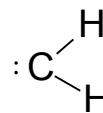
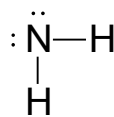
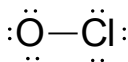
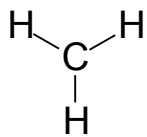
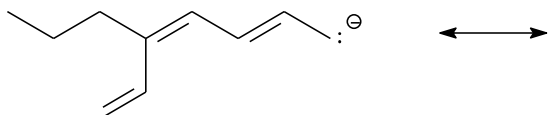


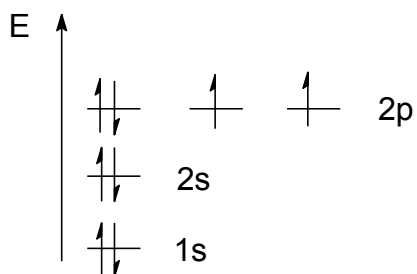
1. (4 pts) Calculate the formal charge on each **C**, **O**, and **N** in the structures below. All non-bonded electrons are shown.



2. (6 pts) Draw **THREE** more Resonance Structures for the carbanion intermediate shown below. Use arrows to show "pushing of electrons". Each resonance structure you draw should have the Negative Charge on a Different Carbon.



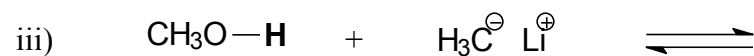
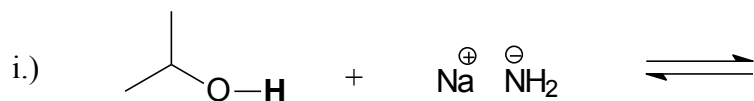
3. (5 pts) Draw an orbital energy level diagram for sp^2 hybrid Oxygen. The electron count for unhybridized Oxygen is $1s^2 2s^2 2p^4$.



4. For each acid-base reaction shown below (the acid is on the left, the base is on the right, the proton which is of interest is drawn in **BOLD**):

A) (8 pts) Draw the structures of the conjugate acid and conjugate base.

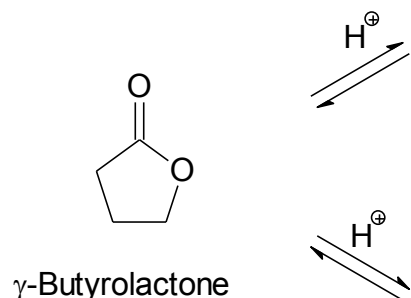
B) (4 pts) Decide whether the equilibrium favors the FORWARD reaction, the REVERSE reaction, or NEITHER.



5. Protonation of γ -Butyrolactone at could occur at either Oxygen.

A) 5 points. Draw the structures of conjugate acids that would be formed by protonation of γ -Butyrolactone at either Oxygen.

B) 5 points. Which conjugate acid is more stable? Explain your choice carefully.



6. (9 pts) Draw an acceptable structure for each of the following:

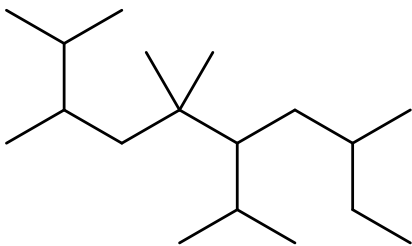
A) 5-(*tert*-butyl)-7-ethyl-6-isopropyl-2-methylnonane

B) 5-(*sec*-butyl)-1,1,3,3-tetramethylcycloheptane

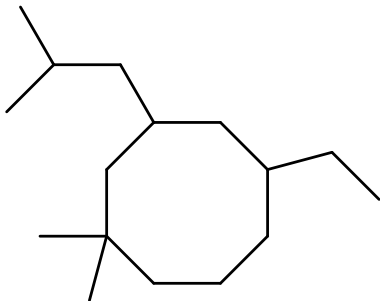
C) bicyclo[3.2.0]heptane

7. (9 pts) Provide an acceptable name for each of the following structures:

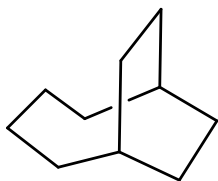
A)



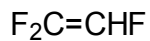
B)



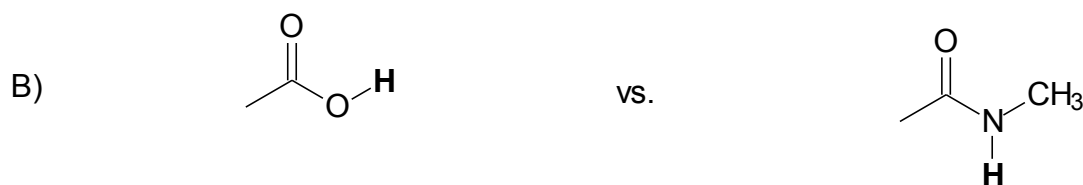
C)



7. (8 pts) Draw a 3-D representation of each of the following molecules. Use wedges and dashes where needed to clearly indicate geometry. Indicate the direction of the Dipole ($\text{+} \longrightarrow$) for each molecule.



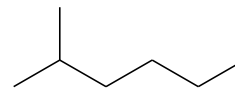
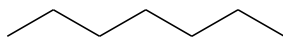
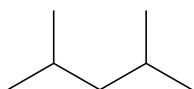
9. (8 pts) For each pair of compounds, indicate which one is the stronger acid (*i.e.* – the **H** in **BOLD**). For full credit, draw the structure of each conjugate base, and provide a brief explanation.



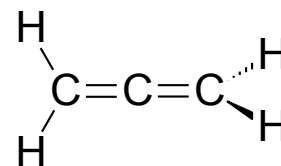
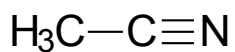
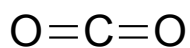
10. (10 pts) Draw a complete set of 6 Newman Projections for 2,2,3-trimethylbutane, considering rotation about the C2-C3 bond (C2 is the front carbon). Indicate which structure(s) are MOST stable and LEAST stable.

11. (5 pts) DRAW and NAME all of the alkanes with the molecular formula C_6H_{14} .

12. (6 pts) Rank the three isomeric alkanes shown below in order of STABILITY (Most to Least). Briefly, explain how this order is determined experimentally.



13. (4 pts) Circle all of the atoms in the structures below that are sp hybrid.



14. (4 pts) Draw the Resonance Hybrid (the weighted average of the available resonance forms) of the resonance structures shown below:

