

CHEM 3311-100 Spring 2007

Final Exam

Professor R. Hoenigman

Average Score = 148

High Score = 255

Low Score = 27

I pledge to uphold the CU Honor Code:

Signature _____

Name (printed) _____

Last four digits of your student ID number _____

Recitation TA _____

Recitation number, day, and time _____

You have 2 hours and 30 minutes to complete this exam.

No model kits or calculators allowed.

Periodic table and scratch paper are attached.

DO NOT TURN THIS PAGE UNTIL INSTRUCTED TO DO SO.

Recitation Sections:

Score:

#	Day	Time	TA	Page 1	Page 6
121	Tuesday	8 am	Kelly	_____ /16	_____ /40
131	Tuesday	1 pm	Kelly	Page 2 _____ /15	Page 7 _____ /40
141	Wednesday	8 am	Greg	Page 3 _____ /20	Page 8 _____ /24
151	Wednesday	12 pm	Greg	Page 4 _____ /30	Page 9 _____ /45
153	Wednesday	12 pm	Kelly	Page 5 _____ /20	Page 10 _____ /10
152	Wednesday	5 pm	Kelly		
171	Thursday	12 pm	Greg		

TOTAL _____ /250

1. (10 pts) Uscharidin is a poisonous natural product with the structure shown below.

A. Label the configuration of each indicated chirality center in Uscharidin.

(2 pts each)

B. Circle **all** of the terms below that describe one or more structural feature of Uscharidin. [Book Problem 4.31a](#)

(1 pts each)

Amine

Ketone

Aldehyde

Amide

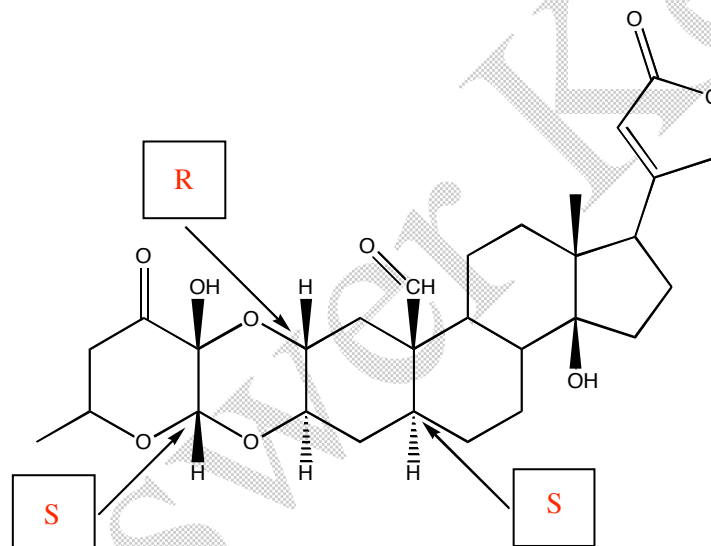
Ester

Sulfide

Nitrile

Ether

Thiol



2. (6 pts) One or more of the following names do not follow the IUPAC rules.

Circle the incorrect name(s) and provide a correct IUPAC name.

(1 pt circle, 2 pt name, -1 pt for incorrect circle)

A. (3E)-4-isopropyl-2,3-dimethyl-3-pentene

E-2,3,4,5-tetramethyl-3-hexene

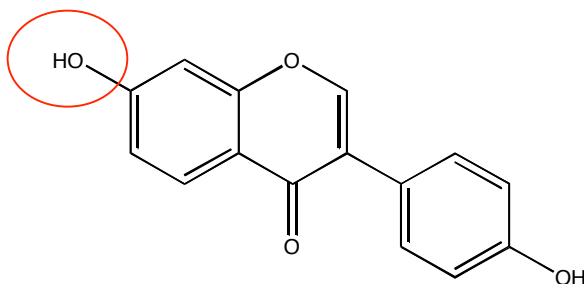
B. 2,6-dimethyl-2-octen-4-yne

C. (3S,4S)-1-bromo-3-chloro-4-hexanol

(3S,4S)-6-bromo-4-chloro-3-hexanol

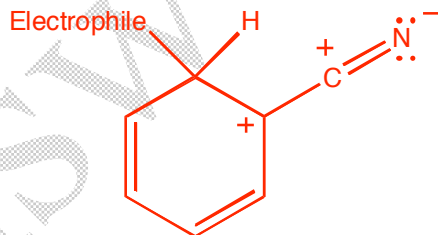
D. (2R)-3,3,5,5-tetramethyl-6-hepten-2-ol

