

## Chemistry Notes 11/8/13

### Warm Up

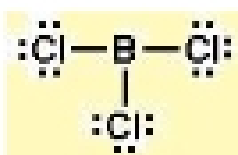
1. The complete Lewis structure of  $\text{COCl}_2$  will have
  - a. At least one lone pair on each atom
  - b. At least one double bond
  - c. Only single bonds
  - d. Resonance forms

### Formal Charge

- “Book keeping” method to see what atoms are electron rich or electron poor
- **Formal Charge = [# of valence electrons] - [# of unshared electrons] - [# of bonds]**
  - o Charge of Carbon in  $\text{COCl}_2$ ?
    - $\text{F.C.} = (4) - (0) - (4) = 0$
  - o Charge of Cl?
    - $\text{F.C.} = (7) - (6) - (1) = 0$
  - o Charge of O?
    - $\text{F.C.} = (6) - (4) - (2) = 0$

### Examples

1. Charge of oxygen & carbon in  $\text{CO}_2$ ?
  - a.  $\text{F.C.} = (6) - (4) - (2) = 0$
  - b. Carbon?  $\text{F.C.} = (4) - (0) - (4) = 0$
2. What about in  $\text{CO}_2$  with a triple bond?
  - a.  $\text{O}_1 = (6) - (2) - (3) = 1$
  - b.  $\text{O}_2 = (6) - (6) - (1) = -1$
3.  $\text{OH}^-$ 
  - a. H:  $\text{F.C.} = (1) - (0) - (1) = 0$
  - b. O:  $\text{F.C.} = (6) - (6) - (1) = -1$ 
    - i.  $\text{OH}^-$  has a total charge of -1, so this makes sense



4.  $\text{BCl}_3$ 
  - a. B:  $\text{F.C.} = (3) - (0) - (3) = 0$
  - b. Cl:  $\text{F.C.} = (7) - (6) - (1) = 0$
5.  $\text{BCl}_3$  with a double bond on one Chlorine
  - a. B:  $\text{F.C.} = (3) - (0) - (4) = -1$
  - b.  $\text{Cl}_1$ :  $\text{F.C.} = (7) - (4) - (2) = 1$
  - c.  $\text{Cl}_2$ :  $\text{F.C.} = 0$ 
    - i.  $\text{BCl}_3$  with single bonds is better because there is no charge
6.  $\text{N}_2\text{O}$  (two double bonds)
  - a.  $\text{N}_1$ :  $(5) - (4) - (2) = -1$
  - b.  $\text{N}_2$ :  $(5) - (0) - (4) = 1$
  - c. O:  $(6) - (4) - (2) = 0$

7.  $\text{N}_2\text{O}$  (Triple bond on oxygen)
  - a.  $\text{N}_2: (5) - (6) - (1) = -2$
  - b.  $\text{N}_2: (5) - (0) - (4) = 1$
  - c.  $\text{O}: (6) - (2) - (3) = 1$
8.  $\text{N}_2\text{O}$  (Triple bond on left most nitrogen)
  - a.  $\text{N}_2: (5) - (2) - (3) = 0$
  - b.  $\text{N}_2: (5) - (0) - (4) = 1$
  - c.  $\text{O}: (6) - (6) - (1) = -1$
  - d. This is the better of the  $\text{N}_2\text{O}$  structures because the charges are lower
    - i. The more electronegative atom should have the most negative charge

### Review

1. The shape of the molecule  $\text{NH}_3$  is \_\_\_\_, and the H-N-H bond angles are approximately \_\_\_\_\_.
  - a. Planar, 120 degrees
  - b. Tetrahedral, 109 degrees
  - c. Pyramidal, 120 degrees
  - d. Pyramidal, 109 degrees

### Hybridization Continued

- $\text{Sp}^3$ : Tetrahedral
- $\text{Sp}^2$ : Trigonal planar
- $\text{Sp}$ : Linear
- Trigonal bipyramidal (5 orbitals)?
  - o  $\text{Sp}^3\text{d}$
- Octahedral (6 orbitals)?
  - o  $\text{Sp}^3\text{d}^2$

### Examples:

1.  $\text{CH}_2\text{CCH}_2$ ; what is the hybridization of each C?
  - a.  $\text{CH}_2$ ?
    - i.  $\text{Sp}^2$
    - ii. Trigonal Planar 120 degrees
  - b.  $\text{CH}_2\text{CCH}_2$ ?
    - i.  $\text{Sp}$
    - ii. Linear, 180 degrees
2.  $\text{CH}_3\text{CH}_2\text{CH}_3$ ; what is the hybridization on the central carbon?
  - a.  $\text{Sp}^3\text{d}$