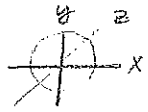
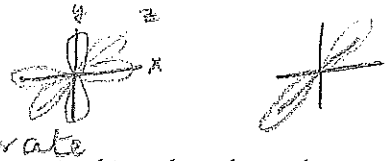
NAME

QUANTUM NUMBERS AND ELECTON CONFIGURATION

SCIENCE IS THE PROCESS OF TRYING TO UNDERSTAND THE WORLD BY USING MODELS OR THEORIES WHICH HAVE PREDICTIVE POWER

1. List the four quantum numbers
   a. Principal (n) energy level
   b. Angular momentum (ℓ), shape
   c. magnetic (m) orientation of orbital
   d. spin (s)

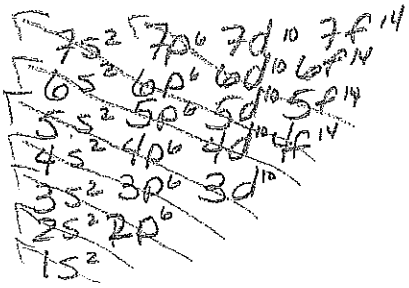
2. Draw an example of an "s" orbital. 

3. Draw an example of a "p" orbital. 

4. Electrons and nature in general will always tend to reduce themselves to the lowest energy possible. Give two examples of this.
   dead organisms - deteriorate
   e⁻ go to lowest level, clean room - gets messy

5. What is Hund's rule?
   fill each sublevel with 1 e⁻ first

6. Draw an Aufbau chart?



7. Draw the electronic configuration of the following elements.
   a. H $1s^1$
   b. He $1s^2$
   c. O $1s^2 2s^2 2p^4$
   d. F $1s^2 2s^2 2p^5$
   e. O^{-2} $1s^2 2s^2 2p^6$

8. How does the energy level or principle quantum number correlate to the periodic table?
   energy level = n for s + p
   n-1 for d and n-2 for f

8. In general what does the Heisenberg Uncertainty principle say?
   impossible to determine both the position (cloud) and velocity of an e⁻

9. What atomic theory did the Heisenberg Uncertainty principle disprove?
   Bohr's theory (e⁻ are like planets around the sun)

10. What is the name of the current atomic theory called?
    Quantum Theory

Name
Chemistry
Electron configuration and Orbital Notation

For the following atoms write the number of valence electrons and give the substance most commonly formed ion.

1. Fluorine 7, -1
2. Chlorine 7, -1
3. Sodium 1, +1
4. Oxygen 6, -2
5. Sulfur 6, -2
6. Magnesium 2, +2
7. Neon 8, 0
8. Aluminum 3, +3

Write the electron configurations (long hand) for the particles

1. H $1s^1$
2. S $1s^2 2s^2 2p^6 3s^2 3p^4$
3. I $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^5$
4. F $1s^2 2s^2 2p^5$
5. F^- $1s^2 2s^2 2p^6$
6. Fe^{+2} $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^4$
7. Cu $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^9$
8. Cu^+ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$
9. Cu^{2+} $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$

Write the electron configurations (short hand) for the following.

1. S: $[Ne]\ 3s^2 3p^4$
2. S^{-2}: $[Ne]\ 3s^2 3p^6$
3. Fe $[Ar]\ 4s^2 3d^6$
4. Fe^{+3} $[Ar]\ 4s^2 3d^3$
5. I $[Kr]\ 5s^2 4d^{10} 5p^5$

6. I⁻ $[Kr]\,5s^2\,4d^{10}\,5p^6$

7. H^+ $1s^0$ or NA.

Write the orbital diagrams for the following:

1. Li $1s^2\ 2s^1$
2. Li^+ $1s^2$
3. Al
4. Al^{+3}
5. O $1s^2\ 2s^2\ 2p^4$
6. O^{-2}
7. F $1s^2\ 2s^2\ 2p^5$
8. F^-
9. Fe $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^6$
10. Fe^{+3}

③ Al $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$

④ Al^{+3} $1s^2\ 2s^2\ 2p^6$

⑥ $1s^2\ 2s^2\ 2p^6$

⑧ $1s^2\ 2s^2\ 2p^6$

⑩ Fe^{+3}: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^3$

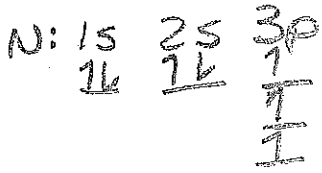
Explain the following.

