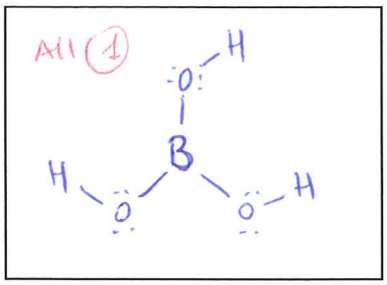
CH 101/103 - Practice sheet – 3/03/2014

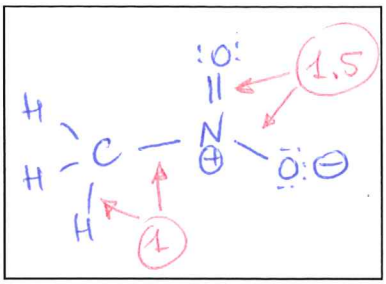
Practice sheet #5: Covalent Bond, Lewis structures, Resonance.

1. Draw a reasonable Lewis Structure for the following compounds:

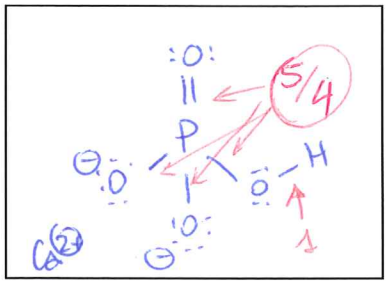
H_3BO_3



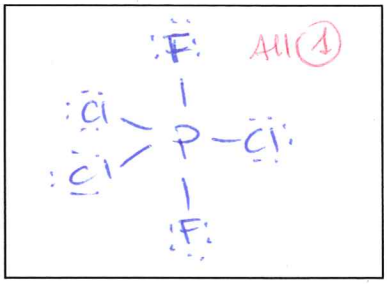
CH_3NO_2



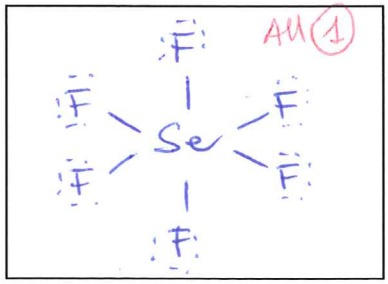
$CaHPO_4$



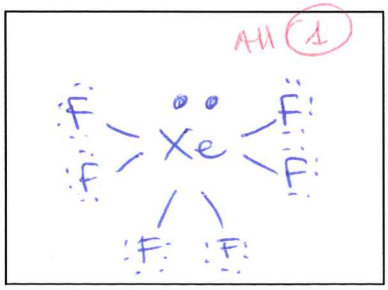
PCl_3F_2



SeF_6



XeF_6



2. For each structure from problem 1, list all the exceptions to the octet rule and explain why it is an acceptable exception.

H_3BO_3 B has less than 8 e^-. Not enough e^- to fill the octect.

CH_3NO_2 NO

$CaHPO_4$ P exceeds the octect, it has 3d orbitals.

PCl_3F_2 -11- same as above.

SeF_6 Se exceeds the octet, it has 4d orbitals.

XeF_6 Xe exceeds the octet, it has 5d and 5f orbitals.

3. For each of the molecules in problem 1, assign the formal charge of each atom.

On the Lewis Structure

4. For each of the molecules in problem 1, assign the bond order to each bond.

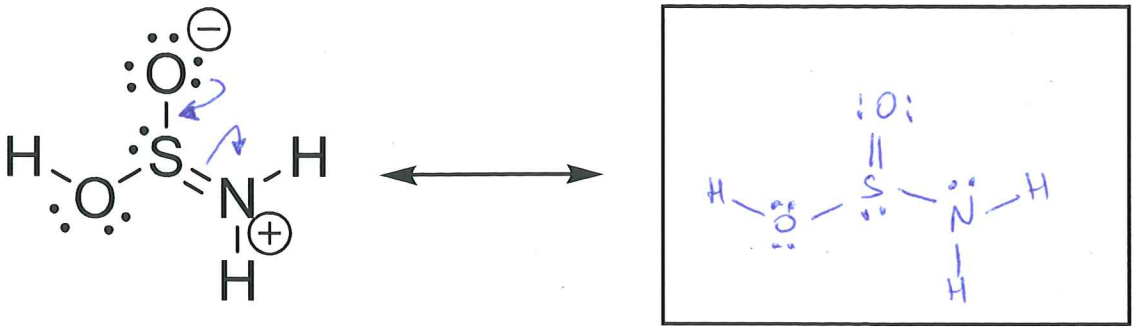
On the lewis structure (Red pen)

