**Quantum Numbers**

* Describe the electron in an Atom.

1. Distance from the Nucleus

 Principle Quantum Number (n)

* describes the main energy level of the electron
* ie. on which orbit is the electron located and therefore how far is the electron from the nucleus

Orbit 1 n = 1

Orbit 2 n = 2

Orbit 3 n = 3

Orbit 4 n = 4

Etc.

* basically we are assigning a number to the electron orbits (shells) of a Bohr diagram

Rule:

 n = the orbit number from the nucleus outward

 maximum # of electrons per main energy level (orbit) = 2n2

Period Orbit n # of e-‘s

1 1 1 2(1)2 = 2

2 2 2 2(2)2 = 8

3 3 3 2(3)2 = 18

4 4 4 2(4)2 = 32

5 5 5 2(5)2 = 50

6 6 6 2(6)2 = 72

7 7 7 2(7)2 = 98

2. Shape

 Angular Momentum (l)

* describes the shape (or type) of the orbital (electron cloud)
* four types of energy sublevels or orbitals (see handout for diagrams)

s p d f

l = 0 l = 1 l = 2 l = 3

Rule:

* the number of orbitals in any main energy level (orbit) is equal to the value of n

Orbit n # of type of l =

 Orbital orbital

1 1 1 s 0

2 2 2 s,p 0,1

3 3 3 s,p,d 0,1,2

4 4 4 s,p,d,f 0,1,2,3

3. Position

 Magnetic Quantum Number (ml)

* the number of possible positions per orbital

s orbital = 1 position

p orbital = 3 positions

d orbital = 5 positions

f orbital = 7 positions

* see the handout of orbital diagrams

Rule:

* for each position the maximum number of electrons that can occupy that position is two (2)

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s p d

 e-= 2 6 10

 ml = 0 -1 0 1 -2 -1 0 1 2

4. Spin (ms)

* why can two negative items remain close to each other?
* describes the direction of spin of the electron
* ie. like the Earth on its axis

+ ½ counterclockwise spin

- ½ clockwise spin

Rules for Drawing Energy-Level Diagrams

Pauli Exclusion Principal

 No two (2) electrons in the same atom have the same four quantum numbers.

Aufbau Principle

 Lowest energy sublevels are filled before moving to next energy sublevel.



Hund’s Rule

 One electron must occupy each of the orbitals at one orbit before a second electron can be added.

Use the example problems on pages 189 and 190, to help you answer Practice problems #2, 3, and 4 on page 191