AP Chemistry

Dr. Wilhelm

**Chapter Eight Reading Guide: Bonding and Molecular Structure**

*On a separate piece of paper, write a response to the following reading prompts while reviewing chapter eight of your textbook.*

**Chemical Bonds- Covalent Bonds and Lewis Structures**

1. Distinguish between ionic bonds and covalent bonds. How do Lewis structures for these two types of compounds differ? Give an example for each.
2. When drawing Lewis dot structures how are valence electrons presented? Using table 8.2 as a reference, draw Lewis dot structures for elements with 1-8 valence electrons.
3. Distinguish between the terms: lone pair, bonding pair electrons.
4. What is meant by the term “octet”, in reference to valence electrons? Why doesn’t the octet rule apply to hydrogen?
5. Guidelines are given for drawing Lewis dot structures for molecular (covalently bonded) compounds. This is described in the five-step process. Transfer the five steps into your notes as a reference. Using these steps will help ensure that your structures are accurate.
6. Interactive 8.1 is very helpful practice of Lewis dot structures. Also, read “a closer look” on page 351 to get some additional tips and tools for drawing Lewis structures.
7. Explain how knowing the number of valence electrons an element has may help predict its structure when writing Lewis structures for molecules that have no charge?

1. Draw the Lewis structure for the Nitrate ion and Nitric acid. Circle the hydrogen atom (H) that is removed when the acid donates a proton (H+) to form the hydronium (H3O+) ion in water. Recognize this same pattern for other oxoacids/ions as described in table 8.4.
2. Give an example of an isoelectronic series as it applies to molecules and explain how this relates to their common Lewis structures.
3. Provide a definition for the term formal charge. The equation provided (8.1) appears more complicated than it really is! We will practice this in class. Read a closer look: Comparing oxidation number and formal charge on page 355. This may help provide some insight into the role of formal charge in viewing molecular compounds.
4. Another concept important to some molecular compounds is resonance. What is resonance and when does this apply? Provide an example of a compound that exhibits resonance structures. Complete example 8.4 to understand the techniques for drawing resonance structures.
5. Explain why there are exceptions to the octet rule, including compounds with less than or greater than an octet of electrons and compounds containing an odd number of electrons. Give an example of each. Why do these exceptions occur?

**Molecular Shapes (VSEPR)**

1. What does VSEPR stand for and how does this provide a method for predicting the shape (molecular geometry) of a molecule?
2. Identify the basic shape that result from single covalent bonds around the central atoms. These basic shapes are provided in figure 8.5
3. How does the repulsive role of lone pair electrons alter the molecular geometry of a molecule? Describe this in terms of bond shape and distortion of bond angles.
4. What is the difference between electron-pair geometry and molecular geometry?
5. Review the shapes described in Figure 8.8 that support the molecular geometry of molecules whose central atom contains more than an octet of electrons. We will review this in class and supplemental charts/tables will be used. Make a list of this shapes so you can begin to memorize them.
6. How are multiple bonds treated in VSEPR? How are they viewed in predicting the 3-dimensional shape and how do they influence the bond angle?

**Bond Polarity and electronegativity**

1. Identify the difference between ionic, polar covalent and nonpolar covalent bonds. What does the symbols **+**, **-** describe? Figure 8.10 provides a visual representation of these three types of bonds. Explain what the gray shaded cloud is describing and how/why it differs for the three models.
2. Define the term electronegativity. What is the scale used for this measurement?
3. Based on figure 8.11, determine the element(s) with the greatest electronegativity and the lowest electronegativity. Does this support our previous understanding of periodic trends?
4. Why is it that the metalloids have a lower electronegativity than nonmetals? Which class of elements have the lowest electronegativity?
5. What is **charge distribution**? What are the two basic guidelines for determining charge distribution of a molecule?
6. Explain the term **dipole moment** and how it is determined. How does this relate to the polarity of molecules?
7. Explain how the symmetry/asymmetry of a molecule influences the polarity? Give an example of a symmetrical, non-polar molecule and a asymmetrical, polar molecule.
8. What is bond order and how is it determined? What is the relationship between bond order and bond length?
9. Define bond dissociation enthalpy and explain why this is always and endothermic process.
10. How does bond dissociation energy relate to bond strength and bond order? Viewing table 8.9 will help you address this question. For example, compare the bond enthalpy of the following bonds: H-H, H-F, C-C, C=C.
11. Bond enthalpy can be used to determine the enthalpy of a reaction based on the following relationship: **ΔH = ΣΔH(Bonds broken) - ΣΔH(Bonds formed).**

1. Review example 8.14 to see how the above equation is applied