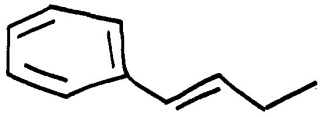
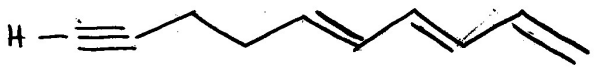
Organic Chemistry 1 – Problem Set #2 Name: Key

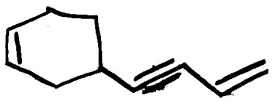
1. Draw Lewis dot structures for the following molecules.

   A) Three isomers of $C_{10}H_{12}$, including one with a ring, and one with a triple bond.
   (5° unsat.)



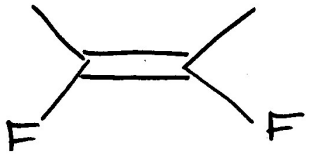


+ MANY OTHERS

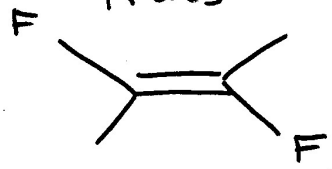


   B) Cis/trans isomers of $CH_3CFCFCH_3$

cis-

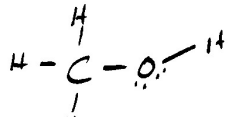


trans-



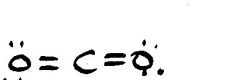
2. Compare all of the CO bond lengths in the three species. Indicate the CO bond order.

methanol, CH_3OH



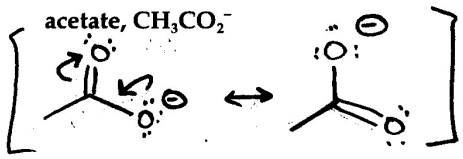
B.O. = 1
(LONGEST)

carbon dioxide, CO_2



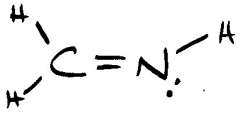
B.O. = 2
(SHORTEST)

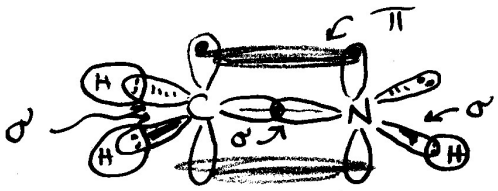
acetate, $CH_3CO_2^-$



BO = 1.5
(MIDDLE)

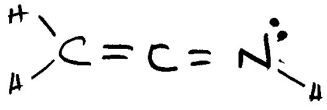
3. Draw the Lewis structure for CH_2NH and build a model of it. Are all of the atoms in the same plane?
   Draw an orbital overlap diagram (show sigma and pi bonds as orbital overlaps).

