

Massachusetts Institute of Technology

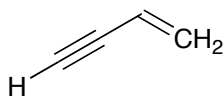
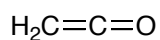
5.12: Organic Chemistry I

Fall 2008, S. O'Connor

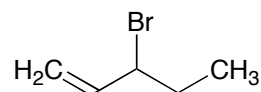
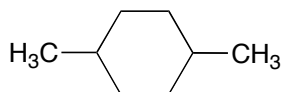
Problem Set I
Posted Wednesday September 3
Key Posted Monday September 8 at 4 pm

attempt **ALL** problems **BEFORE** looking at the key

- I. a)** Draw a molecular orbital bonding picture for each of the following. Include all bonding and non-bonding orbitals, and label each clearly.
b) Label the hybridization of each non-hydrogen atom.
c) Assign all bond angles.



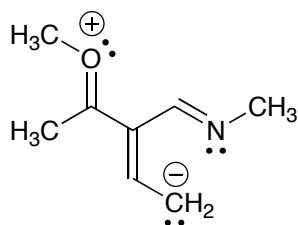
2. Using dashes and wedges, draw two **different** 3-D structures for each molecule. Only indicate 3-D structure for the **relevant** bonds in the structures.



3. A **high energy** resonance structure of the following compound is shown.

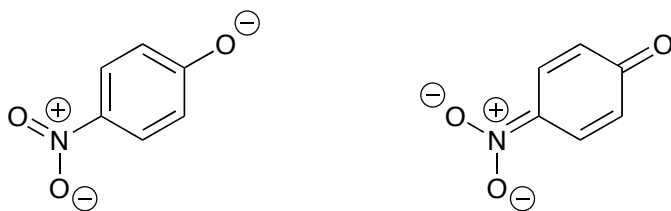
a) Briefly explain why the resonance structure is unfavorable, and provide **three lower energy resonance structures**. (Use curved arrows to interconvert structures, and show all lone pairs and formal charges.)

b) Rank the stability of the four resonance structures, and briefly explain your reasoning.



4. Circle the following pairs of structures that **do not** constitute resonance structures. For the proper resonance pairs, draw curved arrows to convert the first structure to the second. **Draw in any lone pairs that you move.**

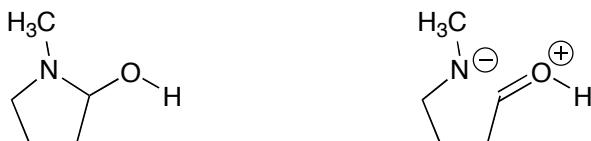
a)



b)



c)



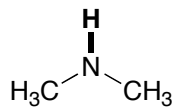
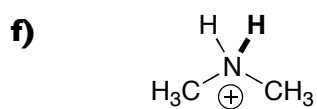
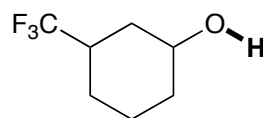
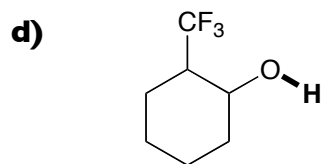
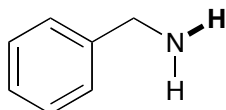
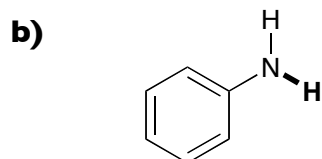
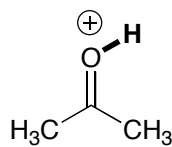
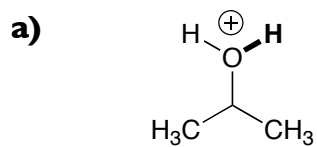
d)



e)



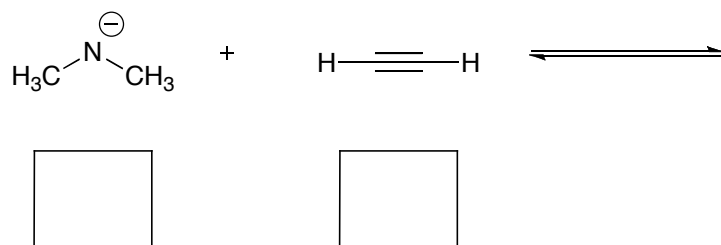
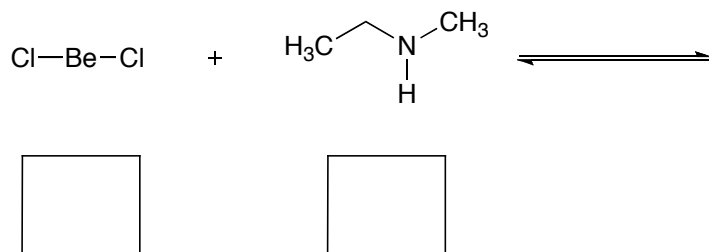
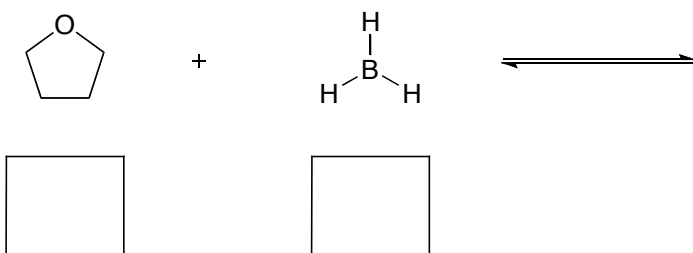
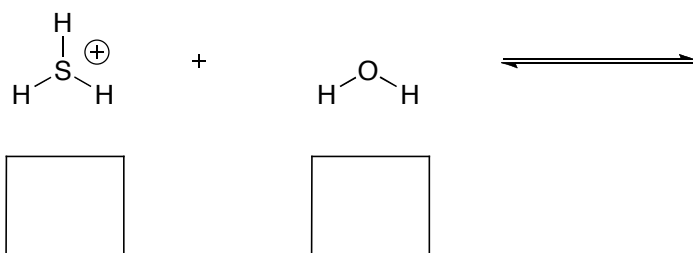
5. For each pair, circle the molecule with the **lowest pK_a** and give a brief explanation.



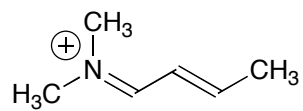
6. a) Provide the products for each of the following acid-base reactions.

b) Provide the mechanism for each reaction. **Don't forget lone pairs and formal charges!**

c) Label each reactant as a Lewis acid (**LA**), Lewis base (**LB**), Brønsted acid (**BA**), or Brønsted base (**BB**).

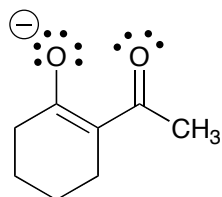


7. a) Use resonance to determine which of the atoms in **A** are **electrophilic**, and circle the electrophilic atoms. **Draw all relevant resonance structures.**



A

b) Use resonance to determine which of the atoms in **B** are **nucleophilic**, and circle the nucleophilic atoms. **Draw all relevant resonance structures.**



B