Chem 112A: First Midterm

October 7th, 2010

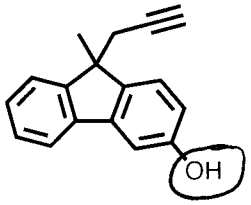
Please provide all answers in the space provided. You are not allowed to use a calculator for this exam, but you may use (previously disassembled) molecular model kits. Including the title page, there should be 8 total questions spread over 6 pages. There is also a seventh page that should be blank. You can use this last page for scratch paper if you need it, but please remember to copy your answers into appropriate exam question.

Name: Key

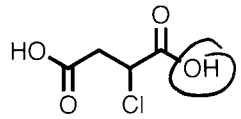
GSI/Section: ———

(1)	_____	(6 points)
(2)	_____	(14 points)
(3)	_____	(15 points)
(4)	_____	(10 points)
(5)	_____	(13 points)
(6)	_____	(12 points)
(7)	_____	(12 points)
(8)	_____	(18 points)
TOTAL	_____	(100 points)

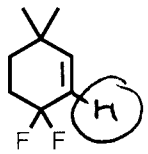
6. Predict the most acidic proton for each of the following compounds. BRIEFLY justify your answer (3 points each):

a. 

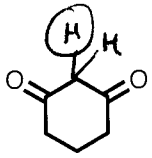
O is more electronegative than C

b. 

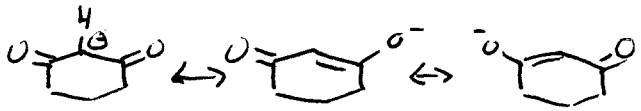
inductive effects of nearby chlorine atom

c. 

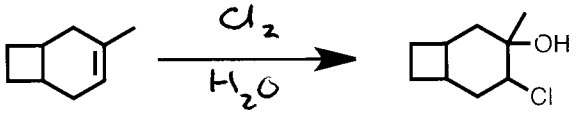
sp^2 is more acidic than sp^3 C-H, plus inductive effects.

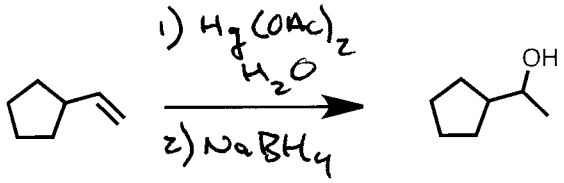
d. 

most possible resonance structures:

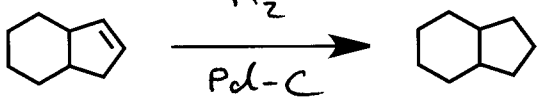


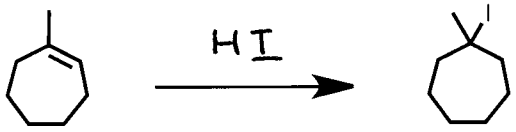
7. Fill in the missing reagents for each of the following organic transformations (3 points each).

a. 

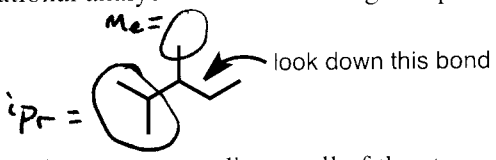
b. 

