Learning Objectives and Worksheet VII

Chemistry 1B-AL Fall 2016

~~Lectures~~ (10-12) "Classical" Theories of Molecular Structure and Geometry (Part 2)

Read pp. 621-650 and 602-606 *[back to molecular polarity dipole moments]*

The next three class sessions will be devoted to asking two questions: i) how do atoms combine in forming covalent bonds in polyatomic molecules and ii) what geometries do the atoms assume in three-dimensional space. In this first look at polyatomic molecules we will again take a 'classical' approach: bonding will be considered in the context of Lewis octet configurations (Lewis dot structures) and most stable geometries will be determined by electrostatic interactions. These approaches are very useful and the results will be consistent with the quantum mechanical description that we will study in future sessions.

I. Concepts of the Valence State Electron Pair Repulsion (VSEPR) Theory of Molecular Geometry

1. An electron group is an _____ region and can be a:
   i. _____ or
   ii. _____ or
   iii. _____ which are counted as a single electron group
2. The number of electron groups around a central atom is the _____ .
3. The electron groups around an atom in a molecule with assume a geometry so as to _____.

VSEPR models and video: http://winter.group.shef.ac.uk/vsepr/index.html
https://www.youtube.com/watch?v=FjjhUI4wFTE&feature=player_embedded#!

II. The "electronic" geometries predicted for atoms with various steric numbers are:

1. SN=2 _____.
2. SN=3_____.
3. SN=4 _____.
4. SN=5 _____.
5. SN=6 _____.

III. For atoms with non-bonding pairs the molecular geometry will differ from the "electronic geometry" and the covalent bonds and non-bonding pairs are arranged so as to _____ .

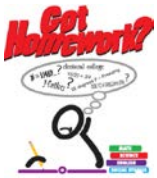
This results in the following **molecular geometries**:

1. SN=2 0 non-bonding pairs _____.
   SN=2 1 non-bonding pair _____.

2. SN=3 0 non-bonding pairs _____.
   SN=3 1 non-bonding pair _____.

3. SN=4 0 non-bonding pairs _____.
   SN=4 1 non-bonding pair _____.
   SN=4 2 non-bonding pairs _____.

4. SN=5 0 non-bonding pairs _____.
   SN=5 1 non-bonding pair _____.
   SN=5 2 non-bonding pairs _____.
   SN=5 3 non-bonding pairs _____.



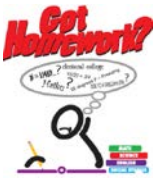
HW#5: **41, 42, 43, 44**

5. SN=6 0 non-bonding pairs _____.
   SN=6 1 non-bonding pair _____.
   SN=6 2 non-bonding pairs _____.

VSEPR geometries http://intro.chem.okstate.edu/1314f97/chapter9/VSEPR.html

IV. Polyatomic dipole moments

1. In a polar covalent bond the _____ electronegative atom will have a partial positive charge (δ+) and the _____ electronegative atom will have a partial negative charge (δ−).



HW#4: **45, S11, S12**

2. Will molecules with polar bonds always have a (non-zero) dipole moment? Explain your answer.

Modeling dipoles and electrostatic surfaces
http://chemtube3d.com/ElectrostaticSurfacesPolar.html