Chapters 5

Bonding Theories: Explaining Molecular Geometry

Learning Objectives

8.12.2022

To satisfy the minimum requirements for this course, you should be able to:

1. **Use VSEPR to predict the molecular geometry of a molecule or ion with up to 6 electron pairs* around the central atom**. You should be able to:
   - determine the steric number (SN) of the central atom of a molecule or ion
   - predict the electron-pair geometry around a specified atom of a molecule or ion from the SN
   - predict the molecular geometry around a specified atom in a molecule or ion and assign values to the bond angles
   - explain why lone pairs of electrons exert a greater repulsive interaction on other regions of electron density than do bonding pairs

2. **Predict whether a molecule is polar or nonpolar based on the molecular geometry and polarities of the individual bonds**

3. **Use the concept of orbital hybridization to describe the bonding in molecules and ions having up to 4 electron pairs around the central atom**
   - explain the relationship between atomic orbitals and hybrid orbitals (up to sp^3)
   - recognize names, shapes, and orientation of hybrid orbitals appropriate for central atoms surrounded by up to 4 electron pairs.
   - use Lewis structures to predict the hybridization of each central atom in a molecule and the geometry around each atom
   - distinguish between sigma (σ) bonds and pi (π) bonds and be able to determine the number of sigma and pi bonds in a molecule

**Note that in the terminology used in your textbook (Gilbert, et al.), an "electron pair" can be a lone pair, a single bond, a double bond, or a triple bond even though a double bond consists of four electrons and a triple bond consists of six electrons.)*

Note - Sections 5.6 (Chirality and Molecular Recognition) and 5.7 (Molecular Orbital Theory) are not assigned.