

Exam 3
April 20, 2006
CHEM 3311 Spring 2006
Professor Rebecca Hoenigman

Average Score = 56

High Score = 93

Low Score = 6

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 1 hour and 15 minutes to complete this exam.
No model kits or calculators allowed; a periodic table is attached.*

**DO NOT TURN PAGE UNTIL INSTRUCTED TO DO SO.
Put your name on ALL pages of the exam**

Recitation Sections:

Number	Day	Time	TA
121	Tuesday	8 am	Andrew
131	Tuesday	1 pm	Heather
141	Wednesday	8 am	Chris
151	Wednesday	12 pm	Andrew
153	Wednesday	12 pm	Nicole
152	Wednesday	5 pm	Chris
171	Thursday	12 pm	Heather

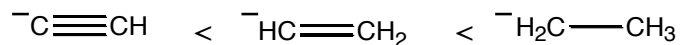
Score:

Page 1 _____/14	Page 5 _____/10
Page 2 _____/8	Page 6 _____/15
Page 3 _____/8	Page 7 _____/15
Page 4 _____/30	Total _____/100

1. (4 pts) Give the IUPAC name of the smallest isolable cycloalkyne.

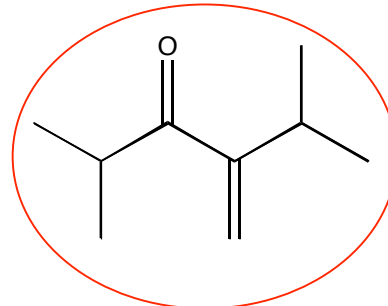
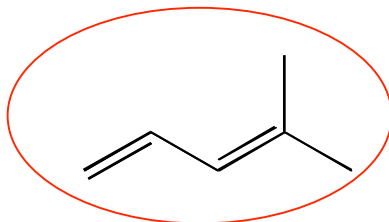
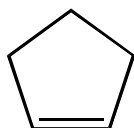
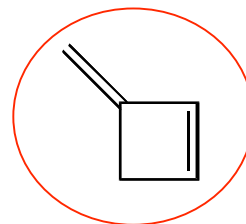
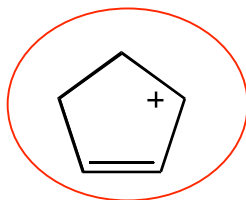
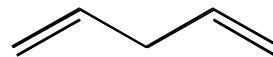
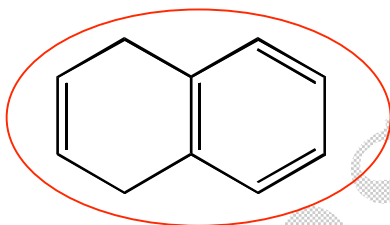
cyclononyne

2. (5 pts) The following compounds are listed in order of increasing basicity. Explain this ordering without discussing the pKa values of the corresponding conjugate acids.



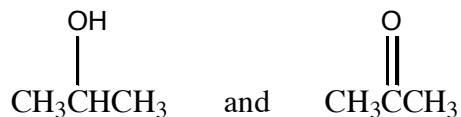
The anion electrons are more stable in an orbital that has more s-character. The HCC^{-} anion is the most stable (least basic) of the three anions listed, since the anion electrons are in an sp hybridized orbital (with 50% s-character). The $\text{CH}_3\text{CH}_2^{-}$ anion is the most basic (least stable, and least electronegative) since the anion electrons are in an sp^3 hybridized orbital with only 25% s-character

3. (5 pts) Circle the compounds below that have delocalized electrons.
(1 point each circle, -1 for incorrect circle, minimum points = 0)

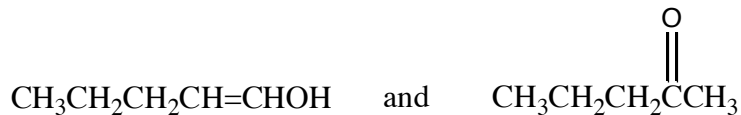


4. (3 pts) Of the following pairs, circle the keto-enol tautomers.
(3 points for correct circle, -1 for incorrect circle, minimum points = 0)

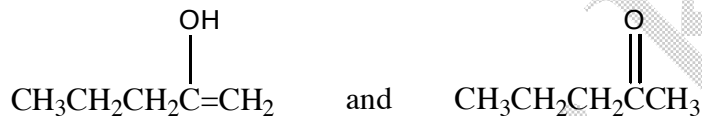
A.



B.



C.



5. (5 pts) A single organic product was obtained when 1-bromo-3-chloropropane was allowed to react with one molar equivalent of sodium cyanide in aqueous ethanol. Draw the product and explain why there is only one product.

Book Problem 8.2

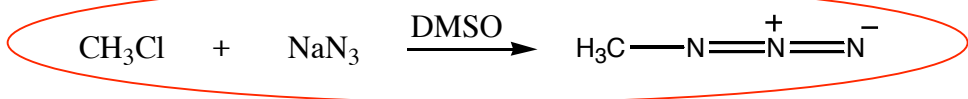
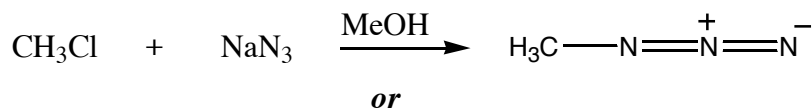
(2 points structure, 3 points explanation)



The product results from an $\text{S}_\text{N}2$ reaction with bromine as the leaving group. Bromine is a better leaving group than chlorine (bromine is more polarizable).

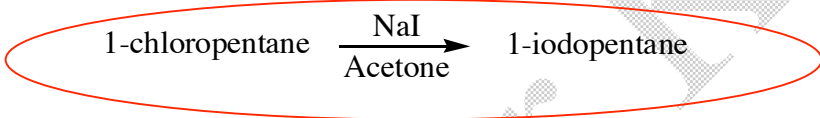
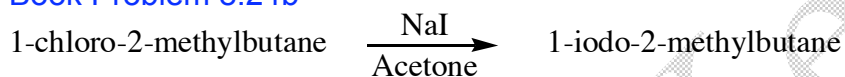
6. (8 pts) Which reactions in the following pairs will take place more rapidly?
Circle your answer.

A.



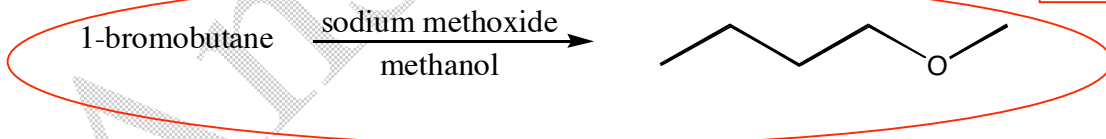
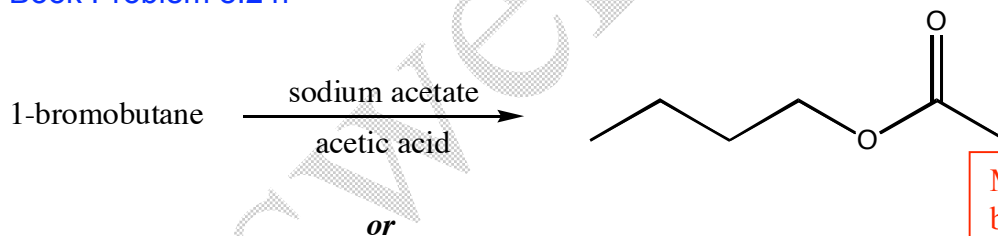
Polar aprotic solvent increases rate of $\text{S}_\text{N}2$ reaction.

B. Book Problem 8.24b



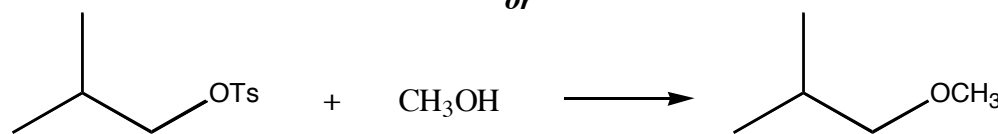
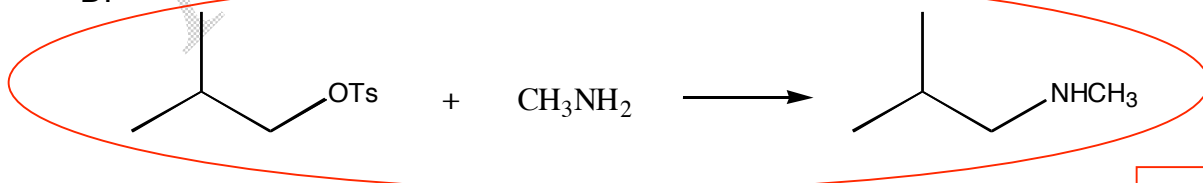
The organic substrate is less hindered.

C. Book Problem 8.24f



Methoxide is a better nucleophile.

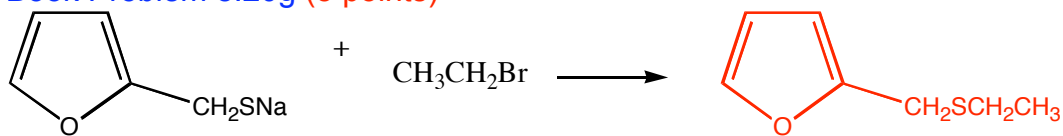
D.



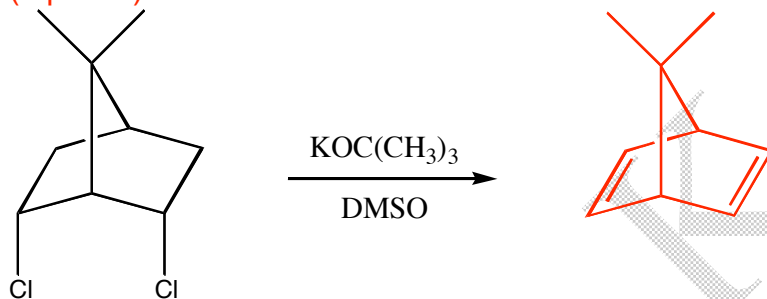
CH_3NH_2 is a better nucleophile.

7. (30 pts) Give the organic products for the following reactions. If necessary, clearly show the stereochemistry of the products. Write NR if no reaction occurs.

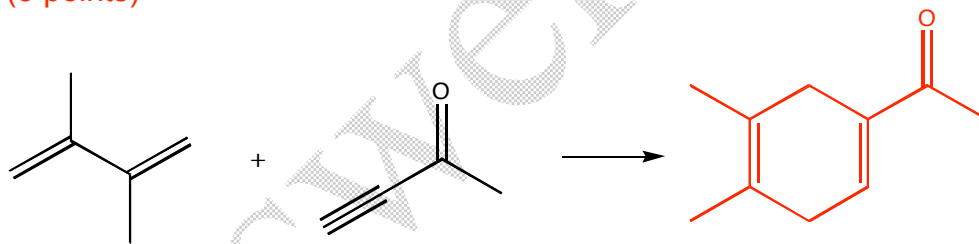
A. Book Problem 8.20g (5 points)



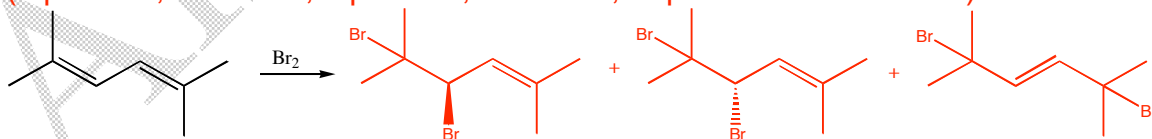
B. (5 points)



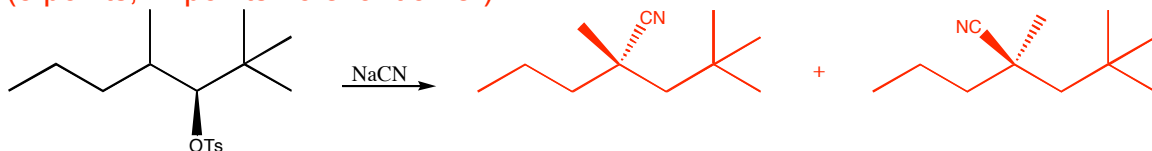
C. (5 points)



