First Exam

Chemistry 3332

February 16, 2007

Name (PRINT) Key, Answer
Last, First

Signature _____

ID# _____

Please circle class time.

Dr. Bean's 10:00 AM

Dr. Bean's 1:00 PM

Page #	Score	
1. 12 pts.		
2. 18 pts.		
3. 18 pts.		
4. 12 pts.		
5. 14 pts.		
6. 14 pts.		
7. 12 pts.		

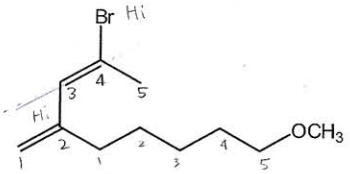
TOTAL_____

Note: Present your student ID when you return the exam booklet

A. Nomenclature: (12 points)

Give an acceptable name for each of the following compounds. Be sure to indicate the **stereochemistry** where appropriate.

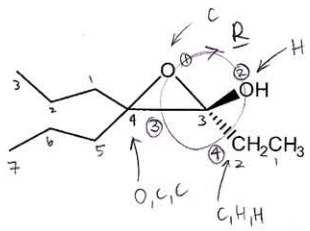
1



(3E)-4-bromo-2-(5-methoxypentyl)penta-1,3-diene

penta-1,3-diene
(3E)
4-bromo
2-(5-methoxypentyl)

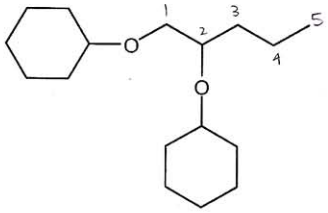
2



(3R)-3,4-epoxy-4-propylheptan-3-ol

heptan-3-ol
3R
3,4-epoxy
4-propyl

3

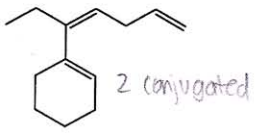


1,2-dicyclohexoxypentane

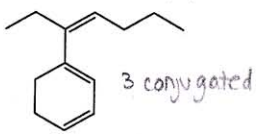
pentane
1-cyclohexoxy
2-cyclohexoxy
1,2-dicyclohexoxy

B. Facts: Total Points = 18

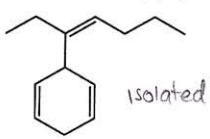
1. Place the following alkenes in order of increasing stability. (1=least stable, 3=most stable) (3 pts.)



[2]

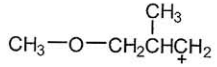


[3]

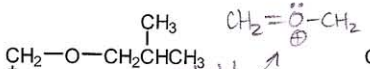


[1]

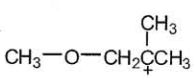
2. Place the following carbocations in order of increasing stability. (1=least stable, 3=most stable) (3 pts.)



[1] 1°

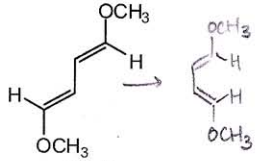


[3]

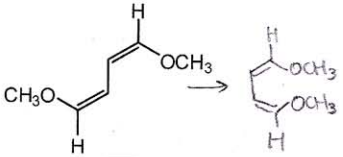


[2] 3°

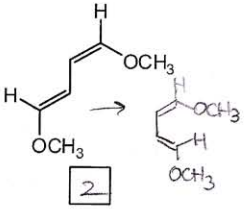
3. Place the following molecules in order of increasing reactivity in a Diels-Alder reaction. (1=least reactive, 3=most) (3 pts.)



[3]

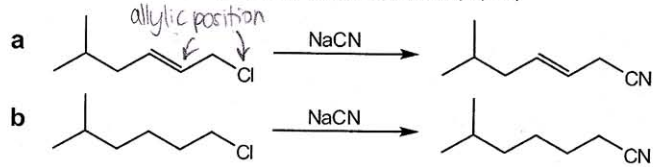


[1]



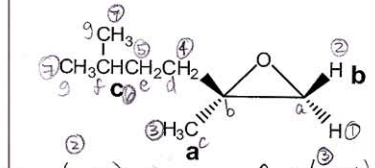
[2]

4. Put the letter of the reaction with the faster rate in the box. (4 pts.)



[A]

5. Answer the following questions for the molecule below and place the answers in the appropriate boxes. (i)How many distinct types of protons are present in the molecule? (ii) How many distinct carbons are present? (iii) & (iv) What are the theoretically predicted multiplicities (splitting patterns) of the signal for protons **b** and **c**? (v) What is the multiplicity of carbon **a** in the proton-coupled ^{13}C NMR? (5 pts.)