3. (5 pts) Although many Southerners think Kudzu is, to put it mildly, a noxious weed, Kudzu does have some medicinal properties. The roots of Kudzu have been used in traditional Chinese folk medicine to suppress the affects of alcohol. The active ingredient in Kudzu root is diadzein, shown below. Circle the most acidic hydrogen in diadzein.

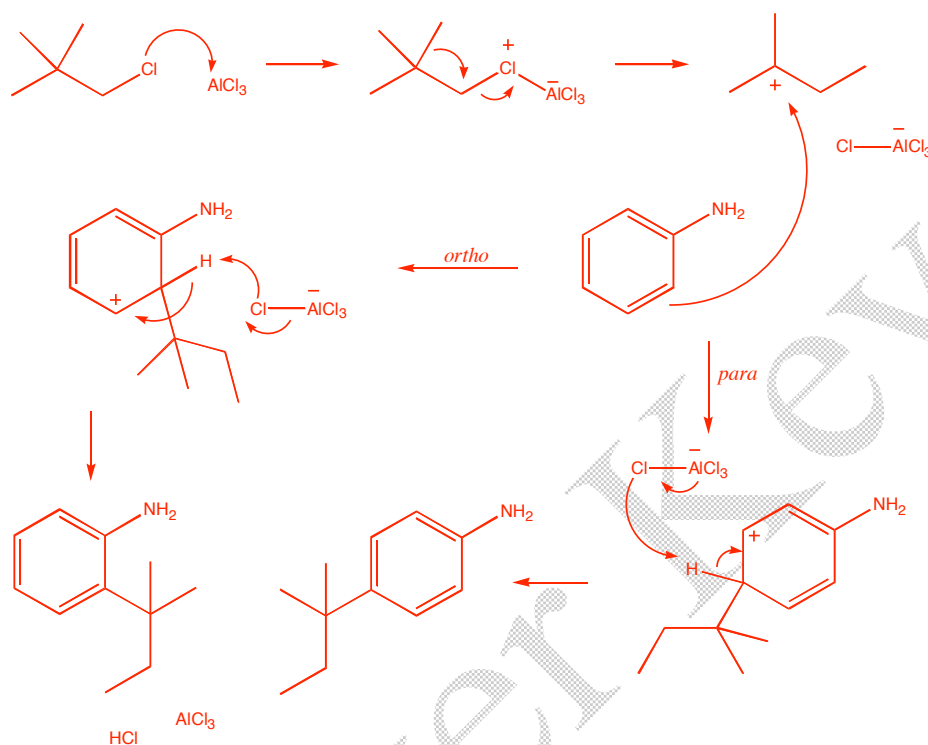


4. (10 pts) Explain why a cyano group is a deactivating, *meta* director. Use resonance structures to support your discussion.

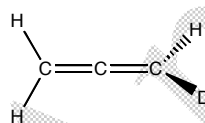
The cyano group is electron withdrawing, and makes benzene less electron-rich, thus deactivating the ring. The cyano group is a *meta* director since the following resonance structure would be *destabilized* (due to adjacent positive charges) by *ortho/para* attack.



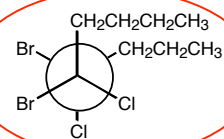
5. (15 pts) Using curved arrows to show the flow of electrons, give a mechanism to account for the Friedel-Crafts alkylation of aniline with 1-chloro-2,2-dimethylpropane.



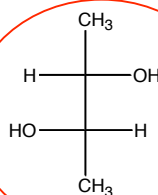
6. (5 pts) Circle the compounds below that are chiral.
(1 pt each, -1 total for any incorrect circles)



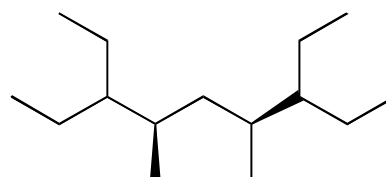
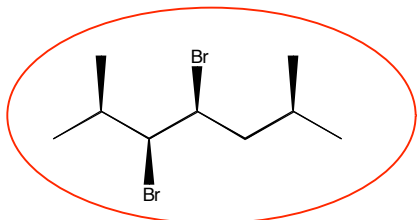
cis-3-methylcyclopentanol



(3*S*,4*S*)-3,4-dimethylhexane

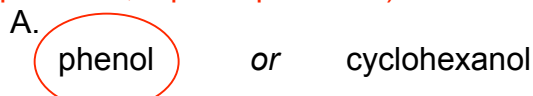


(2*R*,3*S*)-2,3-butanediol

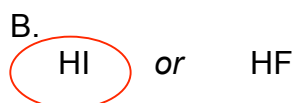


7. (15 pts) Circle the more acidic compound in the following pairs. Give the reason for your choice in the adjacent box.

(2 pts circle, 3 pts explanation)

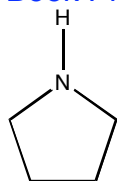


The conjugate base is more stable (has more resonance structures).

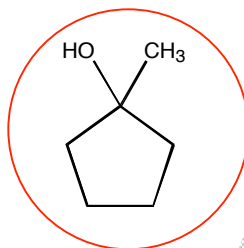


Iodine is more polarizable.

C. Book Problem 1.63



or

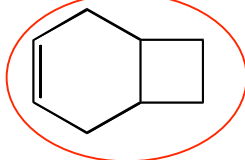


Oxygen is more electronegative than nitrogen, so the conjugate base is more stable.

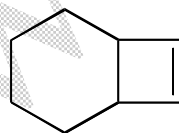
8. (15 pts) Circle the more stable compound. Give the reason for your choice in the adjacent box.

(2 pts circle, 3 pts explanation)

A. Book Problem 5.30c

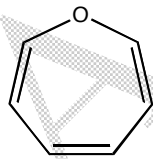


or

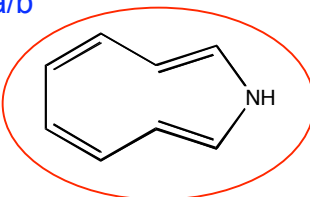


Less strained double bond.

B. Book Problem 11.52 a/b



or



Aromatic compound versus an anti-aromatic compound.

C. (1R,2R)-1-ethyl-2-isopropyl-1-methylcyclohexane

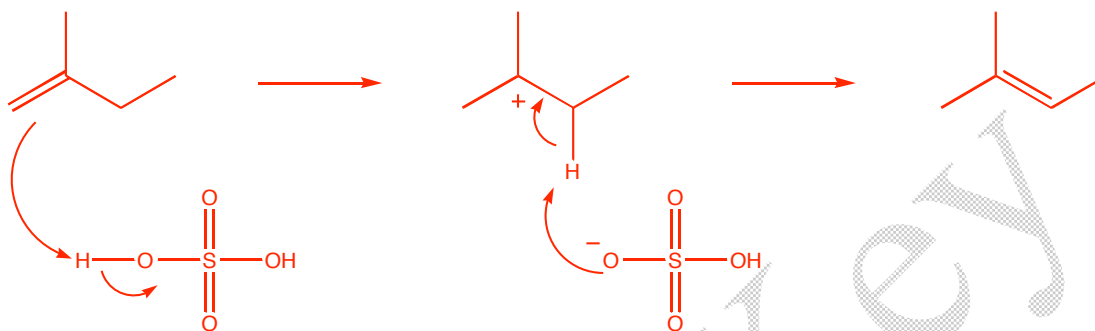
or

(1R,2S)-1-ethyl-2-isopropyl-1-methylcyclohexane

The larger groups are equatorial.

