

Honors Chemistry Assignment Sheet- Unit 3Extra Learning Objectives (beyond regular chem.):

- Related to electron configurations:
 - Be able to write orbital notations for s, p, & d block elements.
 - Be able to explain the concepts behind electron configurations.
- Related to Periodic Trends:
 - Be able to explain & use the concept of second ionization energy
 - Be able to explain & use the concept of atomic radii as related to ions

Assignments (Due class before Unit 3 Test)

- Electron Configurations (Use your book)
 - Read Section 4-3 in your book
 - Review practice problem 4-1 for an explanation (pg 107)
 - Do Section Review Questions # 4 & # 5 (pg 116)
 - Do Chap Review Questions #18, 19, 20, 21, 23, 25, & 43 (pg 118-120)
- Periodic Trends (use your book & internet resources)
 - See below

Honors Assign #1 - Electron Configuration

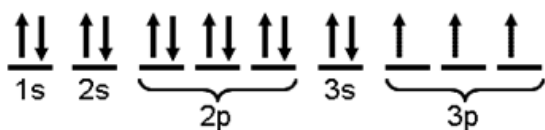
4.

Element	<u>C</u>	<u>Ne</u>	<u>S</u>
e. config.	$1s^2 2s^2 2p^2$	$1s^2 2s^2 2p^6$	$1s^2 2s^2 2p^6 3s^2 3p^4$
Noble gas	[He] $2s^2 2p^2$	[He] $2s^2 2p^6$	[Ne] $3s^2 3p^4$
Orbital notation	$\begin{array}{c} \uparrow\downarrow \quad \uparrow\downarrow \quad \uparrow \quad \uparrow \quad _ \\ 1s \quad 2s \quad \underbrace{\quad \quad} \\ 2p \end{array}$	$\begin{array}{c} \uparrow\downarrow \quad \uparrow\downarrow \quad \uparrow\downarrow \quad \uparrow\downarrow \quad \uparrow\downarrow \\ 1s \quad 2s \quad \underbrace{\quad \quad \quad} \\ 2p \end{array}$	$\begin{array}{c} \uparrow\downarrow \quad \uparrow\downarrow \quad \uparrow\downarrow \quad \uparrow\downarrow \quad \uparrow\downarrow \quad \uparrow\downarrow \quad \uparrow \quad \uparrow \\ 1s \quad 2s \quad \underbrace{\quad \quad \quad} \quad 3s \quad \underbrace{\quad \quad \quad} \\ 2p \quad \quad \quad 3p \end{array}$

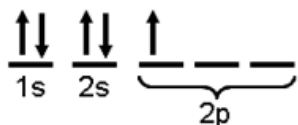
- Identify the elements having the following electron configurations:
 - $1s^2 2s^2 2p^6 3s^2 3p^3$ **P**
 - [Ar] $4s^1$ **K**
 - Contains four electrons in its third and outer main energy level. **Si**
 - Contains one set of paired and three unpaired electrons in its fourth and outer main energy level. **As**
- In your own words, state the Aufbau principle.
An electron occupies the lowest-energy orbital that can receive it.
 - Explain the meaning of this principle in terms of an atom with many electrons.
In a multi-electron atom, the lowest-energy orbital is filled first (ex 1s). Electrons are then added to the orbital with the next lowest energy, and so on, until all of the electrons in the atom have been placed in orbitals.

Honors Chemistry

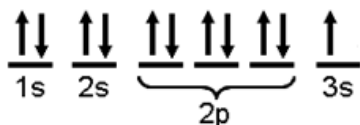
19. a. In your own words, state Hund's rule.
all sub-orbitals most contain one electron before a second electron can be added- see your orbital notation
- b. What is the basis for this rule?
By placing as many single electrons as possible in separate orbitals in the same energy level, electron-electron repulsion is minimized and favorable lower-energy arrangements result.
20. a. In your own words, state the Pauli Exclusion Principle.
No two electrons in the same sub-orbital can have the same spin.
- b. What is the significance of the spin quantum number?
As long as they spin in opposite directions, electrons can be in same sub-orbital.
- c. Compare the values of the spin quantum number for two electrons in the same orbital.
One electron would spin up and one would spin down (see orbital notation)
21. a. What is it meant by the highest occupied energy level in an atom?
The highest occupied energy level in an atom is the electron-containing main energy level with the highest number.
- b. What are inner-shell electrons?
Inner-shell electrons are electrons that are not in the highest occupied energy level (sometimes referred to as "Kernel Electrons").
23. Write the orbital notation for the following elements:
a. P



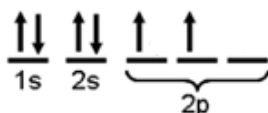
b. B



c. Na



e. C



25. Given that the electron configuration for oxygen is $1s^2 2s^2 2p^4$, answer the following questions:

Honors Chemistry

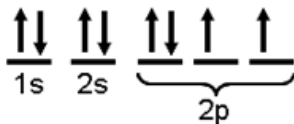
a. How many electrons are in each atom?

