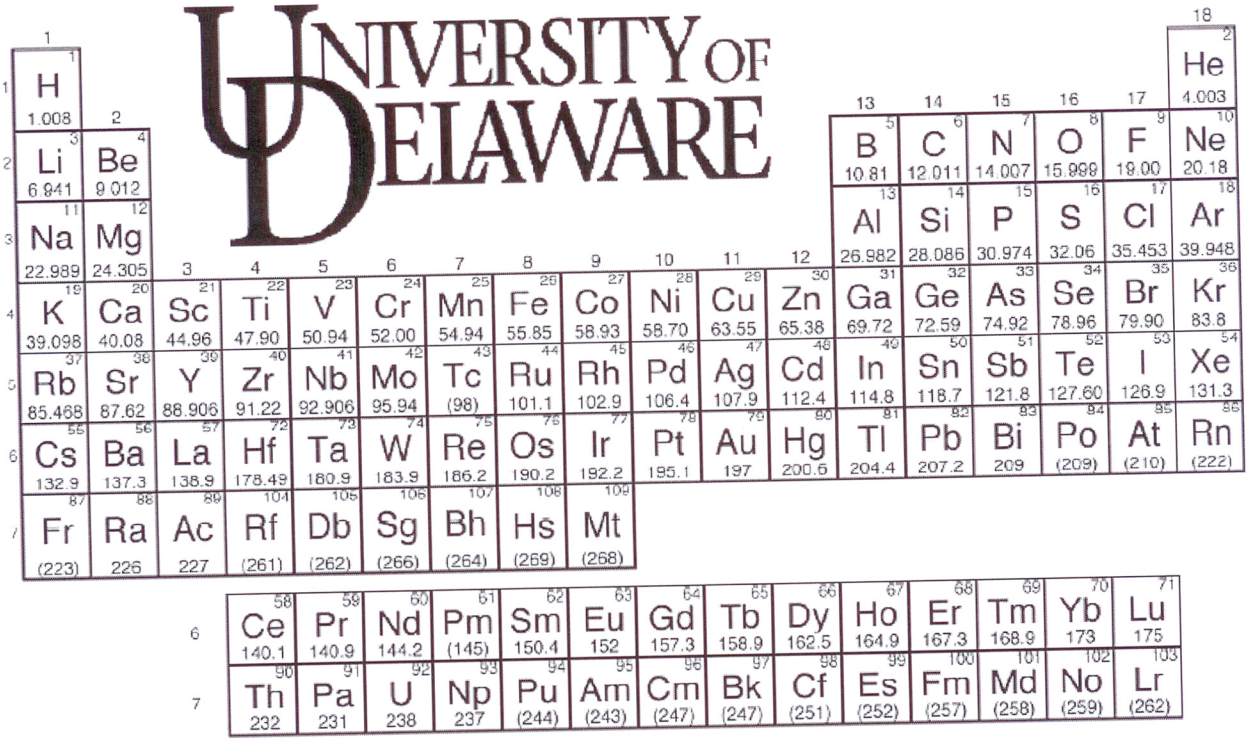
Name:_____

(Print your name clearly!)

Sametz: CHEM 321 2009
Organic Chemistry Final Exam

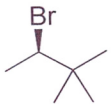
All answers should be written CLEARLY in the space provided. (If it's not clear, it's wrong).



You may raise your hand to ask a question if you are unsure what a question is asking of you.