9. (10 pts) As a method for the preparation of alkenes, a weakness in the acid-catalyzed dehydration of alcohols is that the initially formed alkene (or mixture of alkenes) sometimes isomerizes under the conditions of its formation. Write a mechanism showing how 2-methyl-1-butene might isomerize to 2-methyl-2-butene in the presence of sulfuric acid.

Book Problem 6.47



10. (5 pts) Match the following alkenes with the appropriate ΔH_{comb} value. Heats of combustion: 5293 kJ/mol, 4658 kJ/mol, 4650 kJ/mol, 4638 kJ/mol, 4632 kJ/mol
Book Problem 5.29 (1 pt each)

4658 kJ.mol 1-heptene

4638 kJ.mol 2,4-dimethyl-1-pentene

4632 kJ.mol 2,4-dimethyl-2-pentene

4650 kJ.mol (Z)-4,4-dimethyl-2-pentene

5293 kJ.mol 2,4,4-trimethyl-2-pentene

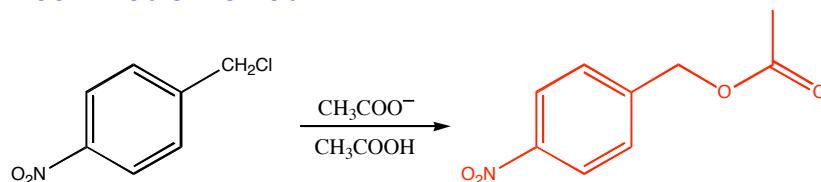
11. (5 pts) What is the difference between the absolute configuration and relative configuration of (+)-tartaric acid?

The relative configuration of a compound is the configuration we know based on some sort of chemical transformation. The absolute configuration is obtained from x-ray crystallography, where we know exactly where the atoms are in 3D space.

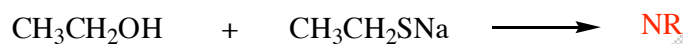
12. (80 pts) Give the major organic product(s) of the following reactions. Be sure to clearly show stereochemistry using dashes and wedges. Write NR if no reaction occurs. **Clearly label any enantiomers, diastereomers, and/or meso compounds.** (Note: some problems have more than one step.)

(5 pts each)

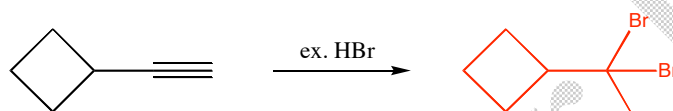
A. [Book Problem 8.20b](#)



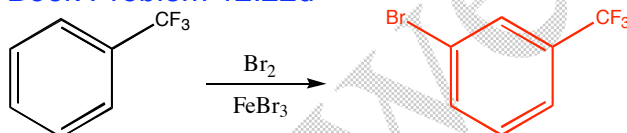
B.



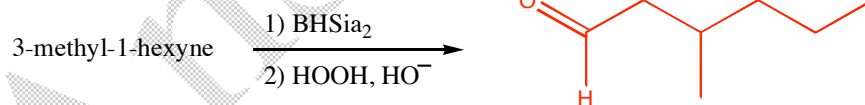
C.



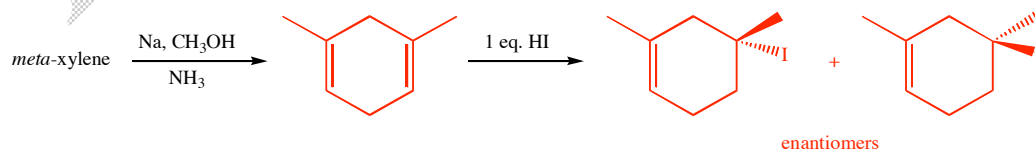
D. [Book Problem 12.22d](#)



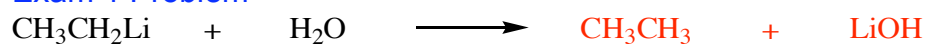
E.



F.

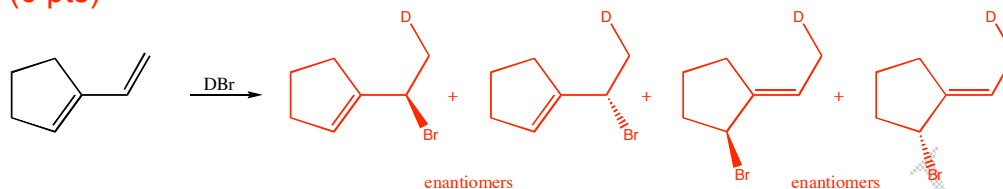


G. [Exam 1 Problem](#)

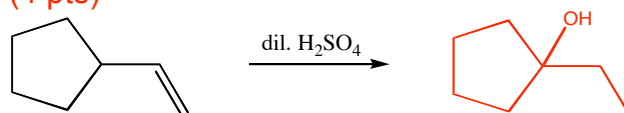


12. continued. [Be sure to clearly show stereochemistry using dashes and wedges. Write NR if no reaction occurs. Clearly label any enantiomers, diastereomers, and/or meso compounds; some problems have more than one step.]

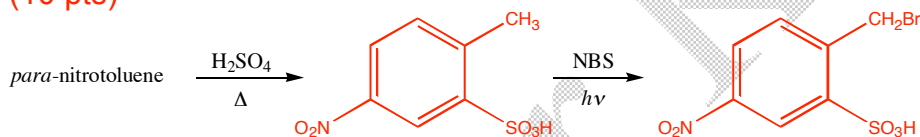
H. (6 pts)



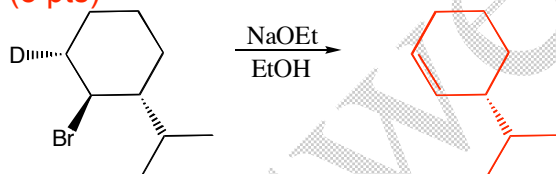
I. (4 pts)



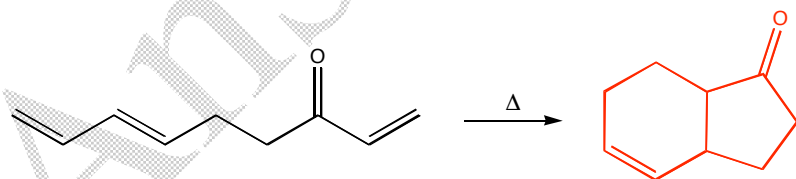
J. (10 pts)



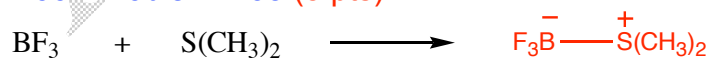
K. (5 pts)



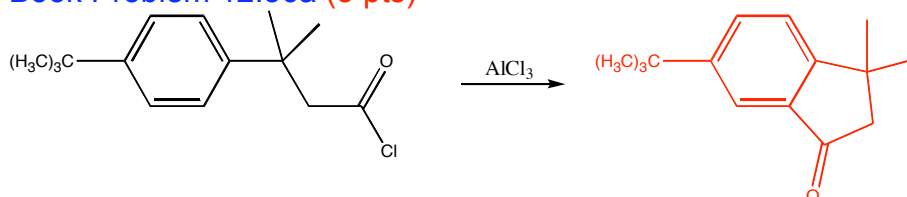
L. (5 pts)



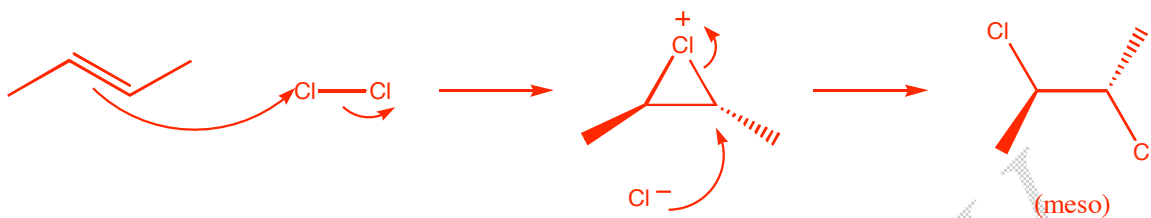
M. Book Problem 1.38 (5 pts)



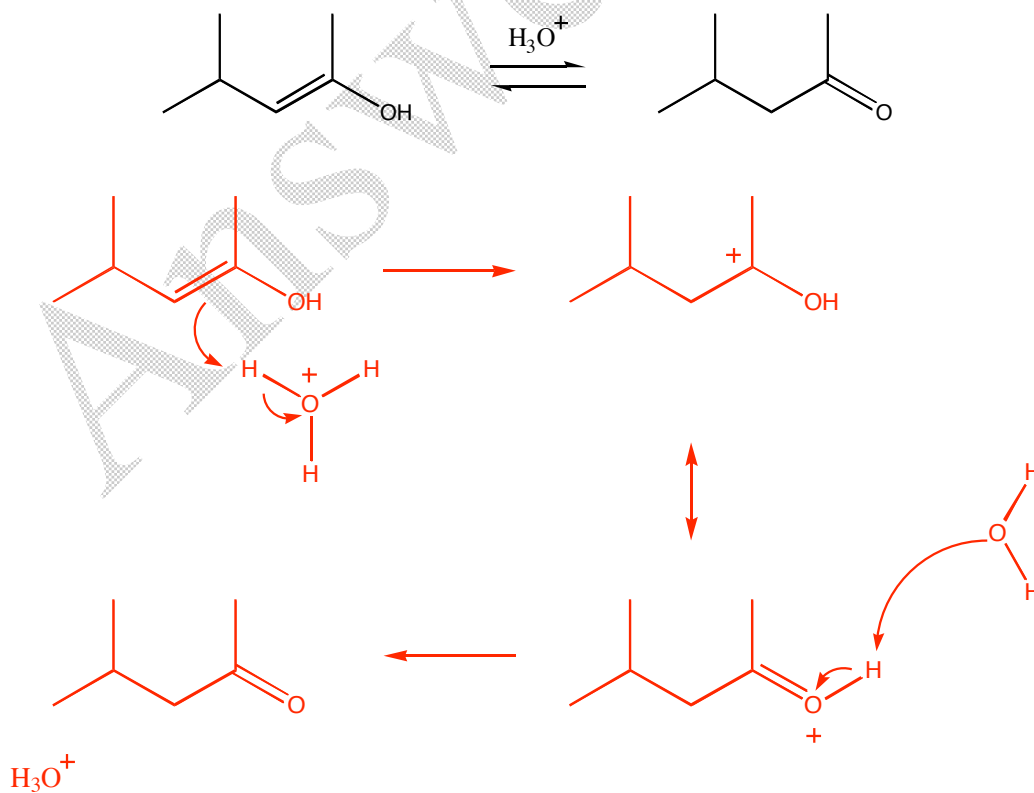
N. Book Problem 12.36a (5 pts)



13. (12 pts) Using curved arrows to show the flow of electrons, draw a mechanism for the chlorination of *trans*-2-butene.

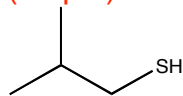


14. (12 pts) Using curved arrows to show the flow of electrons, propose a mechanism for the acid catalyzed enol-keto tautomerization shown below.

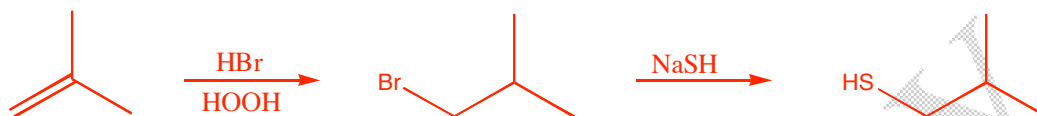


15. (45 pts) Propose an efficient synthesis for each of the following transformations. You may use any reagents you like. Be sure to show any intermediates. (Do not draw a mechanism.)