$H_b = (1+1) = 2$ $\quad C_a = (3+1) = 4$

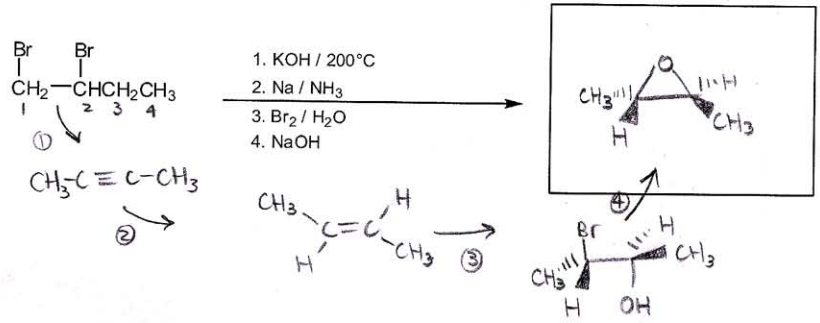
$H_c = (3+3+1)(2+1) = (7)(3) = 21$

↖ equivalent proton sources are added together w/ the n+1 rule. non equivalent sources are multiplied.

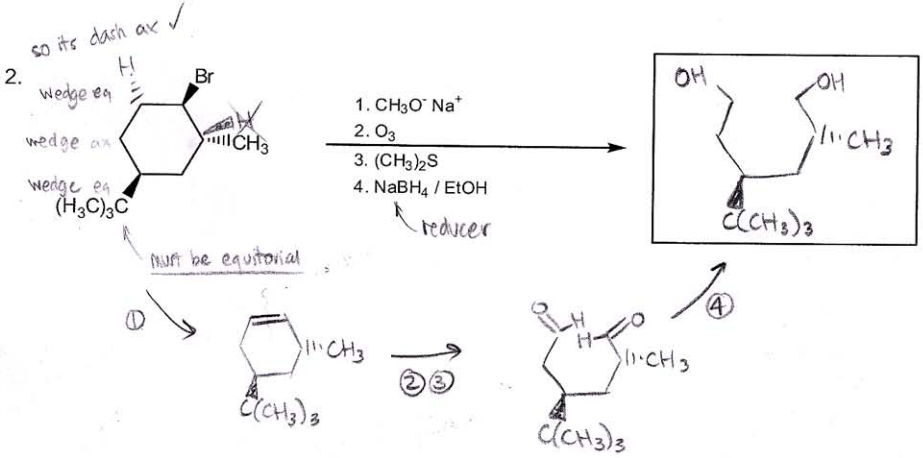
(i) # of proton types	[7]
(ii) # of carbon types	[7]
(iii) multiplicity of H_b	[2]
(iv) multiplicity of H_c	[21]
(v) multiplicity of C_a	[4]

C. Reactions: Total = 30 points, 6 points each
Please provide the major product in the answer box unless indicated otherwise. Indicate **stereochemistry** with wedges and dashes if applicable. Partial credit is awarded only when intermediate products in a multi-step reaction are shown below the reaction.

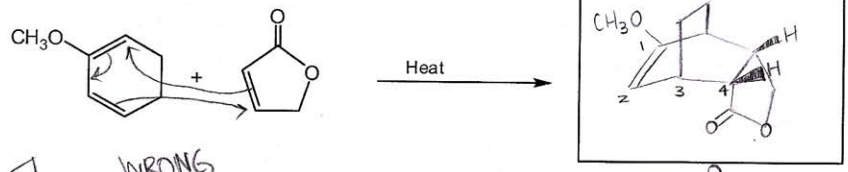
1.

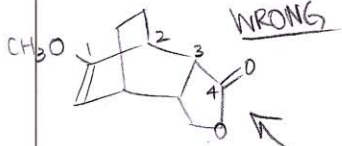


2.



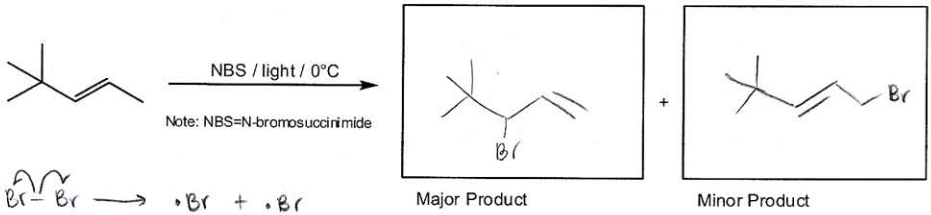
3.

