AP CHEMISTRY

TOPIC 5: BONDING, PART B

Day 50:

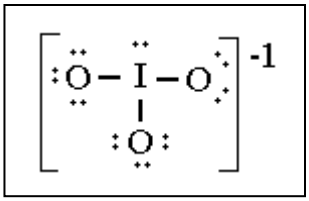
- Bond Energy
- Formal Charge

Calculate the Formal Charge and then draw the "best" Lewis-dot structure representation for the molecule.

1) IO_3^{-1}

$I_{assigned}$: 2 + ½ (6) = 5
$I_{F.C.}$: 7 – 5 = 2

$O_{assigned}$ (single): 6 + ½ (2) = 7
$O_{F.C.}$ (single): 6 – 7 = -1

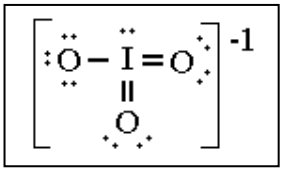


Bond Order: 5 / 3 = 1.67 (for correct structure)

$I_{assigned}$: 2 + ½ (10) = 7
$I_{F.C.}$: 7 – 7 = 0

$O_{assigned}$ (single): 6 + ½ (2) = 7
$O_{F.C.}$ (single): 6 – 7 = -1

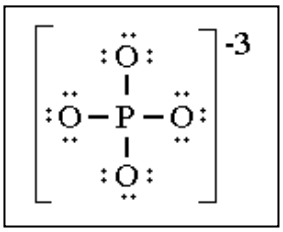
$O_{assigned}$ (double): 4 + ½ (4) = 6
$O_{F.C.}$ (double): 6 – 6 = 0



2) PO_4^{-3}

$P_{assigned}$: 0 + ½ (8) = 4
$P_{F.C.}$: 5 – 4 = 1

$O_{assigned}$ (single): 6 + ½ (2) = 7
$O_{F.C.}$ (single): 6 – 7 = -1

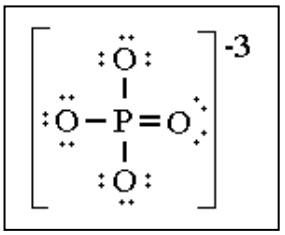


Bond Order: 5 / 4 = 1.25 (for correct structure)

$P_{assigned}$: 0 + ½ (10) = 5
$P_{F.C.}$: 5 – 5 = 0

$O_{assigned}$ (single): 6 + ½ (2) = 7
$O_{F.C.}$ (single): 6 – 7 = -1

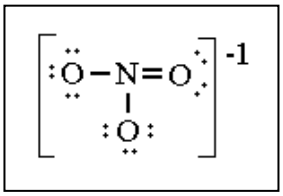
$O_{assigned}$ (double): 4 + ½ (4) = 6
$O_{F.C.}$ (double): 6 – 6 = 0



3) NO_3^{-1}

$N_{assigned}$: 0 + ½ (8) = 4
$N_{F.C.}$: 5 – 4 = 1

$O_{assigned}$ (single): 6 + ½ (2) = 7
$O_{F.C.}$ (single): 6 – 7 = -1



$O_{assigned}$ (double): 4 + ½ (4) = 6
$O_{F.C.}$ (double): 6 – 6 = 0

Bond Order: 4 / 3 = 1.33
http://www.youtube.com/watch?v=kcXFHdCIns8

Note: *For the elements Carbon, Nitrogen, Oxygen, and Fluorine (second energy elements), when either of these elements are central atoms – they **MAY NOT** have more than 8 (eight) electrons.*

The elements in the rows below may have more than 8 electrons since they have "d-orbitals" to place the "extra" electrons into.

Also, recall that Boron, may only have 6 (six) electrons – NOT an octet.

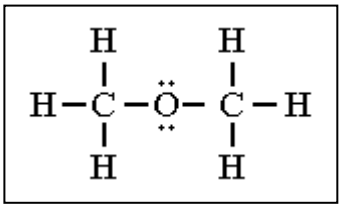
Note: *Formal Charge does not ALWAYS provide the most accurate Lewis structure. But it helps us determine the "BEST" structure for MOST molecules.*

4) CH_3OCH_3

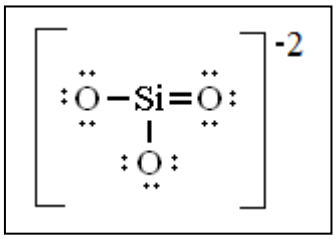
$C_{assigned}$: 0 + ½ (8) = 4
$C_{F.C.}$: 4 – 4 = 0

$O_{assigned}$ (single): 6 + ½ (2) = 7
$O_{F.C.}$ (single): 6 – 7 = -1

$O_{assigned}$ (double): 4 + ½ (4) = 6
$O_{F.C.}$ (double): 6 – 6 = 0



5) SiO_3^{-2}



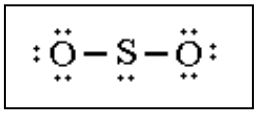
Si $_{assigned}$: 0 + ½ (8) = 4
Si $_{F.C.}$: 4 – 4 = 0

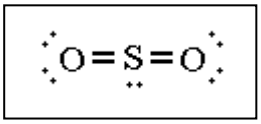
O $_{assigned}$ (single): 6 + ½ (2) = 7
O $_{F.C.}$ (single): 6 – 7 = -1

O $_{assigned}$ (double): 4 + ½ (4) = 6
O $_{F.C.}$ (double): 6 – 6 = 0

Bond Order: 4 / 3 = 1.33

6) SO_2





O $_{assigned}$ (single): 6 + ½ (2) = 7
O $_{F.C.}$ (single): 6 – 7 = -1

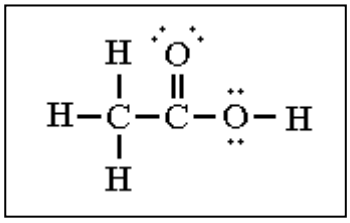
O $_{assigned}$ (double): 4 + ½ (4) = 6
O $_{F.C.}$ (double): 6 – 6 = 0

S $_{assigned}$: 2 + ½ (4) = 4
S $_{F.C.}$: 6 – 4 = - 2

S $_{assigned}$: 2 + ½ (8) = 6
S $_{F.C.}$: 6 – 6 = 0

Bond Order: 2 / 2 = 1.0 (on the correct structure)

7) CH_3COOH

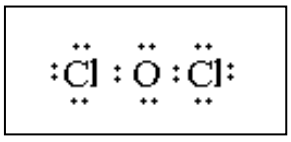


C $_{assigned}$: 0 + ½ (8) = 4
C $_{F.C.}$: 4 – 4 = 0

O $_{assigned}$ (single): 6 + ½ (2) = 7
O $_{F.C.}$ (single): 6 – 7 = -1

O $_{assigned}$ (double): 4 + ½ (4) = 6
O $_{F.C.}$ (double): 6 – 6 = 0

8) OCl_2



O $_{assigned}$ (single): 4 + ½ (4) = 6
O $_{F.C.}$ (single): 6 – 6 = 0

Cl $_{assigned}$: 6 + ½ (2) = 7
Cl $_{F.C.}$: 7 – 7 = 0

Bond Order: 1 / 1 = 1.0