Atoms, Molecules and Reactions (Fall 2011)

Inorganic Chemistry Homework – Week 1

Due on Friday of Week 1

Please use <u>separate sheets</u> to answer these questions. Please <u>staple</u> your answer sheets and add a <u>cover page</u>. On the cover page please write your name and "Fall Quarter, Week 1, Inorganic Chemistry Homework".

Read Chapters 1-3 in your Inorganic chemistry textbook and <u>take notes</u>. You will find that you are familiar with most of the concepts covered in these chapters. Although you should read sections 2.2, 2.2.1 and 2.2.2 you will not be held responsible for this material yet because we will cover these concepts extensively in Quantum Mechanics in the fall quarter. Refer to your general chemistry textbook and notes when needed. If you have questions, please <u>write them down</u> and bring to the first inorganic chemistry lecture for a class discussion.

1. Describe John Dalton's atomic theory.
2. Give three examples for each of the following
   - halogens
   - noble gases
   - alkali metals
   - alkaline earth metals
   - actinides
   - lanthanides
   - transition metals
   - chalcogens
   - coinage metals
3. Draw a ladder type energy diagram to represent the Bohr model of the hydrogen atom. On this diagram clearly label the Lyman, Balmer, Paschen, Bracket, and Pfund series lines (four transition lines for each series)
4. Use the Rydberg formula to calculate the wavelength (in nm units) of the Balmer series spectral line with the lowest energy. The Rydberg formula is:

$$\frac{1}{\lambda} = R_H \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$$

   where R_H is the Rydberg constant, n_1 and n_2 are non zero integers with $n_2 > n_1$
5. In what region of the electromagnetic spectrum do you expect to observe the above spectral line?
6. What is the energy of the above transition in kJ/mol?
7. Calculate the de Broglie wavelength of an electron travelling at the speed of 1% of the speed of light in pm units.
8. The principal quantum number is given the symbol _____ and determines the ______________ and the __________________ of an atomic orbital. It can take values ____________________
9. The angular momentum quantum number is given the symbol ______ and determines the _______________________________ of an atomic orbital. It can take values ____________________
10. The magnetic quantum number is given the symbol ______ and determines the _______________________________ of an atomic orbital. It can take values ____________________

11. The spin quantum number is given the symbol ______ . It can take values ______________________
12. You need ____ quantum numbers to describe an orbital and ____quantum numbers to describe an electron.
13. Define an atomic orbital.
14. Complete the following table.

n	**ℓ**	**m_ℓ**	**Orbital symbol**
2			
3			
4			

15. State the Pauli exclusion principle.
16. What are Hund's rules for filling electrons into atomic orbitals?
17. What are valence electrons?
18. Write the electron configurations of the following.

	Spectroscopic notation	Rare gas notation
Na		
Ca^{2+}		
F^{-}		
Cr		
Mg		
Cu		
V^{2+}		
Mo^{3+}		

19. Show the valence electrons of the following using electron box diagrams and determine their magnetic properties.

species	Valence electrons in box diagram	Diamagnetic or paramagnetic?
Cl		
Ca		
Ti^{+}		
Fe^{2+}		
O^{2-}		
P		

20. Define the following terms.
    - Ionization energy
    - Electron affinity
    - Electronegativity
21. Describe the trends in ionization energy, electron affinity, and atomic radius as you go down a group.