D. (5 points 1,4-addition, 5 points 1,2-addition, -1 points no enantiomer)

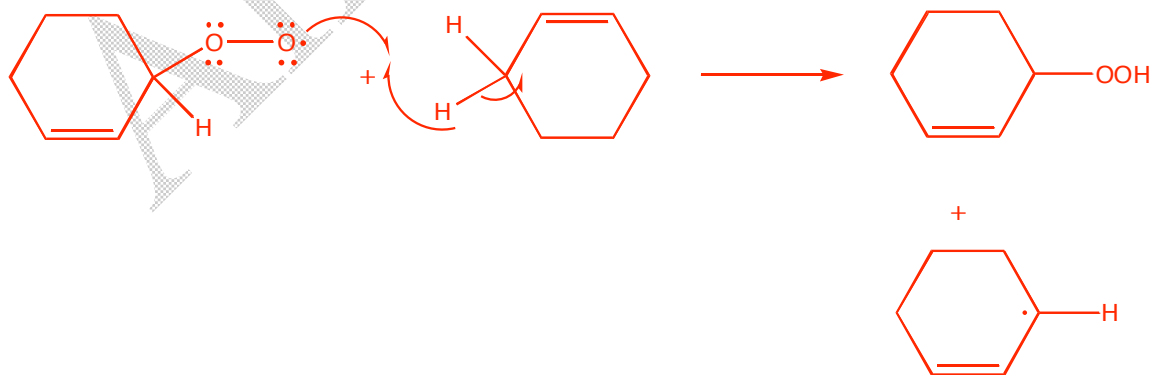
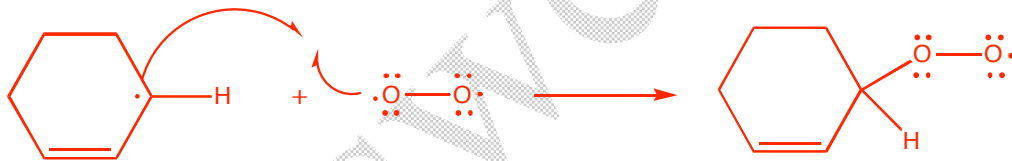
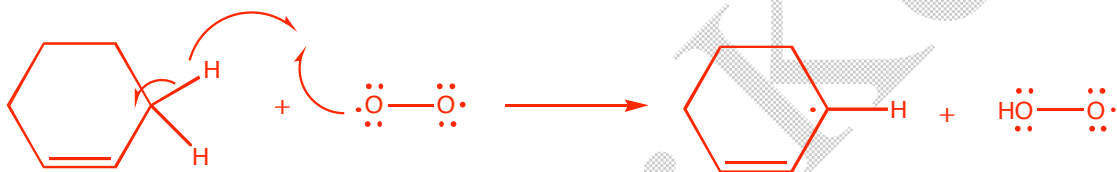
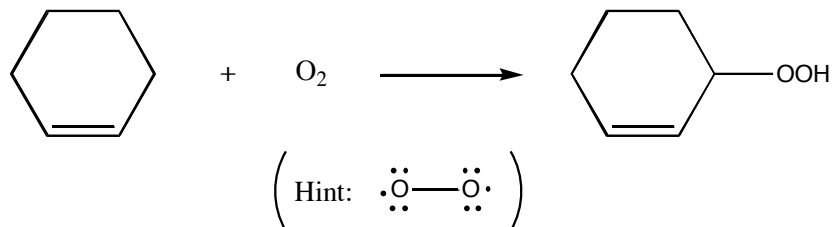


E. (5 points, -1 points no enantiomer)

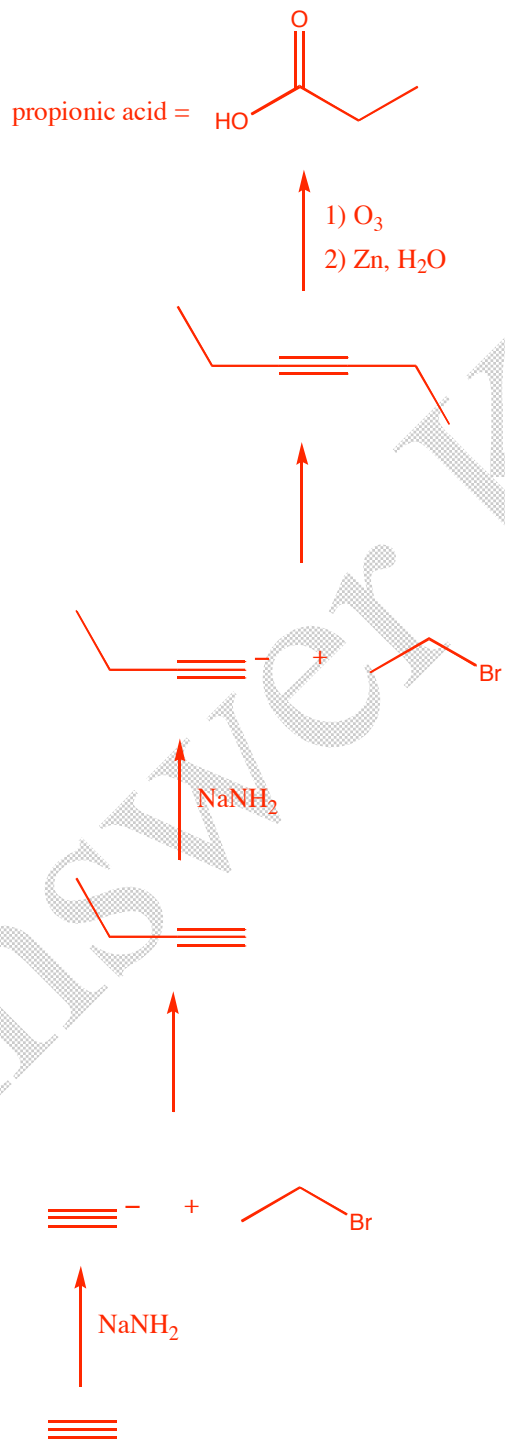


8. (10 pts) Alkenes slowly undergo a reaction in air called *autoxidation* in which allylic hydroperoxides are formed. Keeping in mind that oxygen has two unpaired electrons, suggest a reasonable mechanism for this reaction.

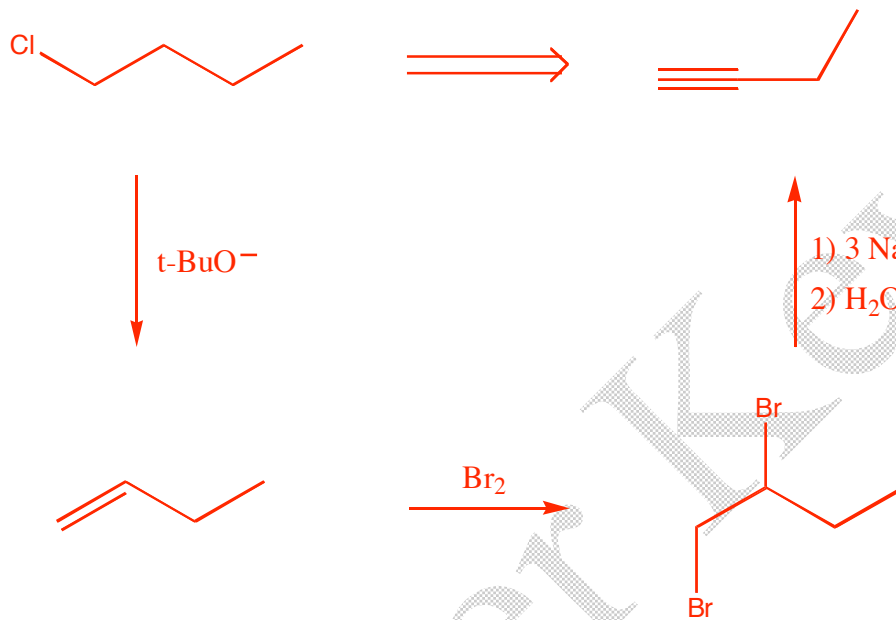
Book Problem 10.42



9. (15 pts) Give an efficient synthesis for propionic acid. You may only use acetylene, organic compounds containing two or fewer carbons, and any inorganic reagents you like. Note: the last step of your synthesis should produce 2 moles of propionic acid.



10. (15 pts) Give an efficient synthesis for the formation of 1-butyne from 1-chlorobutane. You may use any reagents you like.
(5 points each step)



Scratch Page

Answer Key

Scratch Page

Answer Key