1. In the problems above, which would represent a good example of Hund's rule?
   ⑤ O shows 4 e⁻ (not ↑↓)
2. From the examples above, why would atoms electrons gain or lose electrons. Give examples.
   to become more stable, octet rule, outer shell filled
   $Al \rightarrow Al^{+3}$ F to F^- O to O^{-2}
3. Conjecture(make hypothesis) as to why Li only forms Li^+ ions yet Fe forms Fe^{+3} and Fe^{2+} ions. What do you think Li only has one option but Iron has two?
   Li is so close to noble gas e⁻ configuration of He
   Fe is in d → more variable

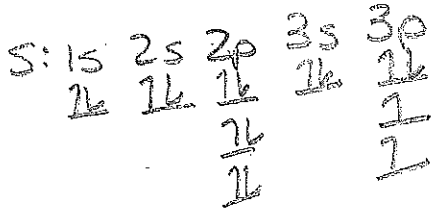
NAME
Chemistry
Electron Configurations and Orbital Notations
ChemElectronOrbital2.doc

For each of the following provide the Long and short hand Electron Configurations and the orbital notations.

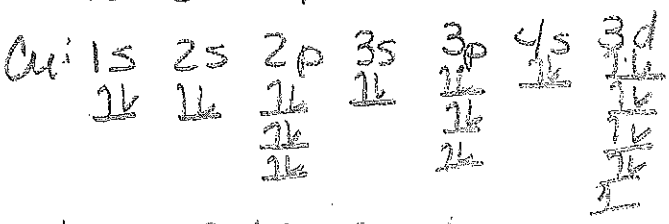
1. N: $1s^2\ 2s^2\ 2p^3$
   N: $[He]\ 2s^2\ 2p^3$



2. S: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$
   S: $[Ne]\ 3s^2\ 3p^4$

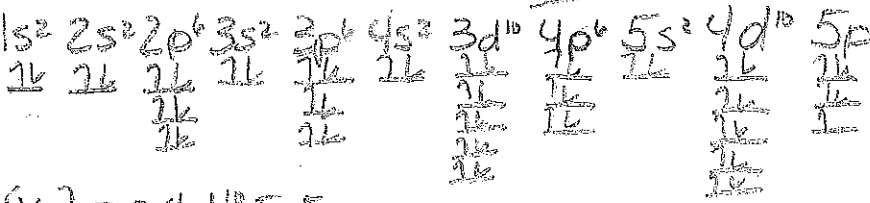


3. Cu: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^9$



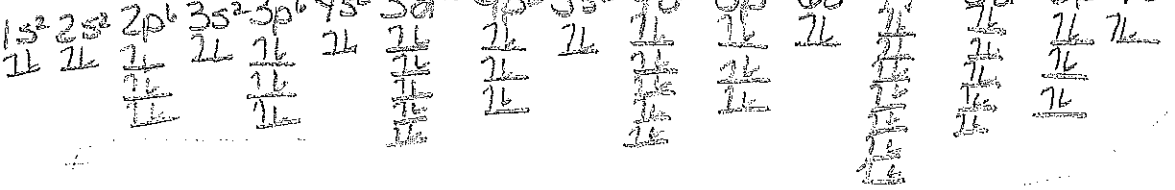
Cu: $[Ar]\ 4s^2\ 3d^9$

4. I: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^5$

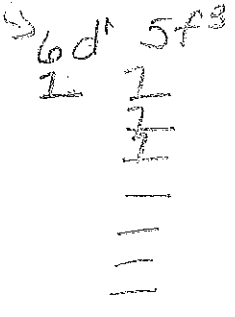


I: $[Kr]\ 5s^2\ 4d^{10}\ 5p^5$

5. U: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^6\ 7s^2$



U: $[Rn]\ 7s^2\ 6d^1\ 5f^3$



6. Define Hund's Rule and give an example.
   orbitals of equal energy are each occupied by 1 e⁻ before a second e⁻ is added

7. Define the Pauli exclusion principle (Use the internet)
   No 2 e⁻ in the same atom can have the same quantum numbers