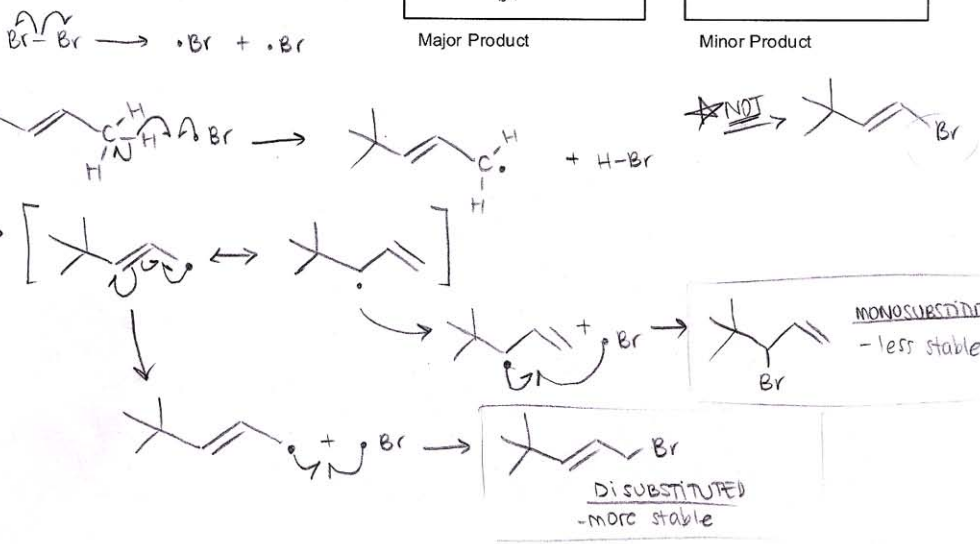




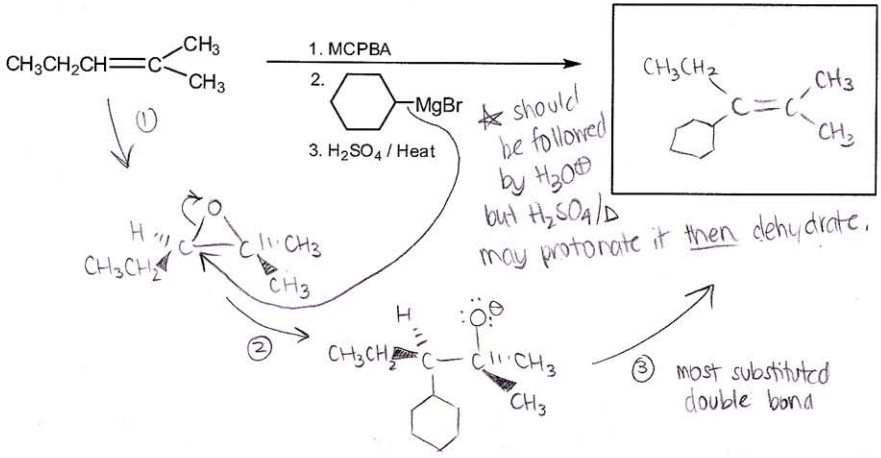
recall that the carbon in C=O is part of the withdrawing group. so 1,4 addition is between carbons connected to the donating group + the withdrawing group. ie: not this addition (1,3)

4.