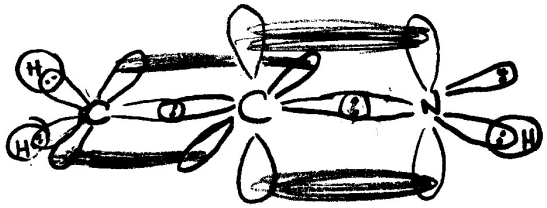




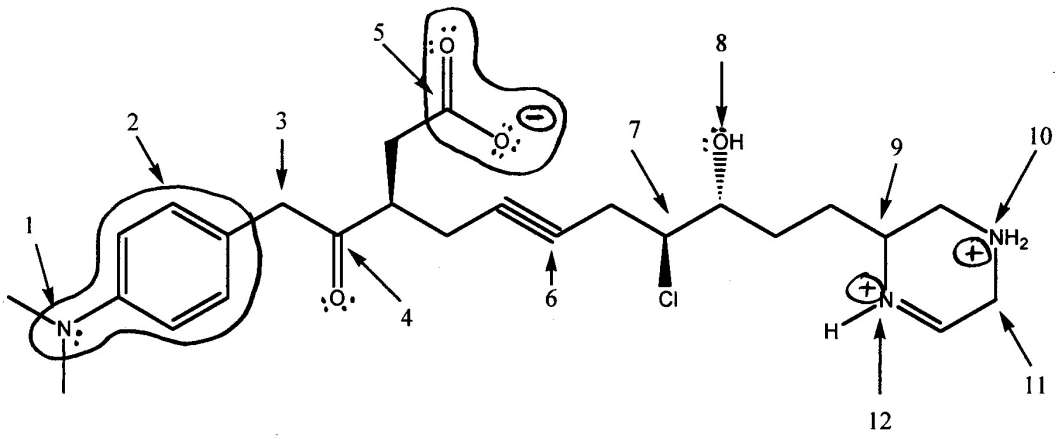
4. Draw the Lewis structure for CH_2CNH and build a model of it. Are all of the ~~N's~~ atoms in the same plane? → NO
   (Note the difference in the formula for this compound and the one in number 3!)
   Draw an orbital overlap diagram (show sigma and pi bonds as orbital overlaps).

Please Note correction!





5. Consider the structure below and answer the following questions.



A) Assuming all atoms depicted have a complete octet, write in formal charges on those atoms that have a charge as depicted in this Lewis structure. (Hint: Putting in the lone pairs may help you.)

B) What is the overall charge on the molecule?

(+1)

C) What is the hybridization on the following atoms?

N-1 = sp^2 N-10 = sp^3 C-2 = sp^2 C-4 = sp^2

C-7 = sp^3 C-9 = sp^3 N-12 = sp^2 O-8 = sp^3

D) What are the following approximate bond angles about the central atoms specified?

N-10 = ~109.5 N-12 = ~120° O-8 = ~106° C-2 = 120°

C-3 = ~109.5 C-5 = ~120° C-6 = 180° C-11 = ~109.5

E) What is the shape with respect to the following central atoms?

N-1 = PYR N-10 = TET N-12 = PL C-2 = PL

C-4 = PL C-7 = TET O-8 = B C-9 = TET

L = Linear **B = Bent** ***PL = Trigonal Planar***

TET = Tetrahedral ***PYR = Trigonal Pyramidal***

F) How many π bonds are in the structure? 8

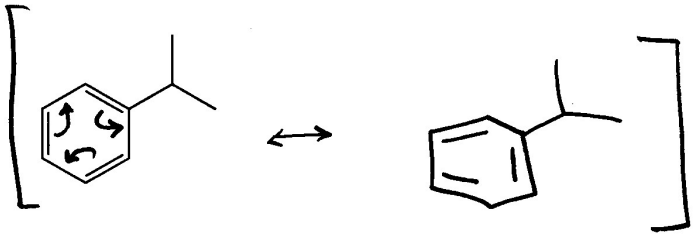
G) Circle portions of the molecule that will have pi-delocalization of electrons (electrons spread out over 3 or more atoms).

2 regions as indicated.

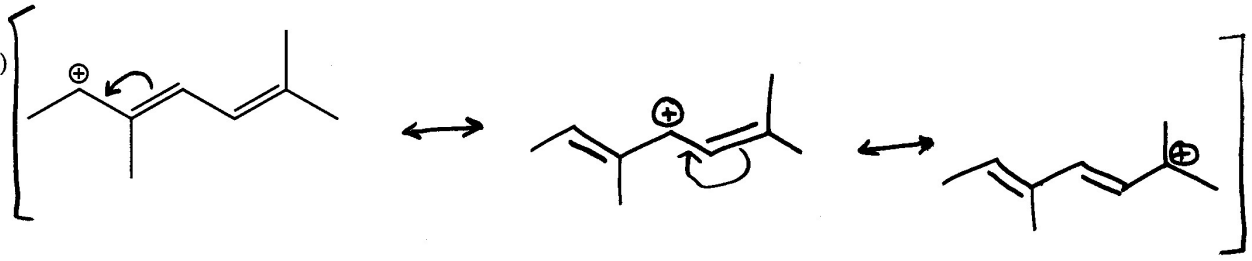
NOTE: N lonepair is in a p orbital so that it can overlap w/ the Benzene Ring.

