Chem 112A: Second Midterm

November 8th, 2011

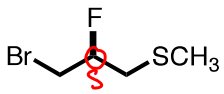
Please provide all answers in the spaces provided. You are not allowed to use a calculator for this exam, but you may use molecular model kits. Only unsubstituted cyclohexane rings may be pre-assembled. Including the title page, there should be **11** total questions spread over **6** pages. There is 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 the blanks that are provided for each question.

Name: Answer Key

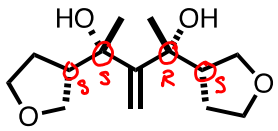
GSI/Section: _____

(1)	_____	(12 points)
(2)	_____	(18 points)
(3)	_____	(12 points)
(4)	_____	(12 points)
(5)	_____	(5 points)
(6)	_____	(4 points)
(7)	_____	(5 points)
(8)	_____	(6 points)
(9)	_____	(12 points)
(10)	_____	(6 points)
(11)	_____	(8 points)
TOTAL	_____	(100 points)

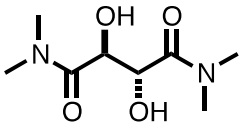
1. Label each of the following compounds as “chiral” or “achiral” AND indicate if any of these structures are *meso* compounds. For each of the chiral compounds, circle all of the stereogenic centers and label them as (*R*) or (*S*) (3 points each).

a. 

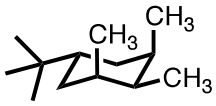
Chiral

c. 

Chiral

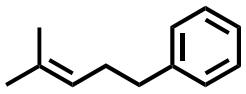
b. 

achiral
meso

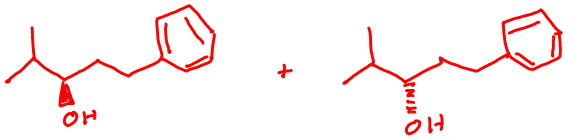
d. 

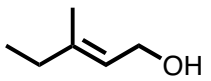
achiral
meso

2. Provide the major product(s) of each reaction shown below, including all unique stereoisomers (3 points each).

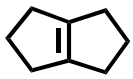
a. 

1. BH_3
2. H_2O_2 / NaOH



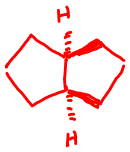
b. 

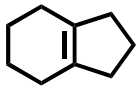
I_2 / H_2O

c. 

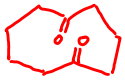
H_2

Pd/C

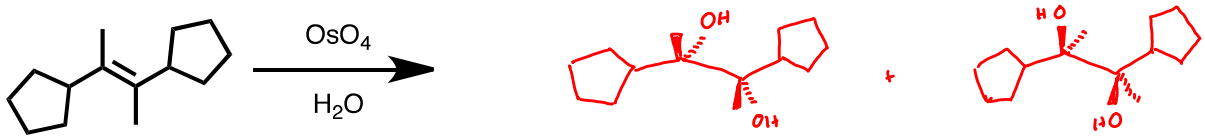


d. 

1. O_3
2. PPh_3

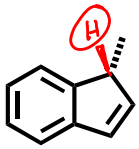
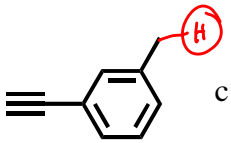
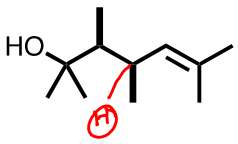


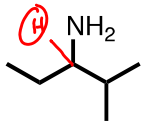
Question 2, continued:

e. 

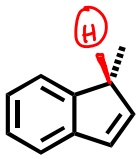
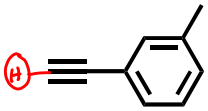
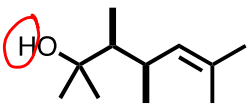
f. 

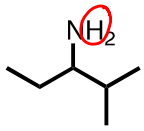
3. For each of the following compounds, indicate (and draw in, if necessary) the hydrogen atom that is attached to the *weakest bond* (3 points each).

a.  b.  c. 

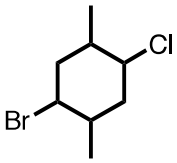
d. 

4. For each of the following compounds, indicate (and draw in, if necessary) the *most acidic proton* (3 points each).

a.  b.  c. 

