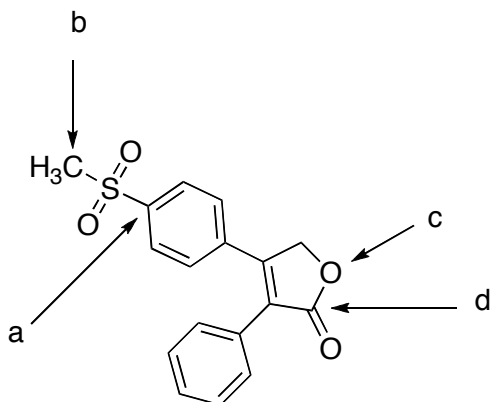


Organic Chemistry

CHM 223

Exam 1 Study Questions

Rofecoxib (Vioxx®) is an anti-inflammatory drug marketed by Merck & Co. that was withdrawn in 2004 because of concerns about increased risk of heart attack and stroke associated with its use. Predict the hybridization of the atoms indicated by each arrow. In addition, indicate the *approximate* angles made from these atoms to their adjacent atoms. See a. below for an example:



a. _____ sp^2 _____ hybridization

_____ 120° _____ angle

b. _____ hybridization

_____ angle

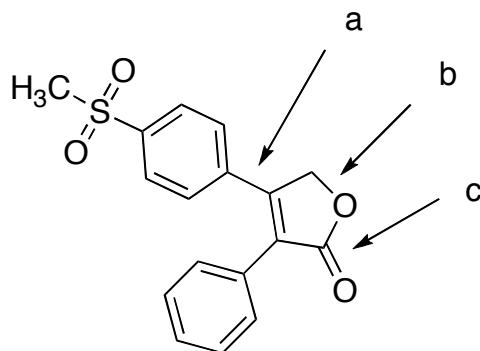
c. _____ hybridization

_____ angle

d. _____ hybridization

_____ angle

Refer to the following structure when answering questions 2 - 4.



For the indicated bonds a and c, describe each in terms of orbital overlap – see b, below for an example. If there is more than orbital overlap (Hint: bond c!), describe each.

a. _____

b. ___ carbon sp^3 orbital overlapping with oxygen sp^3 orbital _____

c. _____

Identify that which is found within the Lipitor structure by placing the number of times (0, 1, 2, etc.) each group occurs.

d. Alcohol _____

e. Carboxylic acid _____

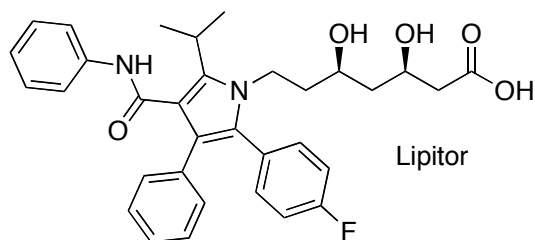
f. Ester _____

g. Amine _____

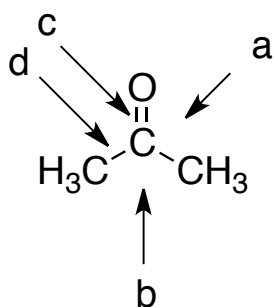
h. Amide _____

g. Alkyl halide _____

i. French Fry _____



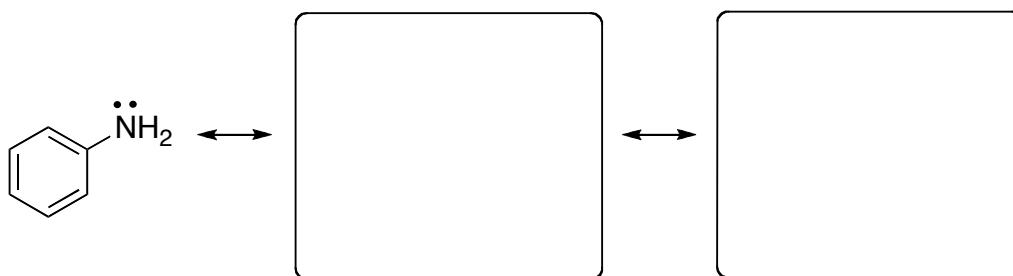
Refer to the structure of acetone, below, when filling in the blanks:



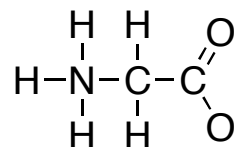
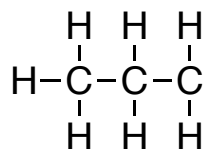
i. The $\text{O}=\text{C}-\text{C}$ bond angle labeled “a” is _____
(larger or smaller) than the $\text{C}-\text{C}-\text{C}$ bond labeled “b”.

ii. The length of the $\text{C}=\text{O}$ bond labeled “c” is _____
(longer or shorter) than the $\text{C}-\text{C}$ bond labeled “d”.