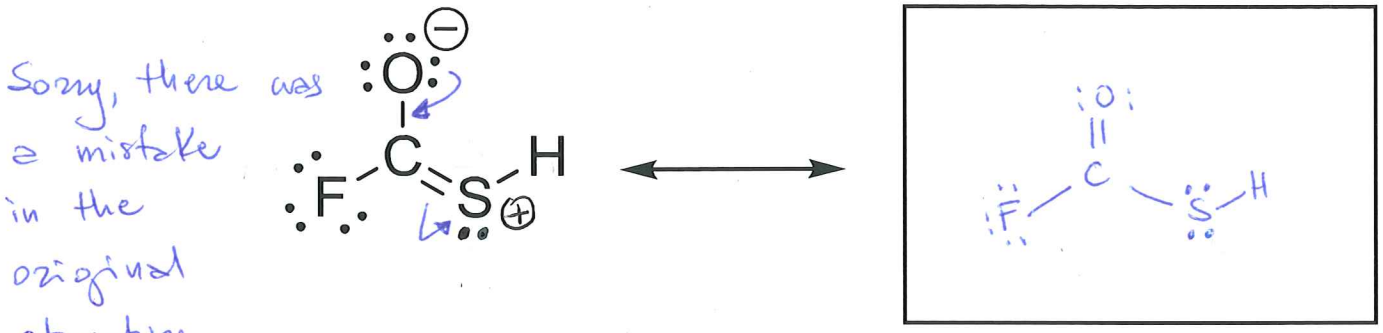
5. Is any of the bonds in the molecules in problem 1 ionic or are all covalent bonds?

In $CaHPO_4$, the $Ca^{2+} - O^-$ bonds are ionic.

6. Resonance:

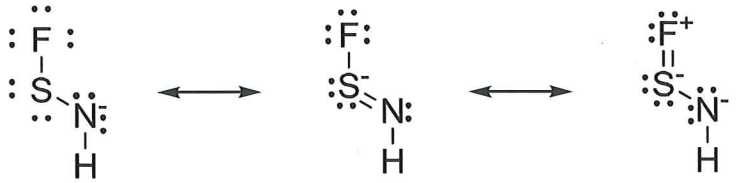
a. Draw an allowed resonance structure for the following molecules:



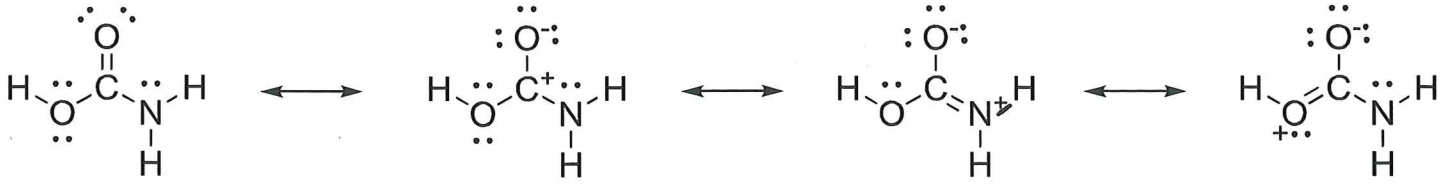


Sorry, there was a mistake in the original structure.

b. Rank the following resonance structure in order of stability: (1 being the most stable)



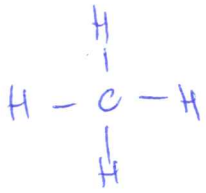
1 2 3



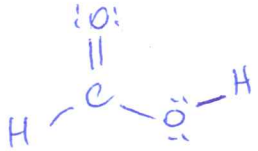
1 4 2 3

a. List all the bonds present in the following molecules and label them as σ or π (you'll need to draw their Lewis structures first):

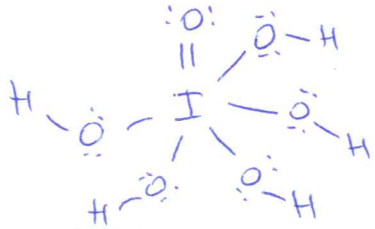
CH_4 4 σ C–H bonds



HCO_2H 1 σ_{CH}
1 π_{CO}
2 σ_{CO}
1 σ_{OH}



H_5IO_6 6 σ_{I-O}
1 π_{I-O}
5 σ_{O-H}



b. Calculate how much energy is necessary to break all bonds of the molecules above.

CH_4 $4 \times 99 = 396 \frac{Kcal}{mol}$

HCO_2H $99 + 86 + 179 + 111 = 475 \frac{Kcal}{mol}$

H_5IO_6 $5 \times 48 + 1 \times 80 + 5 \times 111 = 875 \frac{Kcal}{mol}$