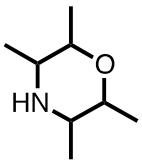
d. 

5. The following substituted cyclohexane compound could exist as a number of different stereoisomers. First, indicate how many there could be (note that you do NOT have to draw them all!). Considering all possibilities, next draw the isomer(s) that would be the lowest in energy (5 points).

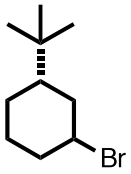


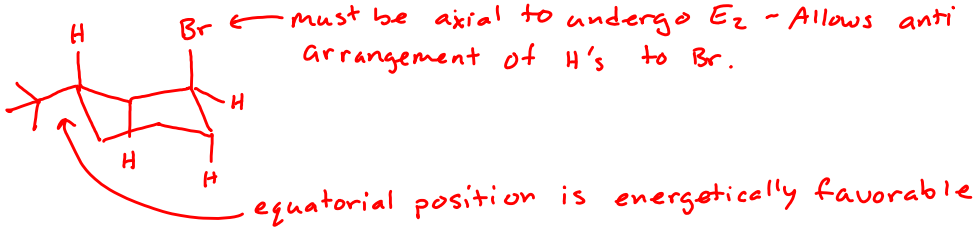
$2^4 = 16$

6. For the following compound, supply the necessary sterochemistry that would correspond to a *meso* structure. Only one correct answer is required (4 points).



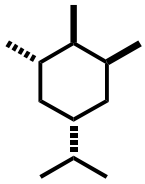
7. Provide the stereoisomer of the following cyclohexane derivative that would undergo E_2 elimination the fastest. Briefly justify your answer (5 points).

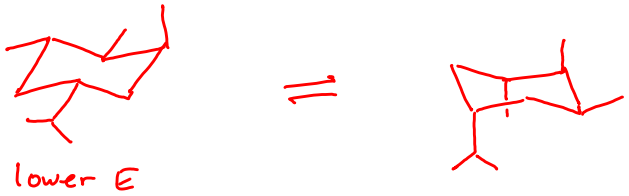




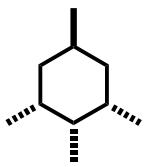
8. Provide clear drawings of both possible chair conformations for each of the following substituted cyclohexanes. For each pair, also indicate which conformer would be the lowest in energy (3 points each).

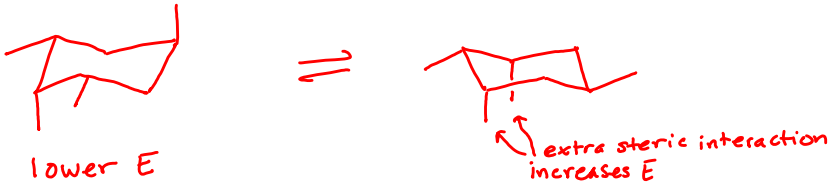
a.



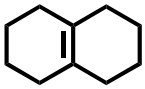


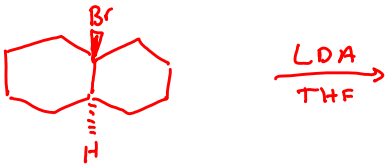
b.

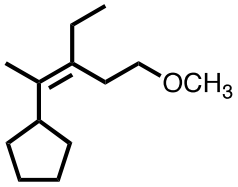


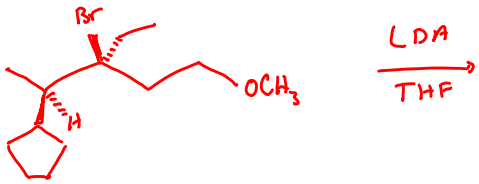


9. Provide an appropriate alkyl bromide starting material that could be used to prepare each of the following alkene products with the indicated stereochemistry. In cases where the products are chiral, provide a structure that will only produce the enantiomer that is shown. Also supply the reaction conditions that you would use to carry out your transformations (4 points each).

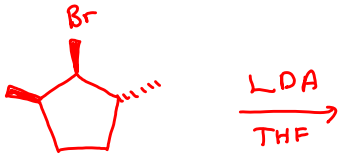
a. 