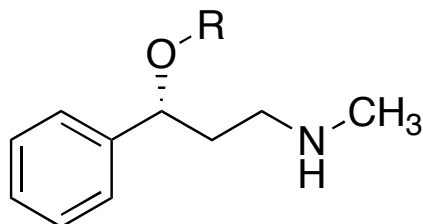
Draw 2 valid resonance structures (although you could draw more) for aniline.



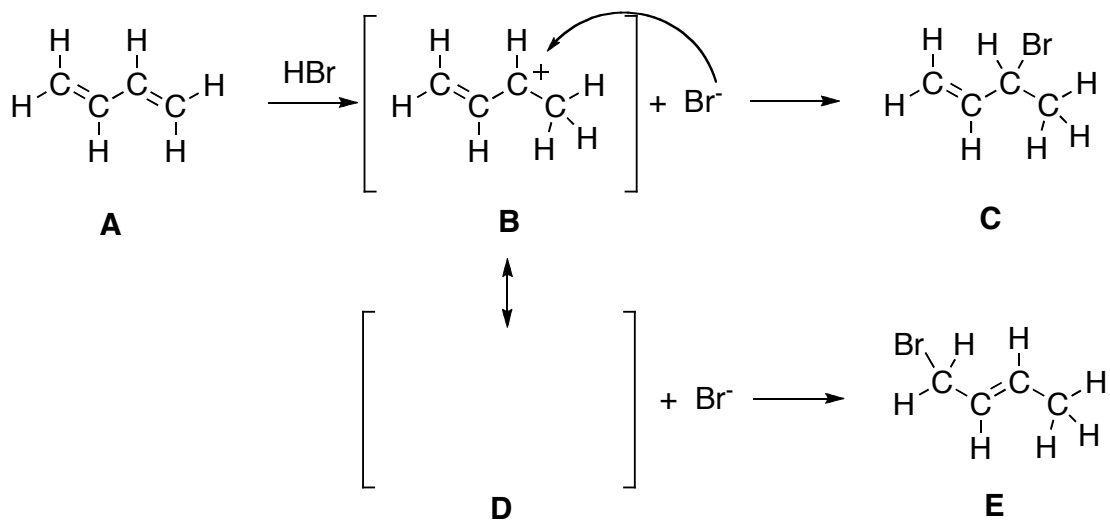
Following the rule that each atom of carbon, oxygen and nitrogen seeks to achieve a complete outer shell of eight valence electrons, add unshared pairs of electrons as necessary to complete the valence shell of each atom in these ions. Then assign formal charges as appropriate.



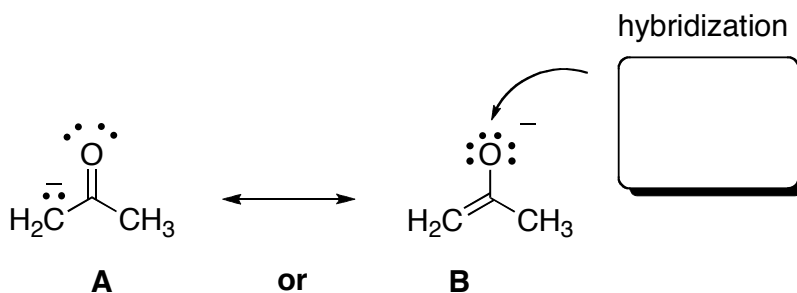
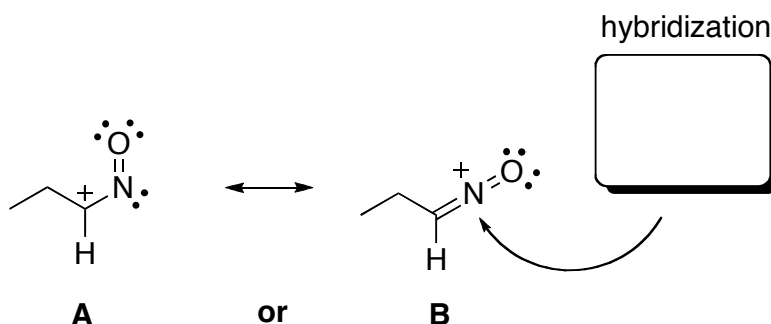
Below is a line-angle drawing of Atomoxetine, marketed by Eli Lilly and Company - it is a norepinephrine reuptake inhibitor used for the treatment of attention-deficit hyperactivity disorder. What is the molecular formula of this molecule? Hint: The usual method is to give the number of carbons and hydrogens first (C_xH_y) then any other atoms in alphabetical order.