NBS / light / 0°C
Note: NBS=N-bromosuccinimide
Br
Br
Major Product
Minor Product

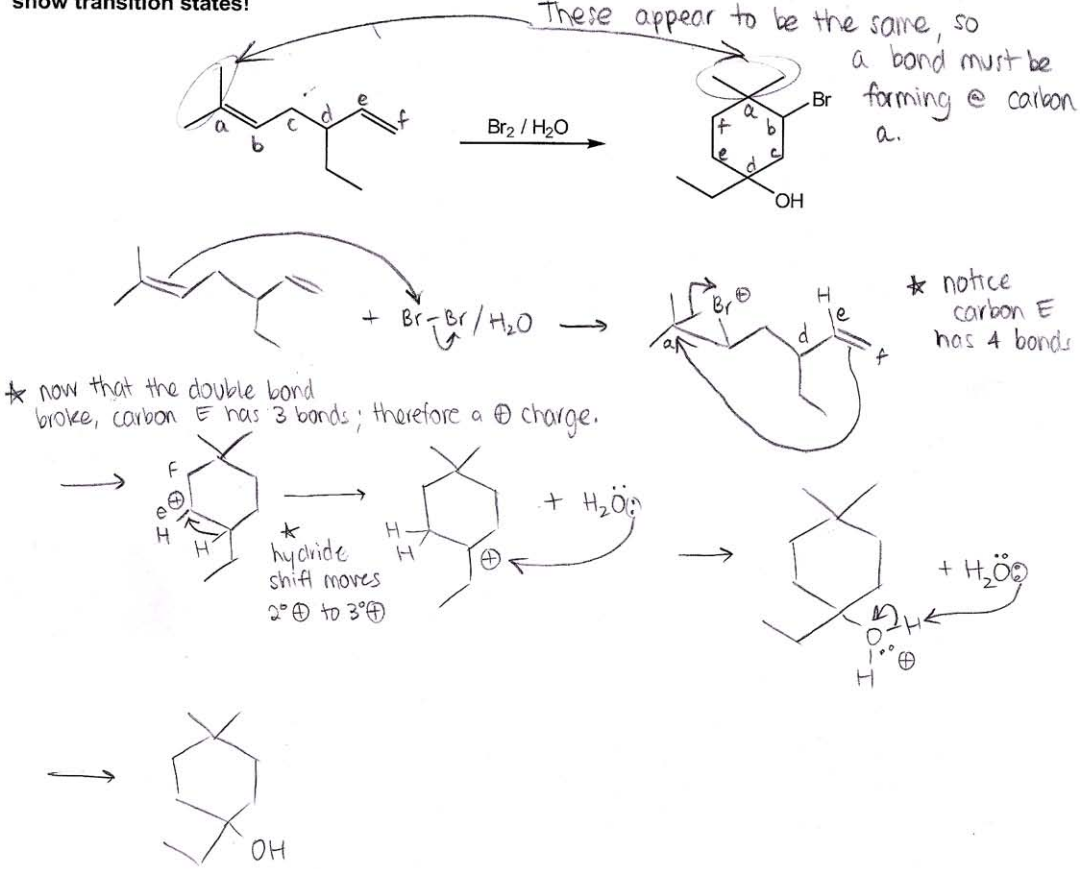

Br – Br → •Br + •Br
+ H–Br
NOT
MONOSUBSTITUTED
- less stable
DISUBSTITUTED
- more stable

5.


CH3CH2CH=C(CH3)CH3
1. MCPBA
2. MgBr
3. H2SO4 / Heat
should be followed by H3O⊕ but H2SO4/Δ may protonate it then dehydrate.
most substituted double bond

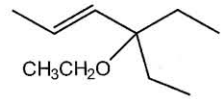
D. Mechanisms: (14 points)

Provide a clear mechanism to explain the formation of the product. Use curved arrows to indicate "electron flow". Remember to show only one step at a time. **Show all intermediates and all formal charges. Do not show transition states!**

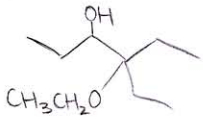


E. Synthesis: (14 points)

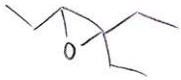
Synthesize the molecule below using any of the following reagents: alcohols, alkanes, alkenes and/or alkynes of **three carbons or less**, any inorganic reagents, any oxidizing or reducing agents, and any peroxyacids.



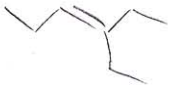
↑ H_2SO_4/Δ



↑ $CH_3CH_2OH/H^{\oplus}$

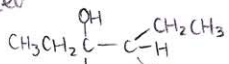


↑ MCPBA

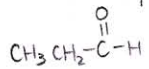


↑ H_2SO_4/Δ

★ carbon w/ the OH is the carbon attacked by the grignard reagent!



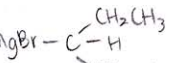
↑ then $H_3O^{\oplus}$ ★★★ dont forget!!



