CHEMICAL BONDING & MOLECULAR GEOMETRY SYLLABUS

I. MAJOR TOPICS:

Chemical Bonding

A. Lewis Structures
B. Resonance Structures
C. Exceptions to Octet Rule
D. Electronegativity and Bond Type
E. Bond Dissociation Energy

Molecular Geometry:

A. Molecular Geometry - VSEPR
B. Dipoles and Polarity
C. Hybridization
D. Sigma and Pi Bonds
E. Resonance and Pi Bonds

II. OBJECTIVES/GUIDELINES:

Chemical Bonding

1. Understand what electronegativity is, how it is measured, and how it differs from electron affinity.
2. Know the periodic trend for electronegativity. Be able to look at a list of elements and put them in order of increasing electronegativity.
3. Be able to recognize an ionic bond, polar bond and a nonpolar bond based on electronegativity.
4. Know the steps for drawing Lewis structures.
5. Know which atoms have Lewis structures that are exceptions to the octet rule.
6. Understand what formal charges are and be able to calculate a formal charge for any atom.
7. Be able to use formal charge arguments to draw more plausible Lewis structures. What sort of formal charges are preferred in a molecule? Upon which atom should a negative partial charge be placed?
8. What does a resonance structure represent? How does resonance explain why all of the S-O bonds in a SO_3 molecule are the same length?
9. Be able to draw possible resonance structures for molecules and indicate the most plausible resonance structure (if there is one) based on formal charge.
10. Be able to determine relative bond lengths of molecules knowing that single bonds > double bonds > triple bonds. Why does length of bond indicate about strength of bond?
11. What is bond dissociation energy? Why is it always an endothermic process? Explain the role bond breaking and bond making determines the energy released or absorbed during a chemical process.
12. Be able to determine the ΔH° using bond dissociation energies.

Molecular Geometry

13. What is VSEPR and how does this model help up predict the molecular geometry of a molecule.
14. Be able to look at a Lewis structure and comment on the arrangement of ALL of the e- pairs as well as the actual molecular geometry of the molecule.
15. Know the names of all of the different molecular geometries and be able to illustrate molecules in 3-D if necessary.
16. Know the relative bond angles for all molecular shapes.
17. Be able to explain the role lone pairs play in determining the bond angles in molecules.
18. Be able to determine if a molecule is polar or nonpolar and be able to indicate the direction of the dipole.
19. Understand the process of hybridization and why it is necessary.
20. By counting the number of e- pairs in a molecule, be able to determine the hybridization on any central atom.
21. Be able to explain the bonding that is occurring in different molecules. For example, in methane, the covalent bonds are a result of the overlap of a sp3 orbital from the C and the s orbitals of the hydrogens.
22. Understand and be able to distinguish between sigma and pi bonds.

23. Understand how pi bonds are formed and realize the pi bonds are only formed from pure p orbitals.
24. Be able to explain how resonance can be explain via overlap of pi bonds.

Complete the following problems from your Brown, LeMay & Bursten chemistry text. Show all of your work! (No Work = No Credit). The answers to the odd numbered problems are in the back of your text. It is your responsibility to get yourself in an academic position to answer ALL of these problems. If needed – PLEASE ASK ME FOR HELP!

Problem Set #11: problems 8.1, 8.7, 8.11, 8.12, 8.25, 8.26, 8.28, 8.32

Due Date:_____

Problem Set #12: problems 8.14, 8.17, 8.20, 8.30, 8.32, 8.34, 8.36, 8.42, 8.46, 8.48, 8.56, 8.58

Due Date:_____

Problem set #13: problems 8.63, 8.66, 9.2, 9.9, 9.14, 9.16, 9.18, 9.28, 9.30, 9.36

Due Date:_____

Problem set #14: problems 9.41, 9.44, 9.52, 9.56, and additional ½ sheet (More Fun with Molecular Geometry) Work all problems on a separate sheet. Do NOT just scribble in the margins of the handout.

Due date:_____