- H_3O^+ not OK due to rearrangement

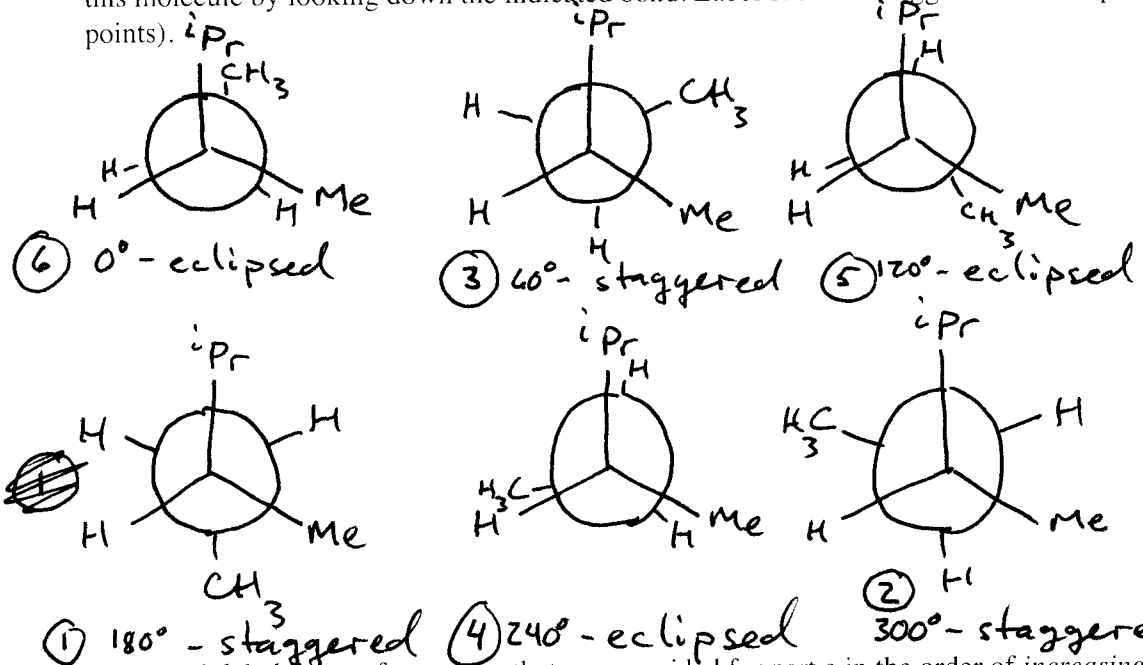
c. 

d. 

5. Provide a full conformational analysis of the following compound by completing the following steps:

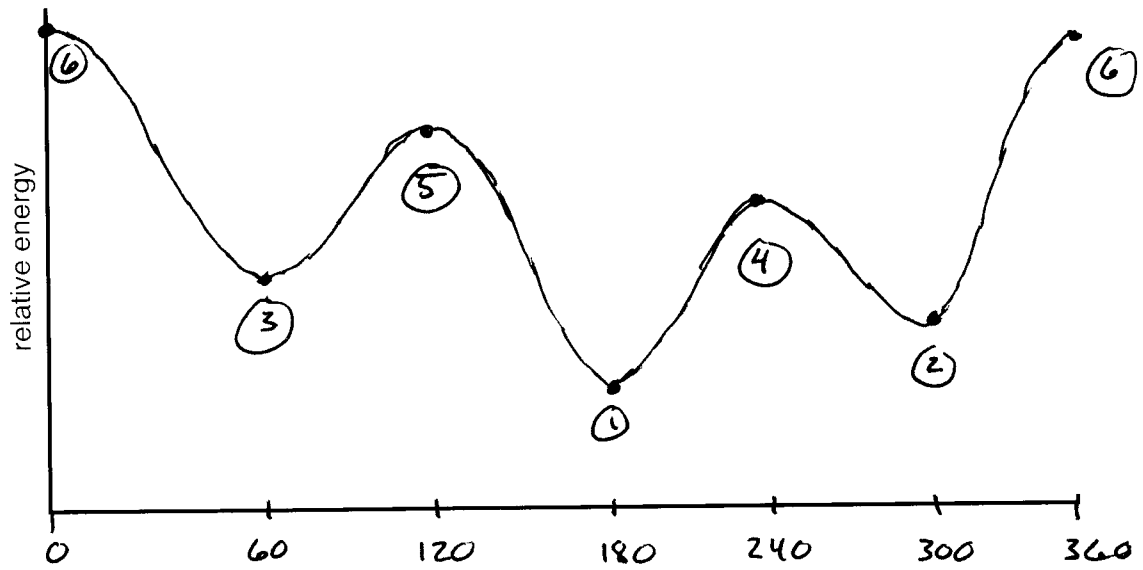


a. Draw Newman projections corresponding to all of the staggered and eclipsed conformations of this molecule by looking down the indicated bond. Label each as "staggered" or "eclipsed" (7 points).



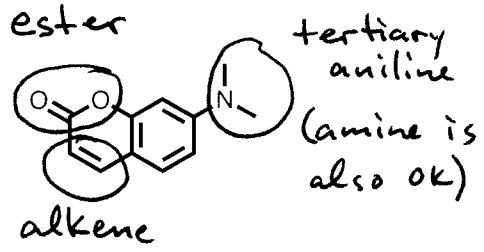
b. Next, rank label the conformations that you provided for part a in the order of *increasing* energy. Start your numbering by assigning the lowest energy conformation as "1" (3 points).

c. Using the coordinate axes that are provided, plot the energy of the conformers that you drew in part a. Label the maxima and minima with the numbers you assigned in part b. You do not need to provide any specific energy values or re-draw the Newman projections (3 points).

