

Seat No. _____

Last Name WST

Section A

First Name _____

PLEASE REMOVE LAST PAGE OF EXAM BEFORE PRINTING YOUR NAME ON THE BACK OF PAGE 13. THERE ARE 14 PAGES TO THIS EXAM

FINAL EXAM
CHEMISTRY 331
Fall 2006
Wednesday, December 13

Course Grade

7:00 to 9:00 p.m.

I. (24 pts) = _____

II. (72 pts)

24 pts	24 pts	24 pts	
<input type="text"/>	<input type="text"/>	<input type="text"/>	
A-H	I-P	Q-X	= _____

III. (30 pts) = _____

IV. (15 pts) = _____

V. (16 pts) = _____

VI. (6 pts) = _____

VII. A-B (12 pts) = _____

C (6 pts) = _____

D (7 pts) = _____

VIII. (12 pts) = _____

<input type="text"/>	<input type="text"/>	
A 6pts	B 6 pts	

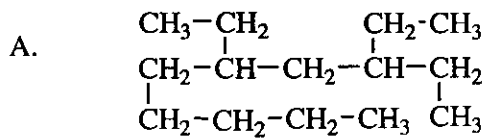
TOTAL FINAL EXAM (200 pts) = _____

To be filled in by graders:	
Number of quizzes taken (cannot exceed 5)	_____
Number of special assignments completed (cannot exceed 5)	_____

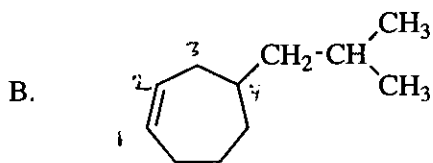
Exams will be held until March 1st.

I. (24 pts) Provide a proper name for each of the following compounds. (Include R or S, cis or trans, or Z or E when required).

