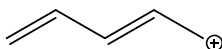


## Chemistry 2500 (Fall 2017): Assignment #8 – Bonding

1. Construct a *complete* molecular orbital diagram for  $F_2^{2-}$ . Label and draw all orbitals. Identify all of the following terms which applies to this molecule: paramagnetic, diamagnetic, triplet, singlet. Do you expect this to be a stable molecule? Why or Why not (Explain Fully)?

2. Draw the  $\pi$ -MOs for the following molecule:



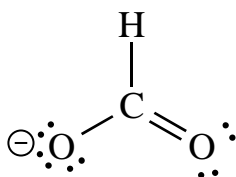
Label all the MOs as bonding, antibonding, or non-bonding.

3. Use molecular orbital arguments to explain why  $Ne_2$  is not a stable molecule.
4. Draw the  $\pi$  molecular orbital diagram for the cyclic molecule  $C_3H_3^+$ . Be sure to label and draw each molecular orbital.
5. A d-orbital is shown below:



Sketch how two such orbitals on adjacent atoms might interact to form:

- a) a  $\sigma$ -bond
  - b) a  $\pi$ -bond
6. a) Sketch the  $\pi$  molecular orbital diagram for the following formate anion. Be sure to draw and label each of the  $\pi$  molecular orbitals.



- b) Add the  $\pi$  electrons to the diagram.
- c) Label the orbitals as bonding, non-bonding or antibonding.
- d) *Where appropriate*, label the molecular orbitals as HOMO, SOMO or LUMO.
- e) Is this anion diamagnetic or paramagnetic? *No explanation is required.*
- f) Reaction of formate anion with HCl gives protonation. Based on the frontier molecular orbitals of formate, explain where protonation takes place.

7. Construct a *complete* molecular orbital diagram for  $\text{N}_2^+$ . Label and draw all orbitals. Identify all of the following terms which applies to this molecule: paramagnetic, diamagnetic, triplet, singlet. What is the bond order?