8

b. What is the atomic number of this element?

8

c. Write the orbital notation for oxygen's electron configuration.



d. How many unpaired electrons does oxygen have?

2

e. What is the highest occupied energy level?

Second main energy level (n=2)

f. How many inner-shell electrons does this atom contain?

2

g. In which orbital(s) are these inner-shell electrons located?

The 1s orbital

43. Given that the electron configuration for phosphorus is $1s^2 2s^2 2p^6 3s^2 3p^3$, answer the following questions:

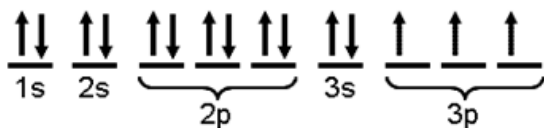
a. How many electrons are in each atom?

15

b. What is the atomic number of this element?

15

c. Write its orbital notation.



d. How many unpaired electrons does phosphorus have?

3

e. What is the highest occupied energy level?

The third main energy level (n=3)

f. how many inner-shell electrons does the atom contain?

10

g. In which orbital(s) are these inner-shell electrons located?

The 1s, 2s, and 2p orbitals.

Honors Chemistry

- Read section "Removing Electrons from Positive Ions" (pg 145) & use internet resources
- Read section "Ion Formation & Ionic Radii" (pg 154) & use internet resources

Questions (1-7):

1 a. Without looking at the ionization energy table, arrange the following elements in order of decreasing first ionization energies: Li, O, C, K, Ne, & F.

Ne, F, O, C, K, Li

b. Which of the elements listed in (a) would you expect to have the highest second ionization energy? Why?

Li, K because both now have a noble gas configuration. Li⁺ is smaller so it would be higher.

2. Is the radius of Mg²⁺ greater than, equal to, or smaller than the radius of Mg? Explain.

**Mg²⁺ is smaller than Mg because it has lost its 3s energy level +2 electrons.
The nucleus charge of 20 protons pulls very hard on the 18 electrons.**

3. Is the radius of O²⁻ greater than, equal to, or smaller than the radius of O? Explain.

**O²⁻ has gained 2 electrons. It has 8 protons and 10 electrons.
O²⁻ will be larger in size the O because 8 protons cannot pull 10 electrons as close as 8 protons and 8 electrons (as in O).**

4. The two ions K⁺ & Ca²⁺ each have 18 electrons surrounding the nucleus. Which would you expect to have a smaller radius? Why? (hint: think about electron-proton attractive forces)

**K⁺ = 19 protons and 18 electrons
Ca²⁺ = 20 protons and 18 electrons
Ca²⁺ would be smaller because Ca with 20 protons pulls more on 18 electrons.**

5. Account for the following in terms of models of atomic structure: Both the sulfide ion and the chloride ion have 18 electrons. However, the radius of the sulfide ion is greater.

**S²⁻ = 16 protons and 18 electron
Cl¹⁻ = 17 protons and 18 electrons**

**The sulfide nucleus does not have as much of a pull on the electrons because it has only 16 protons.
It holds them looser than Cl.**

6. Rb⁺ and Se²⁻. Which ion has the larger radius? Explain.

Rb⁺ = 37 protons and 36 electrons

Honors Chemistry

$\text{Se}^{2-} = 34$ protons and 36 electrons

Se^{2-} has a larger radius because it's 34 protons in its nucleus do not have the same power to pull electrons as Rb with 37 protons.

7. Account for the following observations using principles of atomic structure. In each part, your answer must include specific information about both substances.

a) The Ca^{2+} and Cl^- are isoelectronic (aka have the same number of electrons), but their radii are not the same. Which ion has the larger radius? Explain.

$\text{Ca}^{2+} = 20$ protons and 18 electrons

$\text{Cl}^{1-} = 17$ protons and 18 electrons

Cl^{1-} has a larger nucleus because of the weaker pull on electrons by the nucleus.

b) Atomic size decreases from Na to Cl in the periodic table.

As you move across the row the number of protons in the nucleus increase (ex. $\text{Na} = 11^+$ and $\text{Cl} = 17^+$) because the number on the energy levels remains at 3 . Therefore, Cl with 17^+ protons pulls on the electrons more tightly.

c) The first ionization of K is less than that of Na .

Ionization = energy required to remove an electron.

K has 4 energy levels and Na has 3 energy levels. The electrons on the 4^{th} energy level are more shielded from the attractive forces, of the nucleus and therefore they are more easily removed.