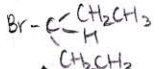
↑ PCC

$CH_3CH_2CH_2OH$

+



↑ Mg/ether



↑ PBr_3

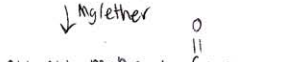
$CH_3CH_2CH_2OH$

CH_3-CH_3

↓ Br_2/hv

CH_3CH_2Br

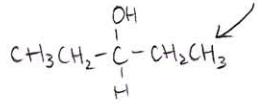
↓ Mg/ether



then $H_3O^{\oplus}$

$CH_3CH_2CH_2OH$

↓ PCC



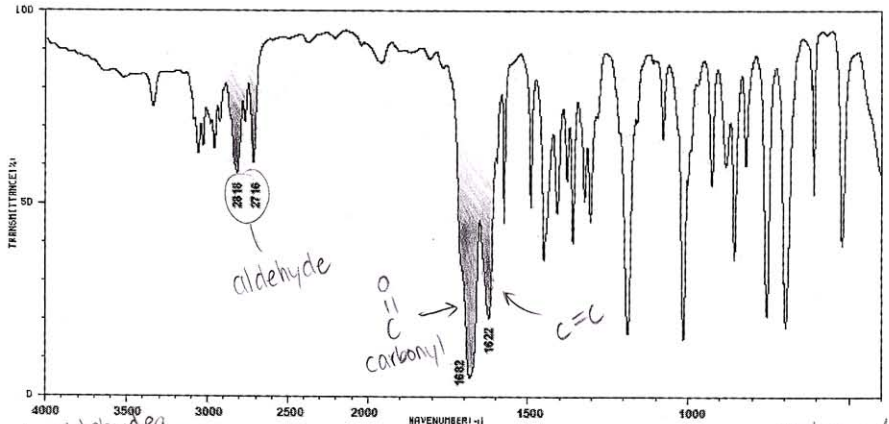
$$10 - \left(\frac{10}{2}\right) + 1 = 10 - 5 + 1 = 6$$

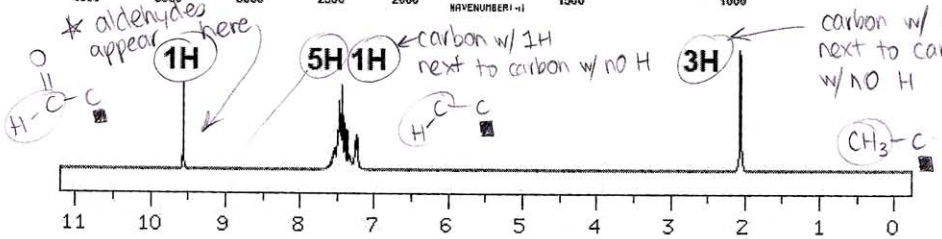
4 = benzene
2 = 2 double bon
& triple bon

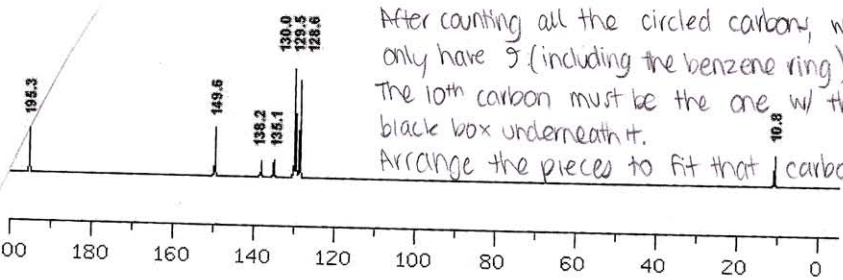
F(a). Spectroscopy (12 points)

A compound with the formula $C_{10}H_{10}O$ exhibits the IR, ^{1}H NMR and proton decoupled ^{13}C NMR spectra shown below. Please identify this compound and draw the structure in the box provided below.

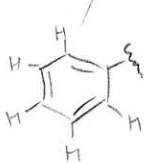
2 double bonds sound correct from IR
1. C
2. C=C

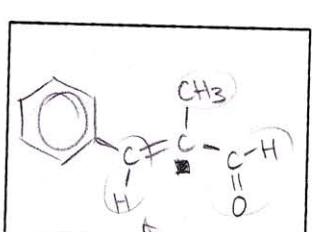






After counting all the circled carbons, we only have 9 (including the benzene ring). The 10th carbon must be the one w/ the black box underneath H. Arrange the pieces to fit that carbon..





should be closest to benzene ring cuz it is so downfield!