6. Draw all of the important resonance structures for the following molecules or ions. Be sure to include formal charge assignments in each resonance structure.

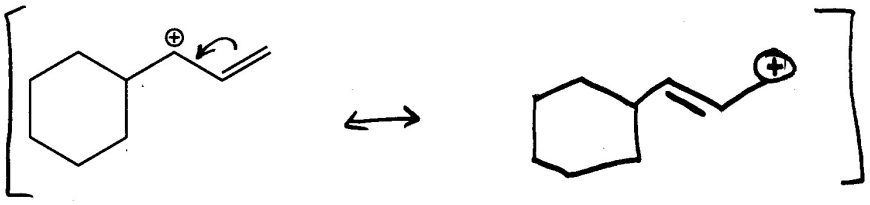
A)



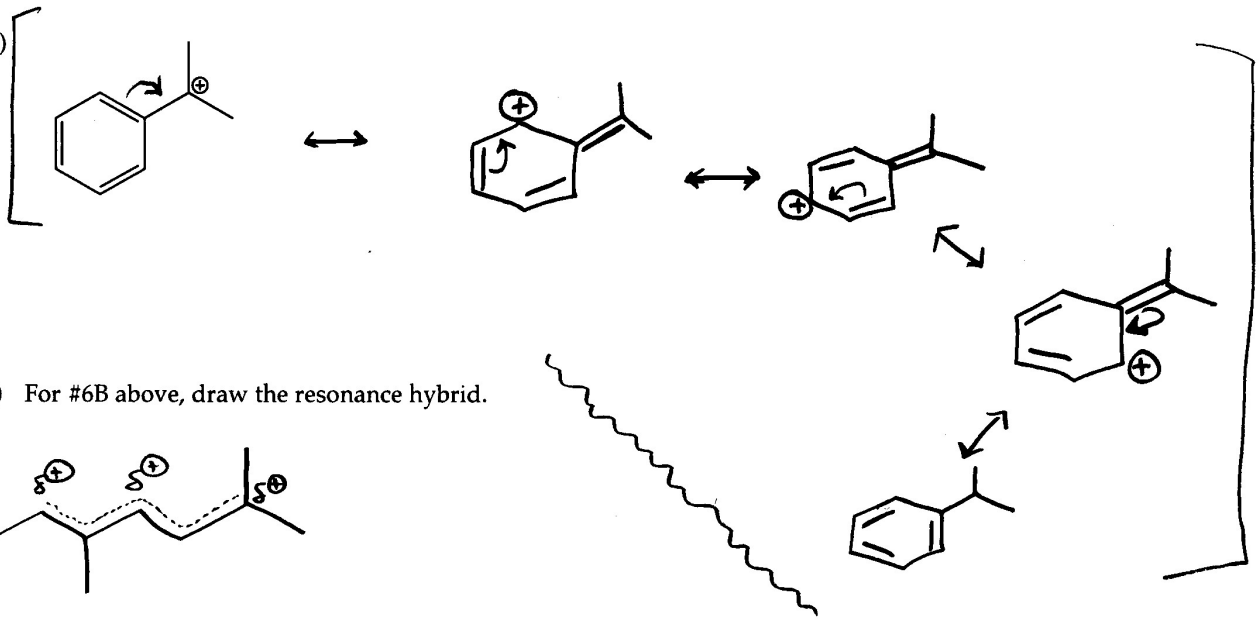
B)



C)



D)



E) For #6B above, draw the resonance hybrid.

F) For #6B above, draw the orbital overlap diagram for the π-bonds (you may depict the sigma bonds as lines.)

See next page:

6F) (overlap diagram for 6B)