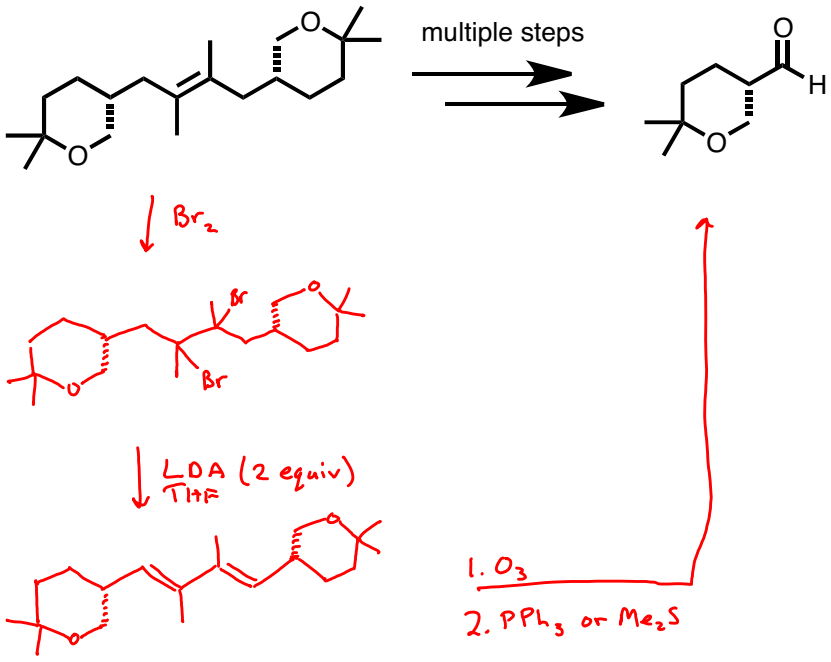
b. 



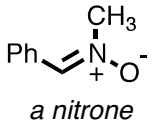
c. 



10. Link together a series of reactions you have learned in class to show how the following overall transformation can be achieved. Draw all of the intermediates along the synthetic route that you propose and supply all reagents and reaction conditions as appropriate. *No "arrow-pushing" mechanisms are required* (6 points).

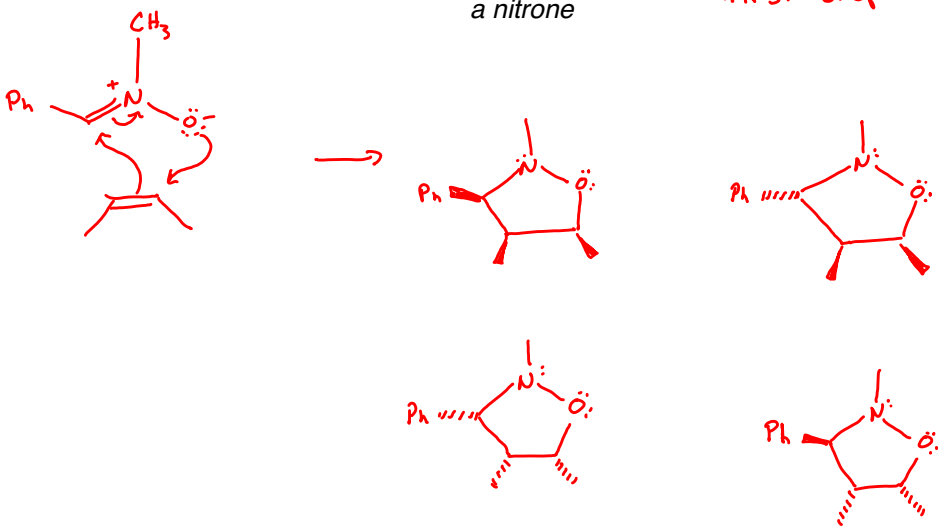


11. Nitrones (shown below) are a class of compounds that react readily with alkenes to generate products with stable rings. By making analogies to the reactions you have learned in class, propose the full set of products that would be obtained when the nitrone shown below reacts with (*Z*)-2-butene. Also provide a detailed arrow pushing mechanism that shows how one of your products was formed (8 points).



a nitrone

- Mechanism is similar to first step of ozonolysis.



This last page should be blank. You may use it as scratch paper, but be sure to recopy your answers into the exam questions so that we can grade them easily.