Butadiene **A** reacts with hydrobromic acid (HBr) to form carbocation intermediate **B** and bromide. In the next step, the anionic bromide attacks the positively charged carbon of compound **B**, and a new covalent bond is formed to create **C**. Compound **E** can also be created from **B**, though the mechanism is different. Draw carbocation intermediate **D**, and, using arrows to represent electron motion, suggest a mechanism for the conversion of **B** to **D** and **D** to **E**.



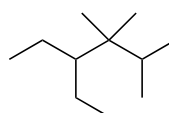
For each pair below, circle the structure (A or B) that is BEST representative of the electron distribution for that given resonance hybrid pair. Determine the hybridization of the atoms indicated by arrows.



A carbon that is sp^2 hybridized comprises 3 sp^2 hybridized orbitals and 1 unhybridized p orbital.. Show off your artistic side by drawing what an sp^2 hybridized orbital looks like (don't worry about the shading of each of the orbitals).

Draw the overlapping of two sp^2 orbitals to form a new σ (sigma) bond.

Provide IUPAC names for the following molecules:

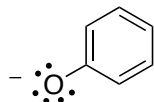


What's wrong with the following IUPAC name (draw the structure, then try re-naming it correctly).

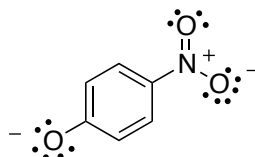
5,5,6-trimethyloctane

2-ethyl-3-methylhexane

The phenoxide anion (left structure) is relatively high in energy when compared to the para-nitrophenoxide anion (right structure). Draw a resonance structure of the para-nitrophenoxide anion that shows how the nitro group can participate in stabilizing the phenoxide anion. Hint: anions can be stabilized through delocalization.

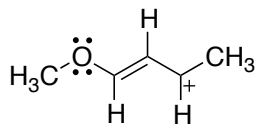


Higher energy anion - less stable

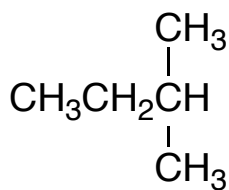


More stable, lower energy anion

The following Lewis structure does not represent the best (most relevant) resonance structure that can be drawn. Draw the best (most relevant) resonance structure for the following structure.



Identify each carbon in the structure as being either primary (1°), secondary (2°), tertiary (3°) or quaternary (4°).

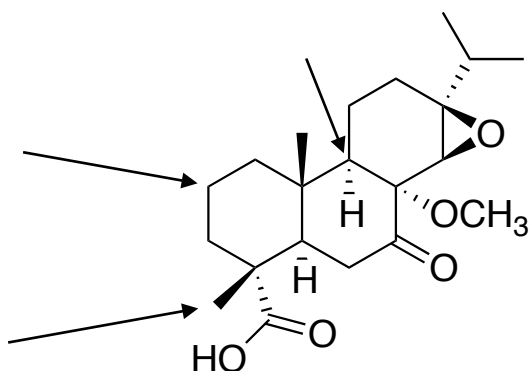


Draw a Newman projection along the C-C bond for both the anti and gauche conformations of 1,2-dibromoethane. Clearly label which one is anti and which one is gauche. Circle the most stable conformation and describe why the two conformations are not of equal stability.

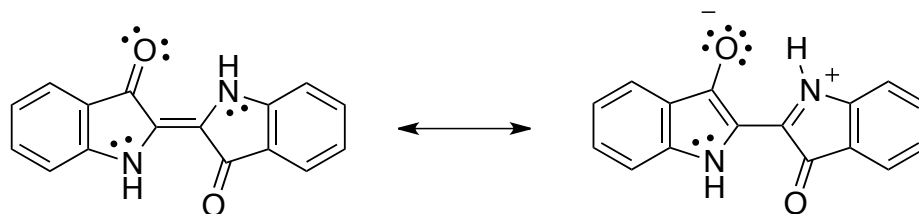


1,2-dibromoethane

For the following compound, label the four carbons with arrow pointing to them as 1°, 2°, 3° or 4°.



Draw curved arrows ON THE LEFT STRUCTURE to show how electrons can be delocalized to give the resonance structure to its right.



Of the four molecules shown below, which would have the rotational energy diagram shown?

