Recitation 4

Lewis Structures, Resonance and Formal Charges

1. Predicting bonding of XeO_3 based on formal charges: Sample Exercise 8.10 (p. 366)

Solution: Refer to book page 366

2. Calculate formal charges to determine the best Resonance structure from Chapter 8: Exercise No. 73.b (N_3^- only).

Solution: 3 resonance structures. Structures are explained in the recitation

3. Significance of resonance Chapter 8: Exercise No. 78

Solution: For resonance structure the bond length will be average of the three structures

VSEPR

Predict the geometry of the following molecules. Indicate, in each case, whether the molecule is polar or non-polar.
IF_5, SeF_4, and XeF_2

Solution:

(You should write the Lewis structure and draw the molecular structure for each case yourself)

IF_5, Square pyramidal, Polar molecule as the bond dipole do not cancel

SeF_4, See-saw, Polar molecule as the bond dipole do not cancel

XeF_2, Linear, Non- polar molecule as the bond dipole cancels out

Hybridization:

Chapter 9: Exercise No. 9.27 (f only) **(from the book)**

TeF_4

Solution:

(*You should write the Lewis structure and draw the molecular structure for each case yourself)*

(a) CF_4 : tetrahedral, 109.5°, sp^3, non-polar

(b) NF_3 : trigonal pyramidal, < 109.5° (due to the lone pair which requires more space than the bonding pair), sp^3, polar

(c) OF_2 : V-shaped, < 109.5° , sp^3, non-polar

(d) BF_3 : trigonal planar, 120°, sp^2, non-polar

(e) BeH_2 : linear, 180°, sp, non-polar

(f) TeF_4 : see-saw, 120° and 90°, dsp^3, polar

(g) AsF_5 : trigonal bipyramida, 90° and 120°, dsp^3, non-polar

(h) KrF_2 : linear, 120°, dsp^3, non-polar

(i) KrF_4 : square planar, 90°, d^2sp^3, non-polar

(j) SeF_6 : octahedral, 90°, d^2sp^3, non-polar

(k) IF_5 : square pyramid, 90°, d^2sp^3, polar

(l) IF_3 : T-shaped, 90°, dsp^3, polar

Chapter 9: Exercise No. 9.31.(from the book)

Solution:
(You should write the Lewis structure and draw the molecular structure for each case yourself)

Valence electrons in biacetyl = 34

All CCO angles are 120°. The six atoms are not in the same plane because of free rotation about the carbon – carbon single (sigma) bonds. There are 11 sigma (σ) and 2 pi (π) bonds in biacetyl.

Valence electrons in acetoin = 36

The carbon with the doubly bonded O is sp^2 hybridized. The other 3 C atoms are sp^3 hybridized. Angles are 120^o (where C is sp^2 hybridized) and 109.5^o (where C is sp^3 hybridized). There are 13 sigma (σ) and 1 pi (π)bonds in acetoin.