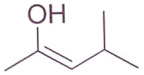
1. (6 points) Provide IUPAC names for the following compounds:

a)



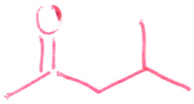
(2R)-2-bromo-3,3-dimethyl butane

b)



4-methyl-2-penten-2-ol
or pent-2-en-2-ol

2. (4 points) The compound shown in 1b) is not actually in its most stable form. It is in equilibrium with another, more stable species. Give the structure of that species. What is the name for this type of equilibrium?



keto-enol tautomerization

3. (8 points) For each of the following pairs of structures, indicate if they represent a pair of structural isomers, diastereomers, enantiomers, or identical compounds:

see p. 174

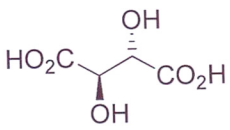
a)

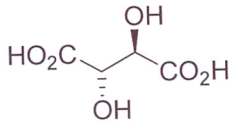
enantiomers

b)

structural (constitutional) isomers

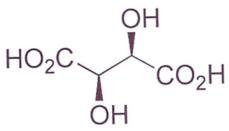
c)

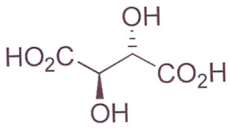




identical

d)



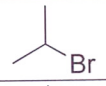
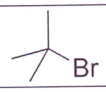


diastereomers

4. (6 points) Is the S_N1 reaction helped, or hindered, by an increase in solvent polarity? Explain why.

Helped. rate-determining step is solvolysis. Creation of charge separation is better in a more polar solvent.

5. (8 points) In the following table, for each compound shown, indicate for each alkyl bromide shown which reaction mechanism(s) are allowed (with a check mark) or forbidden (with an X).

	S_N1	E1	S_N2	E2
CH_3Br	✗	✗	✓	✗
	✗	✗	✓	✓
	✓	✓	✓	✓
	✓	✓	✗	✓

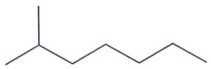
6. (4 points) Consider the following substitution reaction:

How could one determine experimentally whether this reaction is S_N1 or S_N2? (One suggested experiment is adequate for full credit; there are at least two ways that you should be aware of).

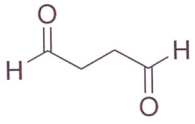
- inversion of stereochem? (S_N2) or racemization? (S_N1)

- change [Nu:] ($[CH_3S^{\ominus}]$ or $[CH_3SH]$). rate change: S_N2. no rate change: S_N1

7. (6 points) A compound with the formula C_8H_{14} reacts with H_2/Pt to provide the following alkane (C_8H_{18}):

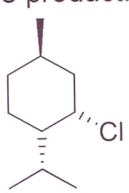


The same C_8H_{14} compound reacts with ozone followed by DMS to provide the following compounds:

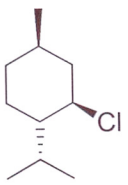


What is the structure of this C_8H_{14} compound?

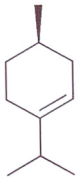
8. (13 points) Two isomers of menthyl chloride, A and B, are shown below. Isomer A reacts quickly with a strong base to give a 3:1 mixture of X and Y. Isomer B reacts much slower, and gives only Y as the product.



A



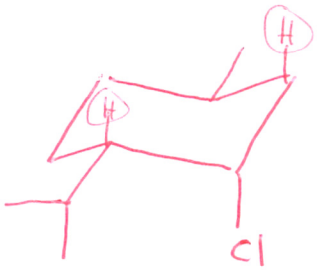
B



X

Y

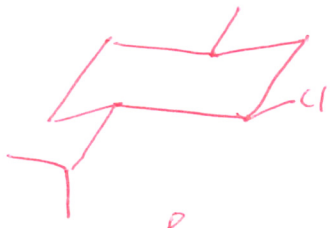
Using relevant chair conformations for A and B, explain the difference in the two reaction rates, and explain the difference in product ratios (3:1 X:Y vs. 0:100).



A

E2: both X and Y possible (antiperiplanar β-Hs and Cl)

X = Zaitsev: more stable ∴ preferred



B

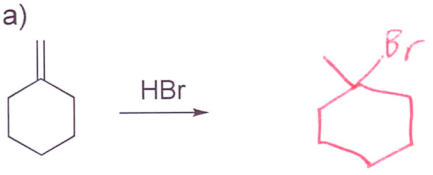
can't do E2 in favoured chair conformer – Cl equatorial; no antiperiplanar H–Cl arrangement

this is the only β-H antiperiplanar to the Cl; only E2 elimination possible gives the non-Zaitsev product Y.