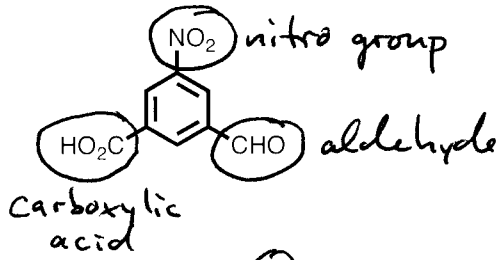


3. Circle and identify the functional groups in the following compounds. You do not need to specify the "alkyl" and "aromatic" groups as part of your answer (3 points each).

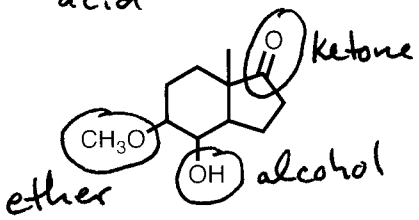
a.



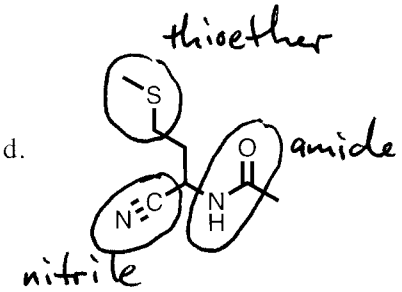
b.



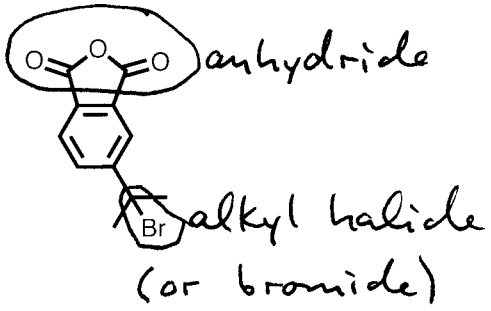
c.



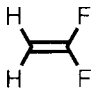
d.



e.

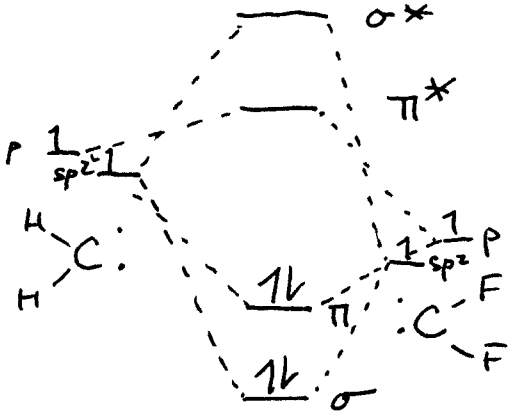


4. Provide an orbital interaction diagram for 1,1-difluoroethene *considering only the carbon-carbon double bond*. Clearly label molecular orbitals that you generate. Finally, sketch the highest energy molecular orbital that contains electrons and the lowest energy empty orbital on the structures at right (10 points).



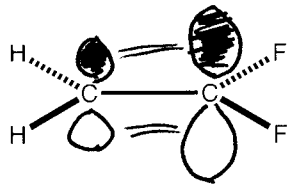
1,1-difluoroethene

orbital interaction diagram:



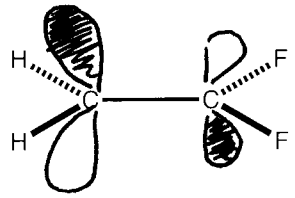
Highest energy orbital that contains electrons:

π:

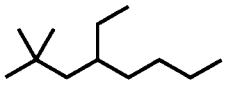


Lowest energy orbital that is unoccupied:

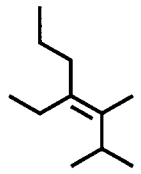
π*:



1. Provide IUPAC names for each of the following compounds (3 points each):

a. 

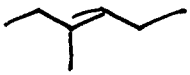
4-ethyl-2,2-dimethyloctane

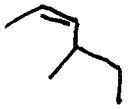
b. 