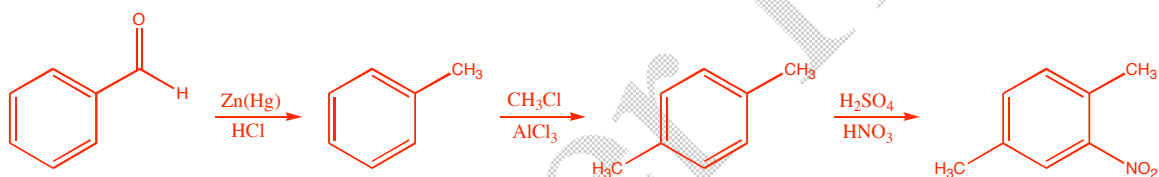
A. (10 pts)



starting from 2-methylpropene



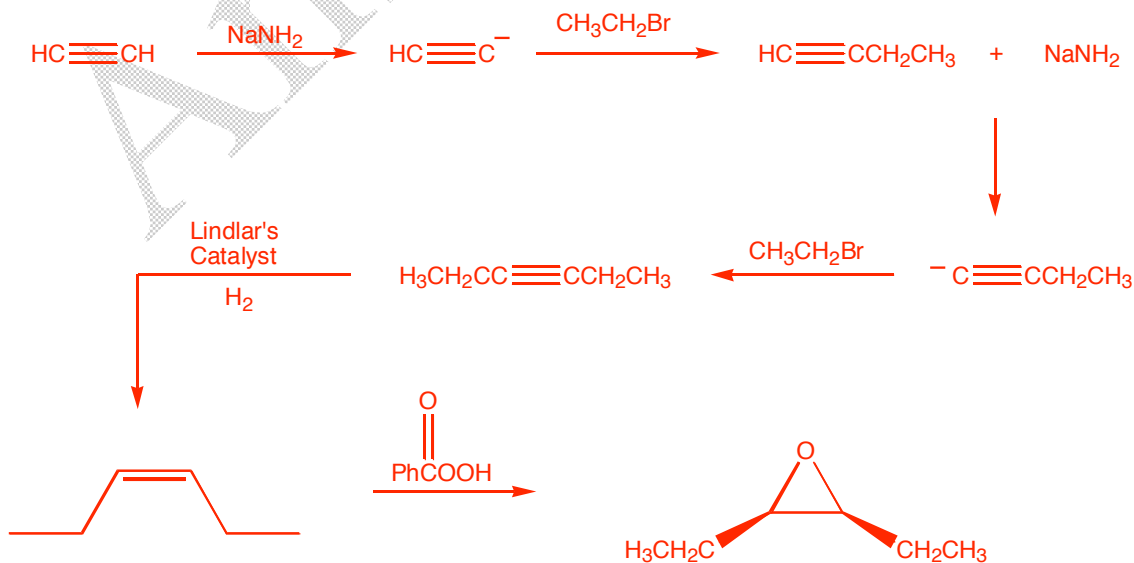
B. 1,4-dimethyl-2-nitrobenzene (15 pts) (There is more than one way to solve this problem.) starting from benzaldehyde



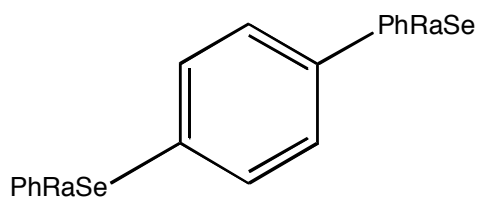
C. (20 pts)



starting from acetylene and any other organic reagents



Extra Credit: (10 pts) Draw a parody of aromatic nomenclature. For example, below is paraphrase. (You don't have to use elements.)



Answer Key