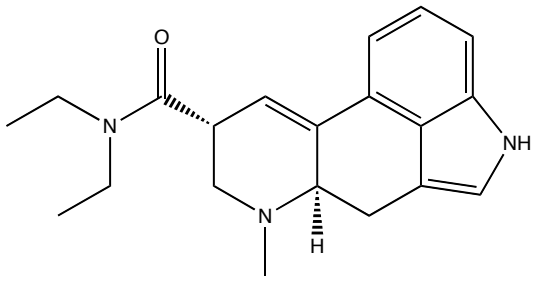
Name:_____ April 6, 2011

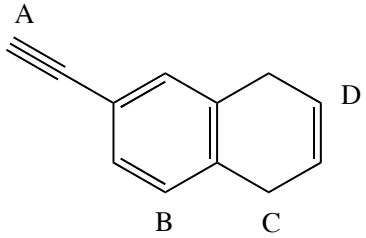
PEERS Workshop
Chemistry 30A
Worksheet 2

1. For the following compound (lysergic acid diethylamide, LSD), please provide the following:



   a. The number of sp^2 hybridized carbons: _____
   b. The number of sp^2 hybridized nitrogens (via resonance): _____
   c. The number of lone pair electrons: _____
   d. The number of C-N bonds with free rotation: _____
   e. The predicted bond angle for a sp^3 C-C bond: _____
   f. The largest number of atoms that can possibly lie in the same plane: _____

2. Identify the hybridization and bond angle for each of the following carbon atoms:



   a. Carbon A: hybridization: _____; bond angle: _____
   b. Carbon B: hybridization: _____; bond angle: _____
   c. Carbon C: hybridization: _____; bond angle: _____
   d. Carbon D: hybridization: _____; bond angle: _____
   e. Which carbon has the longest C-H bond? _____
   f. Which carbon has the shortest C-H bond? _____
   g. Which carbon has the most acidic proton? _____

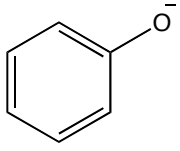
3. Draw the MO diagram for the B_2 molecule. Is the molecule predicted to be stable or reactive? If the molecule is stable, what is the bond order (BO) of the molecule and will it have a single, double, or triple bond? If the molecule is stable is it paramagnetic or diamagnetic? Identify the LUMO and the HOMO.

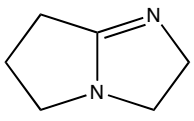
4. Draw the MO diagram for the N_2 molecule. Is the molecule predicted to be stable or reactive? If the molecule is stable, what is the bond order (BO) of the molecule and will it have a single, double, or triple bond? If the molecule is stable is it paramagnetic or diamagnetic? Identify the LUMO and the HOMO.

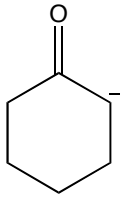
5. Draw the MO diagram for the O_2 molecule. Is the molecule predicted to be stable or reactive? If the molecule is stable, what is the bond order (BO) of the molecule and will it have a single, double, or triple bond? If the molecule is stable is it paramagnetic or diamagnetic? Identify the LUMO and the HOMO.

6. Draw the MO diagram for the Ne_2 molecule. Is the molecule predicted to be stable or reactive? If the molecule is stable, what is the bond order (BO) of the molecule and will it have a single, double, or triple bond? If the molecule is stable is it paramagnetic or diamagnetic? Identify the LUMO and the HOMO.

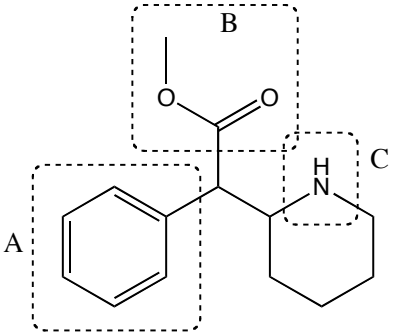
7. Draw resonance structures for the following pi systems. Also draw the resonance hybrid with dotted lines and partial charges. Don't forget formal charges.

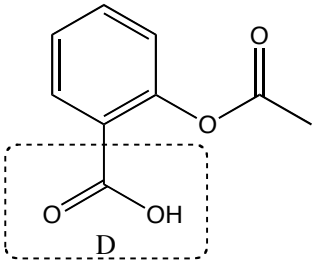
a. 

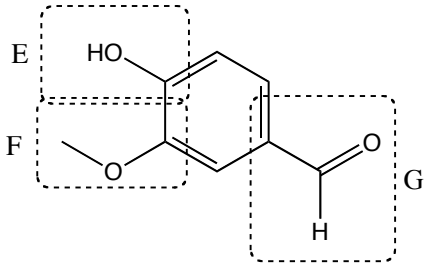
b. 

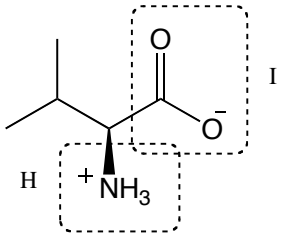
c. 

8. Identify all the functional groups on the following molecules:

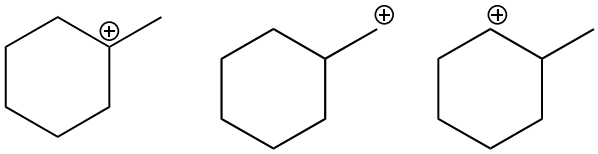
a. Ritalin 

b. Aspirin 

c. Vanillin 

d. Valine, an amino acid 

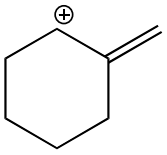
9. Provide the type of carbocation (primary, secondary, tertiary). Arrange in order of stability.



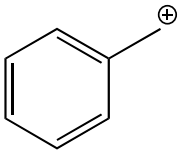
A B C

10. Below are special carbocations. Provide the name of the carbocation and show why they are special.

a.



b.



11. Below is a molecule with 2 nitrogen atoms. One is more basic than the other. Show which nitrogen is more basic by drawing the product of an acid/base reaction with that nitrogen and comparing stabilities of resonance structures.