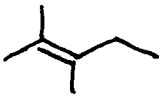
(E)-4-ethyl-2,3-dimethyl-3-heptene

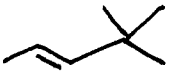
2. Provide accurate structures of each of the following alkenes (2 points each):

a. 1-heptene  (5)

b. (*E*)-3-methyl-3-hexene  (2)

c. (*Z*)-4-methyl-2-hexene  (4)

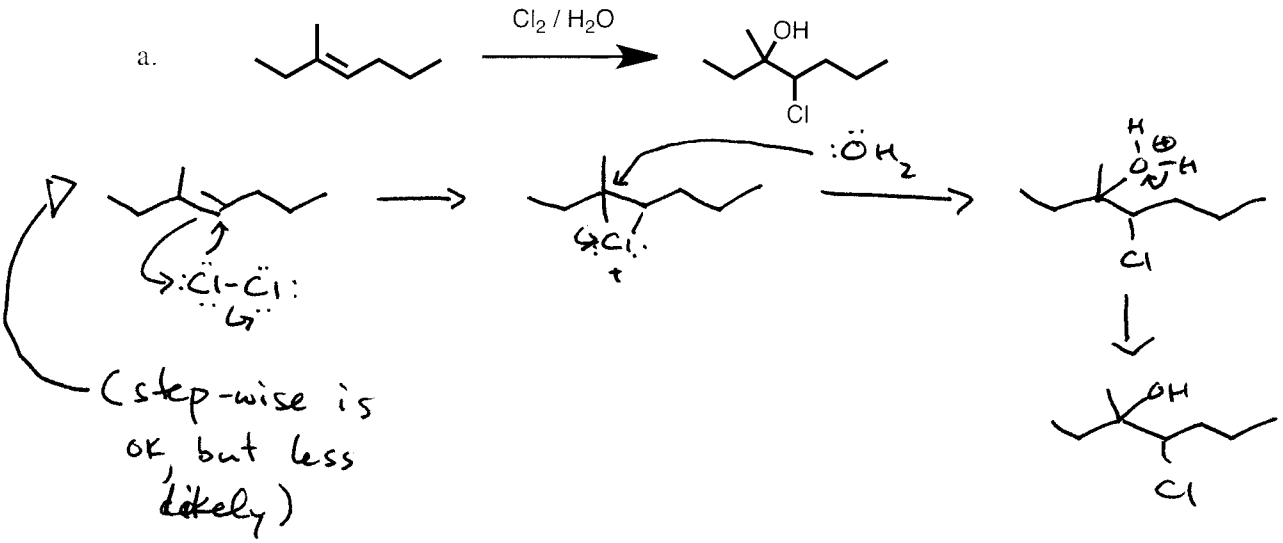
d. 2,3-dimethyl-2-pentene  (1)

e. (*E*)-4,4-dimethyl-2-pentene  (3)

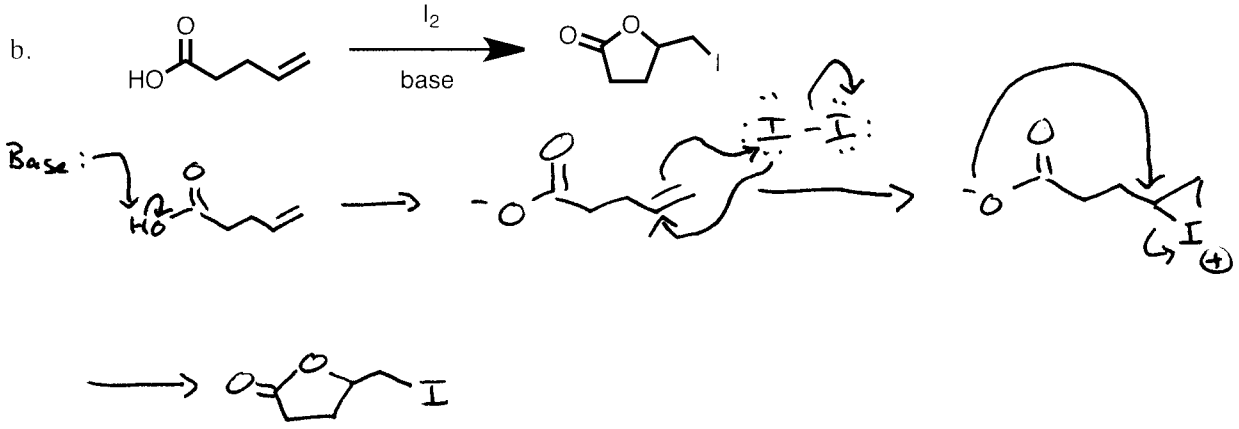
f. Rank the structures you provided above in terms of their relative energies (1 being the lowest and 5 being the highest, 4 points).

8. Provide arrow pushing mechanisms for each of the following reactions (6 points each).

a.



b.



c.