

Chemistry Notes 10/14/13

Warm Up

Why can't an electron have the following quantum numbers?

1. $N=2$ $l=2$ $M_l=1$
 - a. l can only be from $0 - (n-1)$
2. $N=3$ $L=0$ $M_l=3$
 - a. M_l can be from $-L$ to $+L$

Spin Quantum Number

- $M_s =$ Can be $+\frac{1}{2}$ or $-\frac{1}{2}$

Pauli Exclusion Principle

- No two electrons in an atom can have the same four quantum numbers
- Each orbital can only hold two electrons
 - o $N=1$ (Shell); $L=0$ (Subshell); $M_l=0$; # of electrons=2
 - o $N=2$; $L=0$; $M_l=0$; # electrons=2
 - $L=1$; $M_l=+1,0,-1$; # electron=6
 - $2+6 = 8$
 - o $N=3$; $L=0$; $M_l=0$; #=2
 - $L=1$; $M_l=+1,0,-1$; #=6
 - $L=2$; $M_l=+2,+1,0,-1,-2$; #=10
 - $2+6+10=18$ (Can hold 18 electrons)
 - o $N=4$; $L=0$; $M_l=0$; #=2
 - $L=1$; $M_l=[-1,1]$; #=6
 - $L=2$; $M_l=[-2,2]$; #=10
 - $L=3$; $M_l=[-3,3]$; #=14
 - $L=4$; $M_l=[-4,4]$; #=18
 - $2+6+10+14+18=32$

Multielectron Atoms

Two forces acting on electrons:

1. Attraction of positive nucleus for the negative electrons
2. Repulsive forces between electrons

Effective Nuclear Charge (Z_{eff})

- The “pull” of the positive nucleus that is felt

Aufbau Principle

1. Electrons fill the lowest energy orbitals first
2. Only two electrons can be in any one orbital
3. If two or more equal energy orbitals are available (like “p” and “d”) then one electron will fill each before pairing up (Hund’s Rule)

Examples

1. H: $1e^-$
 - a. $^{\uparrow}/1s$ OR $1s^1$
2. He: $2e^-$
 - a. $^{\uparrow\downarrow}/1s$ OR $1s^2$
3. Li: $3e^-$
 - a. $^{\uparrow\downarrow}/1s$ $^{\uparrow}/2s$ OR $1s^2 2s^1$
4. Be: $4e^-$
 - a. $^{\uparrow\downarrow}/1s$ $^{\uparrow\downarrow}/2s$ OR $1s^2 2s^2$
5. C: $6e^-$
 - a. $^{\uparrow\downarrow}/1s$ $^{\uparrow\downarrow}/2s$ $^{\uparrow\uparrow}/2p$ OR $1s^2 2s^2 2p^2$
6. F: $9e^-$
 - a. $^{\uparrow\downarrow}/1s$ $^{\uparrow\downarrow}/2s$ $^{\uparrow\downarrow\uparrow}/2p$ OR $1s^2 2s^2 2p^5$
7. Ne: $10e^-$ (Noble Gas)
 - a. $^{\uparrow\downarrow}/1s$ $^{\uparrow\downarrow}/2s$ $^{\uparrow\downarrow\uparrow\downarrow}/2p$ OR $1s^2 2s^2 2p^6$
 - b. The last shell (valence shell) can only hold $8e^-$ and is then full.
 - i. Ex. The last shell (N=2) has 8 electrons
8. What is the correct electron configuration for N?
 - a. N= $7e^-$
 - b. $^{\uparrow\downarrow}/1s$ $^{\uparrow\downarrow}/2s$ $^{\uparrow\uparrow\uparrow}/2p$ OR $1s^2 2s^2 2p^3$
9. Na: $11e^-$
 - a. $^{\uparrow\downarrow}/1s$ $^{\uparrow\downarrow}/2s$ $^{\uparrow\downarrow\uparrow\downarrow}/2p$ $^{\uparrow}/3p$
 - b. Noble Gas Shortcut
 - i. [Ne] + $3s^1$