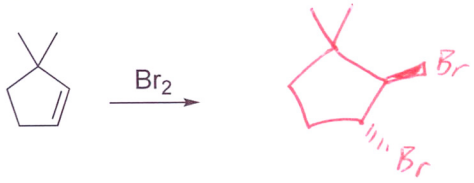
E2 can only occur in unfavourable chair conformer that places all 3 substituents axial (multiple 1,3-diaxial interactions).

9. (33 points) Give the major organic product(s) for the following reactions, including stereochemistry if applicable.

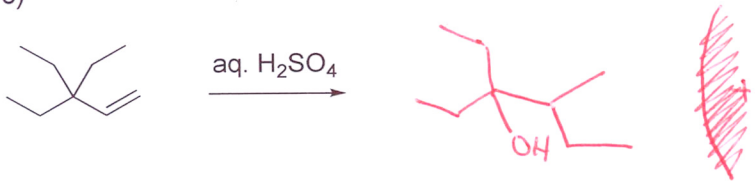
a)



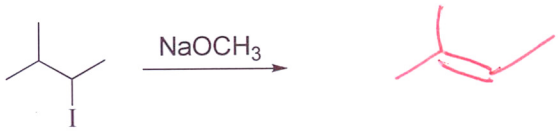
b)



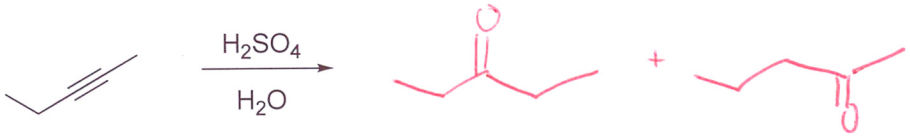
c)



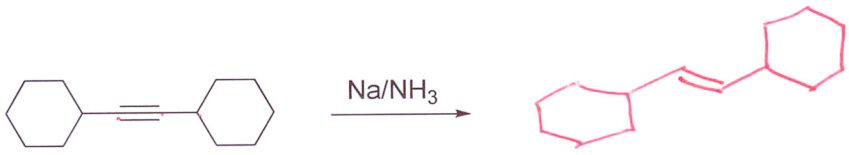
d)



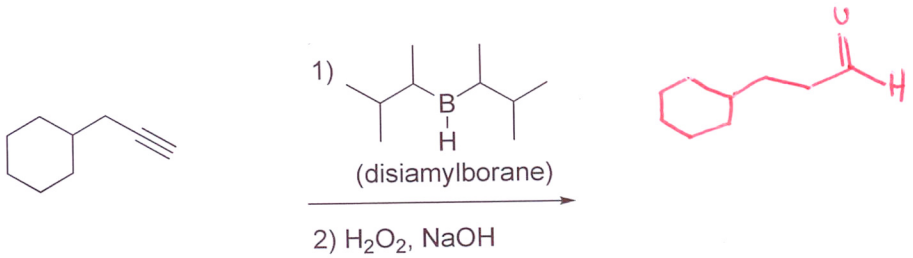
e)



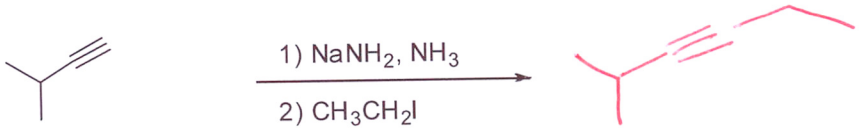
f)



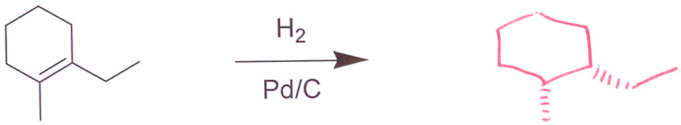
g)


