Name: _____ Date: _____ CHEM 1A

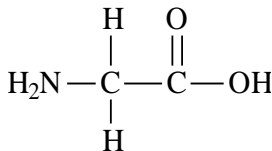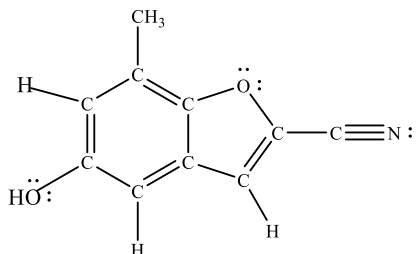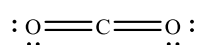*Monday/Tuesday, December 2 & 3, 2019-* Covalent Bonding & Orbitals (All Chapter 14)

I.   Local Electron Model

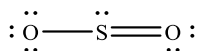1. **Sigma & Pi Bonding -** Determine the number of sigma (σ) and pi (π) bonds in the following structures.

Sigma Bond –
Pi Bond –

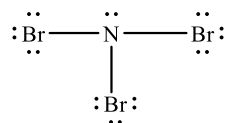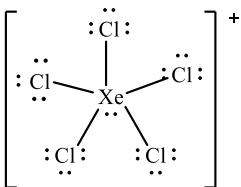2. **Hybridization** - . Label the hybridization of the central atoms for the following:

a.

$:O{=}C{=}O:$

c.

$:O{-}S{=}O:$

e. I_3^-

b.

$:Br{-}N{-}Br:$
       $|$
      $:Br:$

d.

f. C_2H_4

3. **The Shapes of Molecules -** How many of the following molecules have all of their atoms in the same plane?

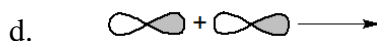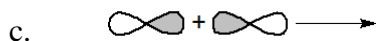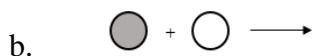a. F_2O b. H_2CO c. NH_3 d. CO_2 e. C_2H_4
f. $BeCl_2$ g.H_2O_2

5. For the following will all of the atoms in lie in the same plane?

a. $H_2C{=}C{=}CH_2$ b. $H_2C{=}C{=}C{=}CH_2$ c. $H_2C{=}CH{-}C{\equiv}N$

There are three things which Lewis Theory/VSEPR and the LE Model cannot explain –
1.
2.
3.
Molecular Orbital Theory–
Paramagnetic $\Rightarrow$ *attracted to amagnetic field due to unpaired electrons*
Diamagnetic $\Rightarrow$ *repelled by a magnetic field due to a lack of unpaired electrons*

II.   Molecular Orbital Theory

4. **Orbital Overlap/Local vs. Molecular Orbitals -** Draw and label the molecular orbitals for each of the following combinations of atomic orbitals. State whether the potential energy of the molecular orbitals is higher or lower than the atomic orbitals.
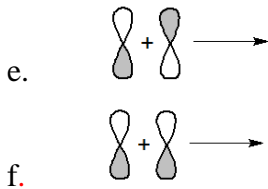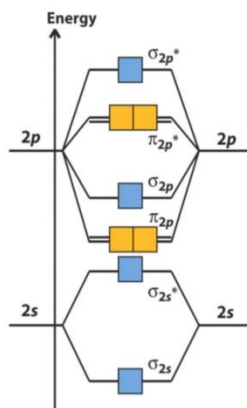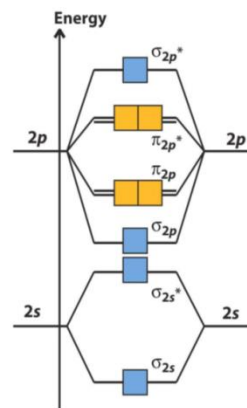
a.

b.

c.

d.

e.

f.

Energy

MO diagram for homonuclear
molecules in Groups 1-5

Energy

MO diagram for homonuclear
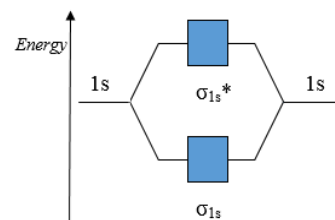molecules in Groups 6-8

7. For the following draw the *valence* molecular orbital energy diagram and determine if they're diamagnetic or paramagnetic:

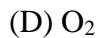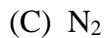a. H_2　　　　　　　　b. He_2^+
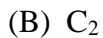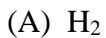
Energy

c. B_2　　　　　　　　d. CN^-　　　　　　　　e. O_2

8. Which of the following will have a stronger bond if an electron is added?

(A) H_2　　　(B) C_2　　　(C) N_2　　　　　(D) O_2　　　　　(E) F_2

9. According to the MO model predict the relative bond energies for the following:

a. F_2　　　b. F_2^-　　　c. F_2^+

10. According to the MO model predict the relative bond lengths for the following:

a. H_2　　　b. B_2　　　c. C_2　　　d. N_2