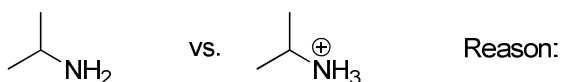
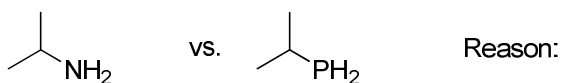
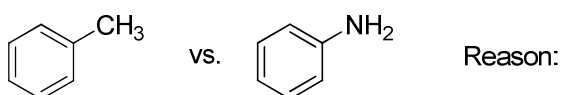
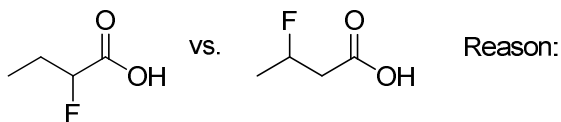
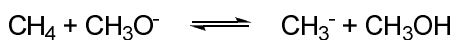
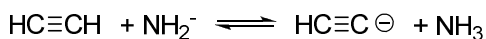
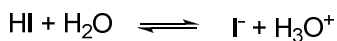


1) Acids and bases (20 pts)

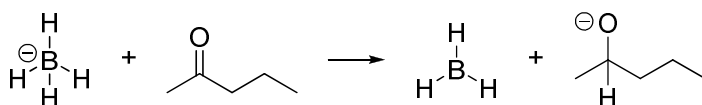
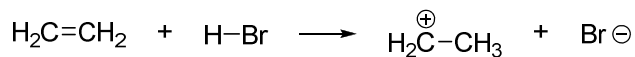
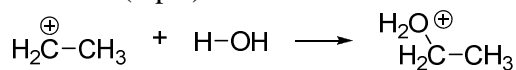
- a. For each pair of compounds shown below, select the more acidic of the two compounds and explain your reasoning. (8 pts)



- b. For each of the following reactions, does the equilibrium favor the reactants or products? (3 pts)

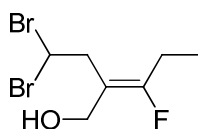
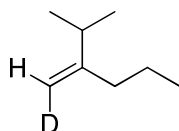
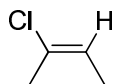


- c. Complete each arrow-pushing mechanism and identify the HOMO and LUMO of each reaction. (9 pts)

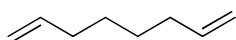


2) Alkene naming and stereoisomers (15 pts)

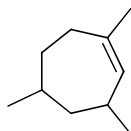
- a. Assign an E or Z descriptor to the following molecules. D is deuterium, an atom with the same atomic number as hydrogen, but with an atomic weight of 2 instead of 1. (6 pts)



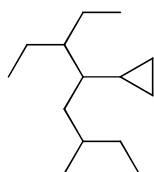
- b. Name the following structures. Include E/Z descriptors where appropriate. (6 pts)



Name:



Name:

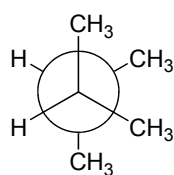
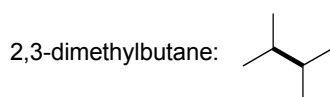


Name:

- c. Draw the structure of (Z)-4-*tert*-butyl-2,3-dimethyl-3-hexene. (3 pts)

- 3) The structure of 2,3-dimethylbutane is shown below. Sighting along the C2-C3 bond (shown in bold), show a Newman projection for the molecule for dihedral angles in increments of 60° . **Keep the front atom stationary and rotate the back atom clockwise.** For each conformation, plot these energy levels and create a conformational energy diagram. You do not need to calculate the exact energy for each level – a rough estimate is acceptable. (20 pts)

| Interaction | Energy (kcal/mol) |
|---|-------------------|
| H/H eclipsed | 1 |
| CH ₃ /H eclipsed | 1.15 |
| CH ₃ /CH ₃ eclipsed | 3.6 |
| CH ₃ /CH ₃ gauche | 0.67 |



Interactions:

3 x
CH₃/CH₃
gauche

Interactions:

Interactions:

Interactions:

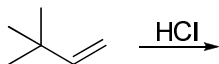
Interactions:

Interactions:

Interactions:

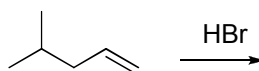
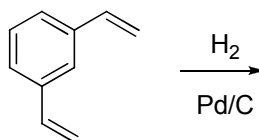
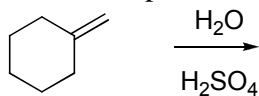
4) Additions to alkenes (20 pts)

a. Predict the major product of the reaction shown below. (4 pts)

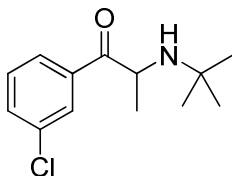


b. Write an arrow-pushing mechanism for this reaction. Show all intermediates including correct formal charges, but do not show transition states. (10 pts)

c. Predict the products of the following reactions. (6 pts)



- 5) Wellbutrin, shown below, is an antidepressant and smoking cessation aid. Which of the listed functional groups does Wellbutrin contain? Circle all that apply. (5 pts)



- | | | | | |
|----------|---------|-------|---------|----------------------|
| Aldehyde | Ketone | Amide | Amine | Aromatic Hydrocarbon |
| Alkyne | Alcohol | Ester | Nitrile | Carboxylic Acid |

- 6) Draw all the constitutional isomers with formula C_4H_9I , using bond-line structures. Be careful not to repeat any structures. (10 pts)

- 7) Put the following alkenes in order of stability, from most stable to least stable. 2-methyl-2-butene, 1-pentene, (E)-2-pentene, (Z)-2-pentene (5 pts)

- 8) The structure of ethynyl estradiol, an oral contraceptive, is shown below. For each of the labeled atoms, describe the hybridization as sp , sp^2 , or sp^3 . (5 pts)