1)
B
H
(disiamylborane)
2) H_2O_2, NaOH
O
H

h)


1) $NaNH_2$, NH_3
2) CH_3CH_2I

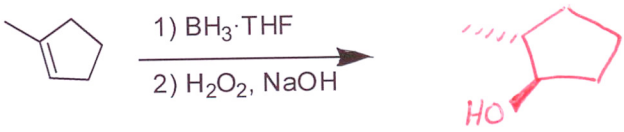
i)


H_2
Pd/C

j)

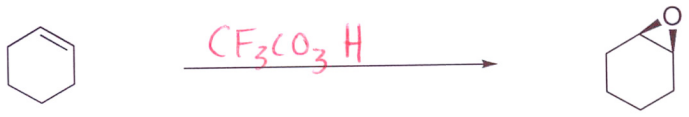

Br_2
H_2O
Br
OH

k)

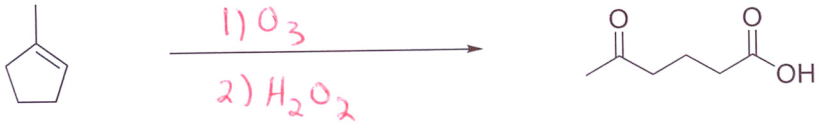

1) BH_3·THF
2) H_2O_2, NaOH
HO

10. (21 points) Give the reaction conditions required to effect the following transformations:

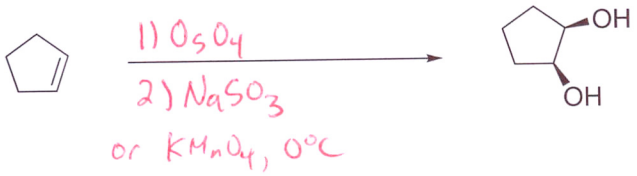
a)



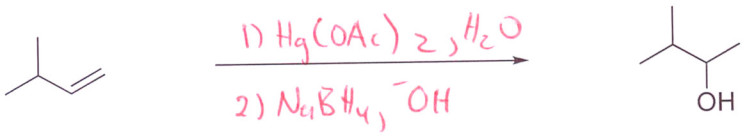
b)



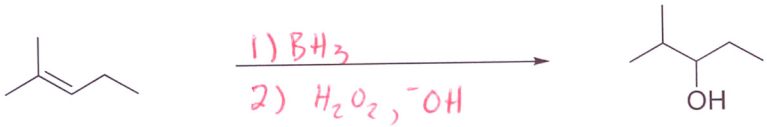
c)



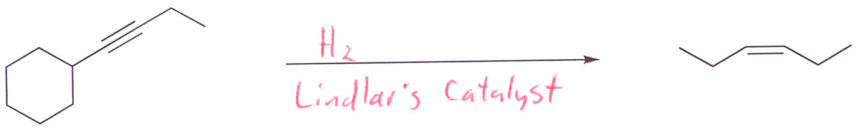
d)



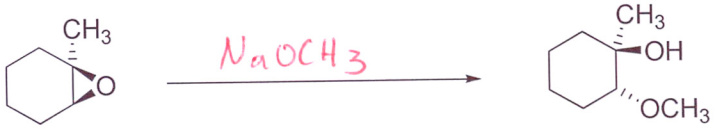
e)



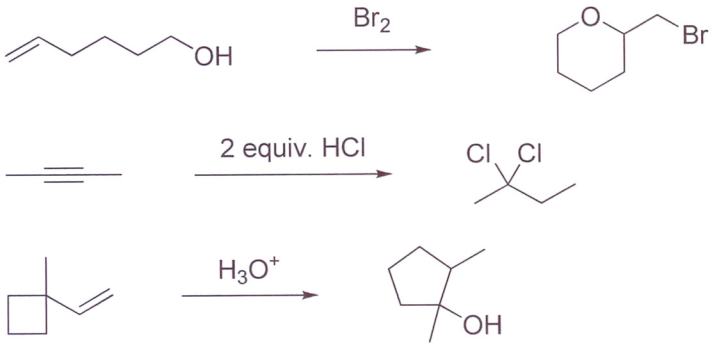
f)