1 pt numbers, 1 pt substituents, 1 pt parent name

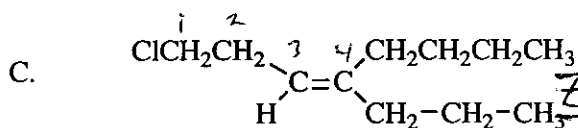


3,5-diethyldecane



4-isobutylcycloheptene-1

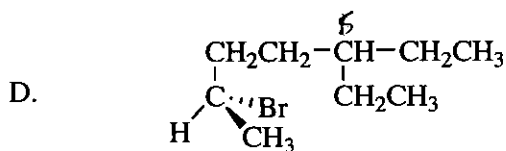
1 optional



Z-1-chloro-4-propyl-3-octene

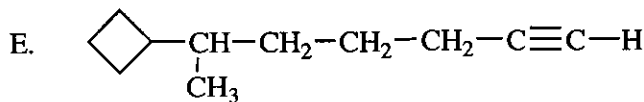
2 pts

or 3 here or here



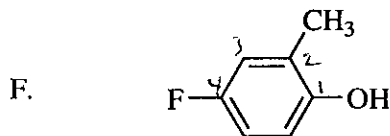
S-2-bromo-5-ethylheptane

2 pts



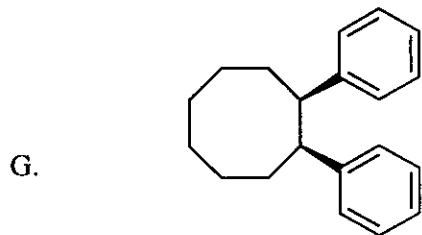
6-cyclobutylhept-1-yne

or 1 here or here



4-fluoro-2-methylphenol

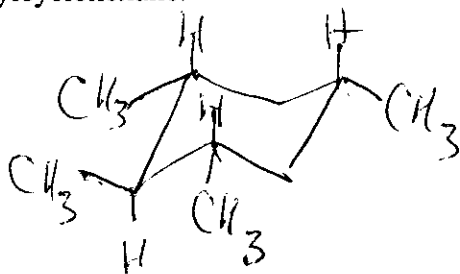
4-fluoro-1-hydroxy-2-methylbenzene



Cis-1,2-diphenylcyclooctane

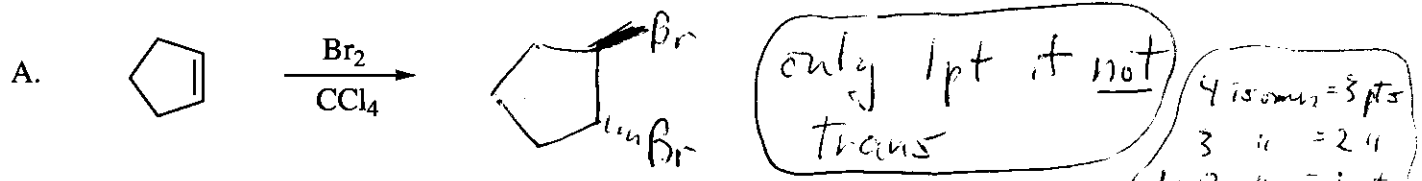
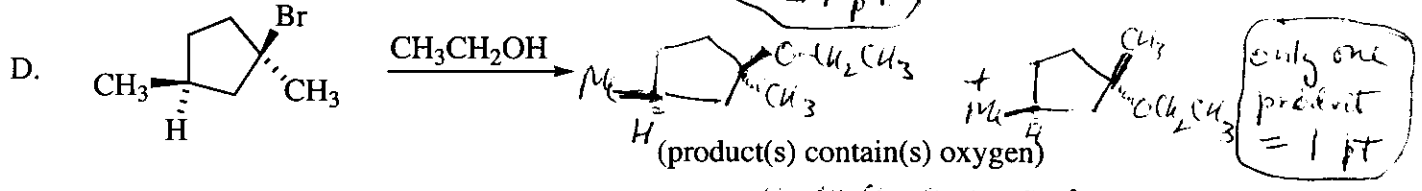
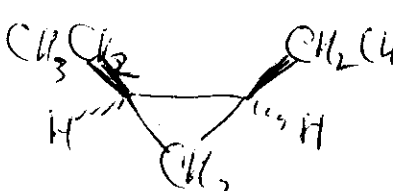

