

Chem E-1a
Friday Review Problems
Chapter 10: Chemical Bonding II

1. For each of the following molecules, draw a complete Lewis structure. Then determine the number of electron domains around the central atom and predict the hybridization, electron-pair geometry, and molecular geometry around the central atom. Finally, determine the approximate bond angles around the central atom and determine if the molecule is polar or nonpolar.

a) OCS

Lewis Structure

of Electron Domains (Pairs):

Hybridization:

Electron-Pair Geometry:

Molecular Geometry:

Bond Angles:

Polar or Nonpolar?

b) BF₃

Lewis Structure

of Electron Domains (Pairs):

Hybridization:

Electron-Pair Geometry:

Molecular Geometry:

Bond Angles:

Polar or Nonpolar?

1. (cont.)

c) IF₃

Lewis Structure

of Electron Domains (Pairs):

Hybridization:

Electron-Pair Geometry:

Molecular Geometry:

Bond Angles:

Polar or Nonpolar?

d) SF₄

Lewis Structure

of Electron Domains (Pairs):

Hybridization:

Electron-Pair Geometry:

Molecular Geometry:

Bond Angles:

Polar or Nonpolar?

e) XeF₄

Lewis Structure

of Electron Domains (Pairs):

Hybridization:

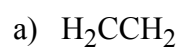
Electron-Pair Geometry:

Molecular Geometry:

Bond Angles:

Polar or Nonpolar?

2. For each of the following, draw a sketch of the molecule that shows all of the sigma and pi bonds, and shows the orbitals that form each sigma and pi bond. Label all orbitals and bonds in your drawing.



3. For each of the following, draw a perspective sketch of the molecule using lines, dashes, and wedges that clearly shows the geometry of the molecule and the location and orientation of the pi bonding. Show any unhybridized p orbitals and connect them to indicate the pi bonding. Do not draw any orbitals involved in sigma bonding.

a) SO_3

b) H_2CCCH_2

4. Consider the neutral CN molecule.

a) Draw a molecular orbital diagram for the valence molecular orbitals of CN. Include the relevant atomic orbitals in your diagram, and be sure to label your atomic and molecular orbitals. (Use the “BCN” ordering of energy levels.)

b) Is the CN molecule paramagnetic or diamagnetic?

c) What is the bond order of the neutral CN molecule?

d) The CN molecule could gain an electron to form the cyanide ion, CN^- . Which of these two species, CN or CN^- , has the longer bond length?

5. For each of the following molecular orbitals, draw the atomic orbitals that would combine to form the indicated molecular orbital, showing the atomic orbitals with the correct orientation and shading for phase to form the molecular orbital indicated. Then draw a depiction of the molecular orbital. Be sure to shade your orbitals to indicate phase.

a) σ_{1s}

b) σ^*_{1s}

c) π_{2p}

d) π^*_{2p}