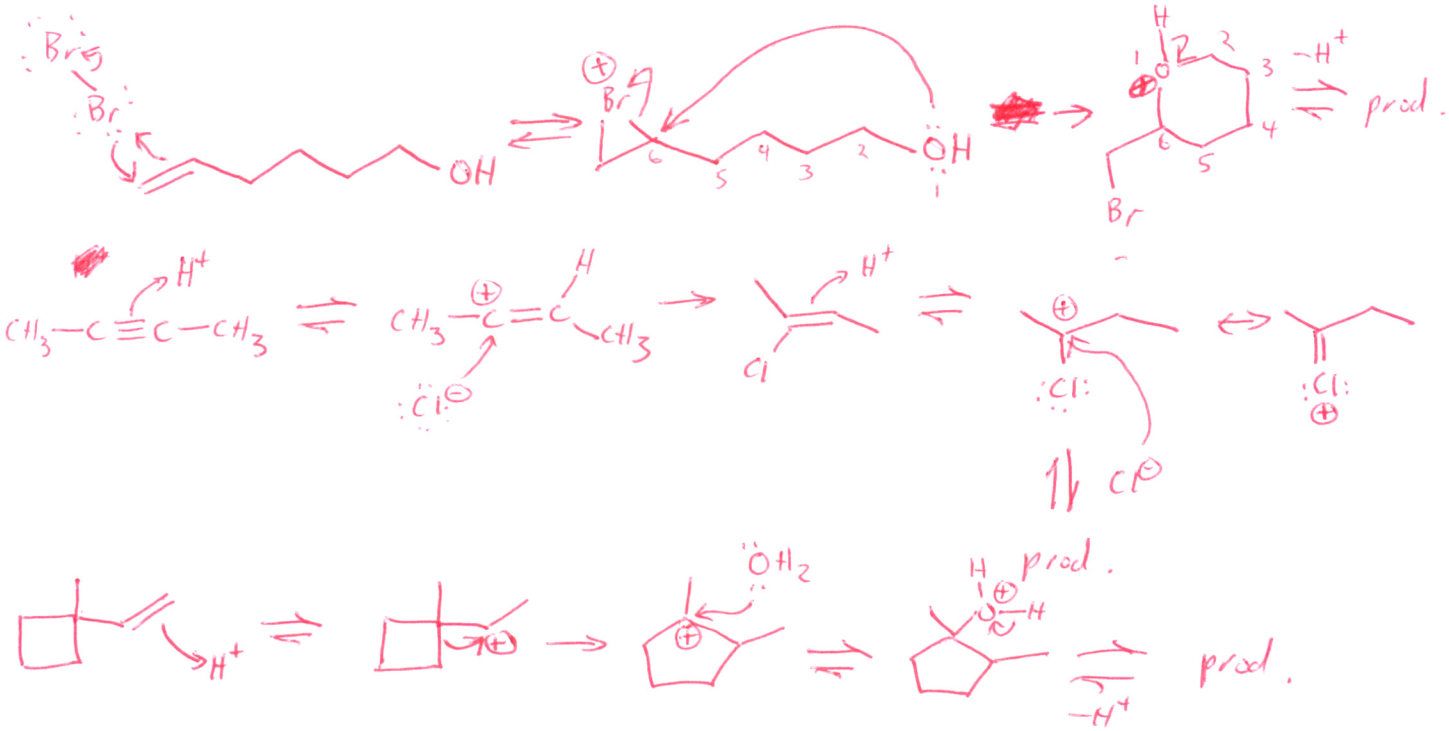


g)



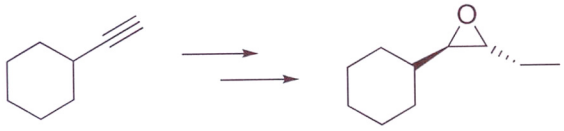
11. (12 points) Reaction Mechanisms: Choose TWO of the following THREE reactions and show a reaction mechanism that accounts for the formation of the product. If you choose b) you should also explain why both chlorine atoms added to the same carbon. CLEARLY INDICATE which two you wish graded for credit; otherwise, if you show work on all three, only the first two will be graded.

