Ne 20.18
11 Na 22.99
12 Mg 24.31
13 Al 26.98
14 Si 28.09
15 P 30.97
16 S 32.06
17 Cl 35.45
18 Ar 39.95
19 K 39.10
20 Ca 40.08
21 Sc 44.96
22 Ti 47.90
23 V 50.94
24 Cr 52.00
25 Mn 54.94
26 Fe 55.85
27 Co 58.93
28 Ni 58.71
29 Cu 63.55
30 Zn 65.37
31 Ga 69.72
32 Ge 72.59
33 As 74.92
34 Se 78.96
35 Br 79.90
36 Kr 83.80
37 Rb 85.47
38 Sr 87.62
39 Y 88.91
40 Zr 91.22
41 Nb 92.91
42 Mo 95.94
43 Tc 98.91
44 Ru 101.07
45 Rh 102.91
46 Pd 106.42
47 Ag 107.87
48 Cd 112.40
49 In 114.82
50 Sn 118.69
51 Sb 121.75
52 Te 127.60
53 I 126.90
54 Xe 131.30
55 Cs 132.91
56 Ba 137.34
57 † La 138.91
72 Hf 178.49
73 Ta 180.95
74 W 183.85
75 Re 186.21
76 Os 190.21
77 Ir 192.22
78 Pt 195.09
79 Au 196.97
80 Hg 200.59
81 Tl 204.37
82 Pb 207.19
83 Bi 208.98
84 Po (210)
85 At (210)
86 Rn (222)
87 Fr (223)
88 Ra (226)
89 ‡ Ac (227)
Ar-18: 1s2 2s2 2p6 3s2 3p6
K-19: [Ar] 4s1
Ni-28: [Ar] 3d8 4s2
As-33: [Ar] 3d10 4s2 4p3