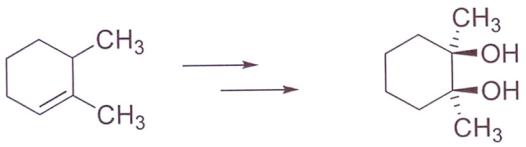


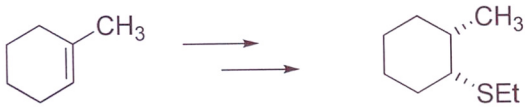


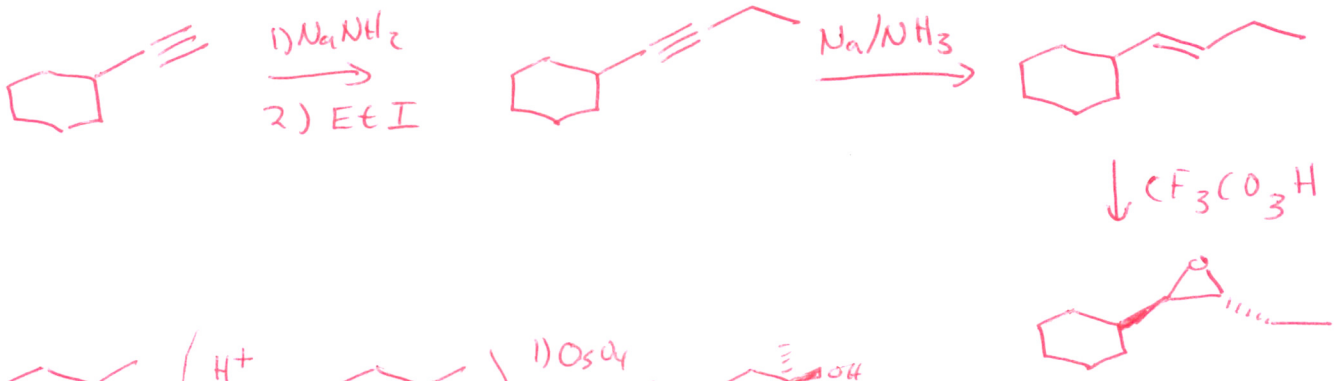
12. (12 points) Multistep Synthesis: Choose ONE of the following THREE synthesis problems. You must synthesize the compound on the right from the indicated starting material on the left. Although multiple solutions may be possible, each synthesis could be accomplished in three steps .Retrosynthetic analysis counts for part credit, but for full credit write the complete sequence of forward reactions.

CLEARLY INDICATE which two you wish graded for credit; otherwise, if you show work on all three, only the first two will be graded.

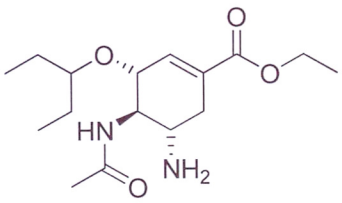








13. (17 points) Oseltamivir (sold under the trade name Tamiflu) is a drug used for the treatment and prevention of influenza. The following questions involve the structure and synthesis of oseltamivir.



oseltamivir

a) (2 points) How many sp^2-hybridized carbons are there in oseltamivir? _____

b) (6 points) Indicate the relative stereochemistry at each stereogenic carbon on the structure above.

c) (9 points) Several syntheses of oseltamivir have been reported. The following reactions are identical or similar to individual steps in these syntheses. For every arrow surrounded by a box, provide a reagent that would cause that transformation.