1 pt

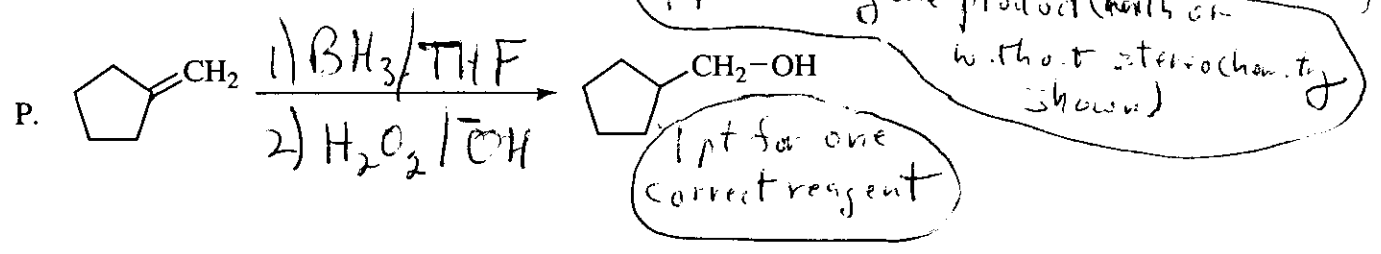
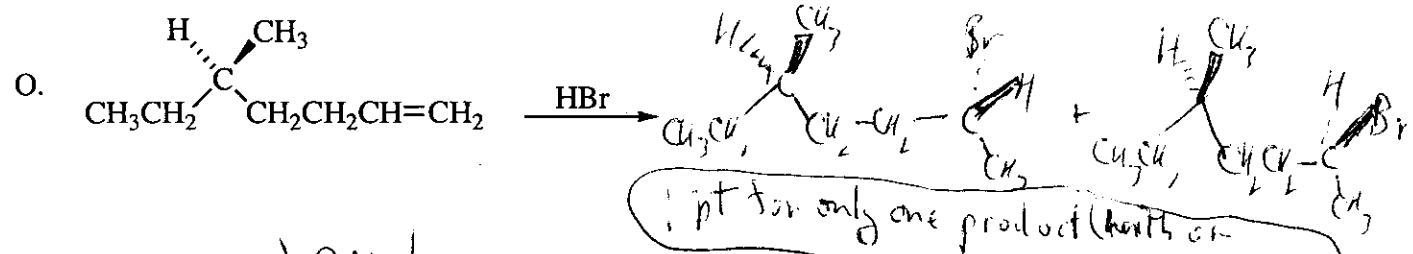
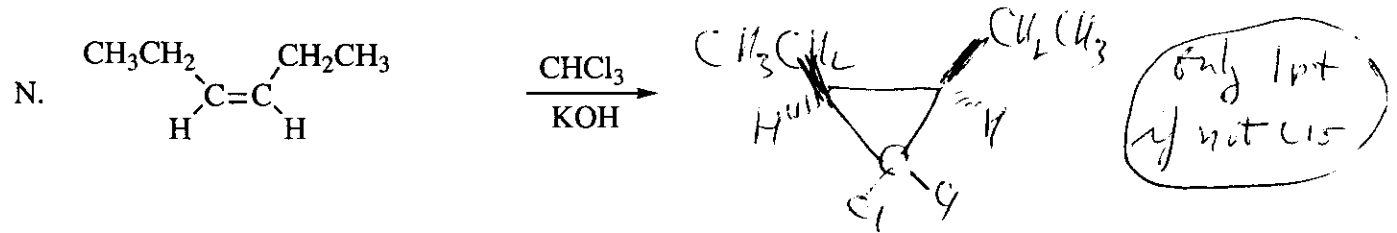
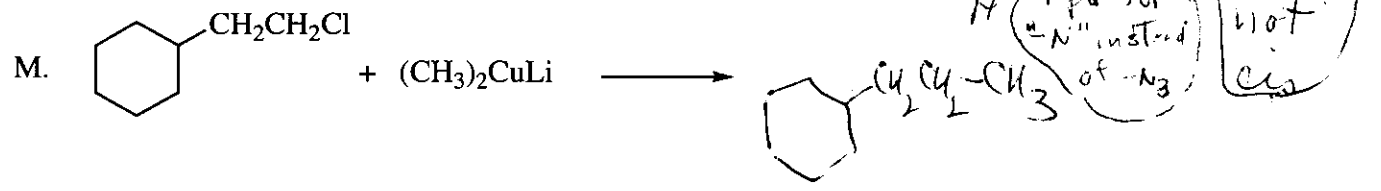
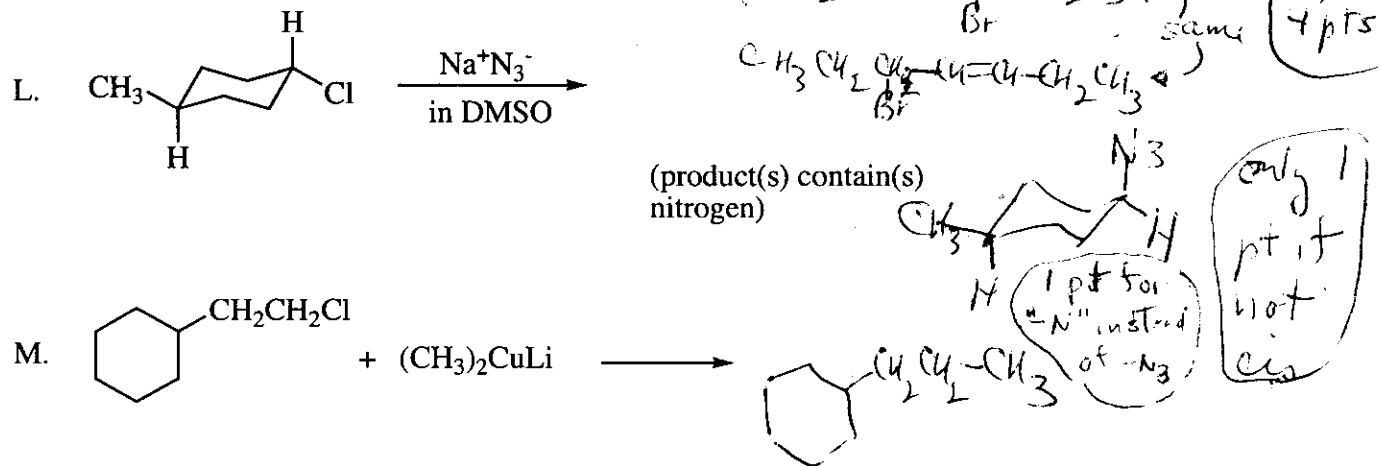
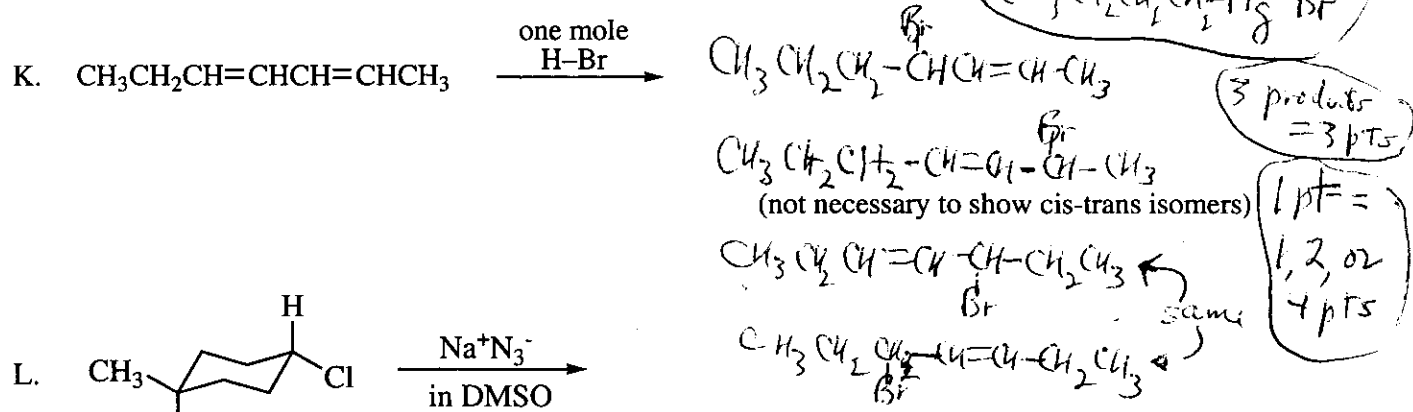
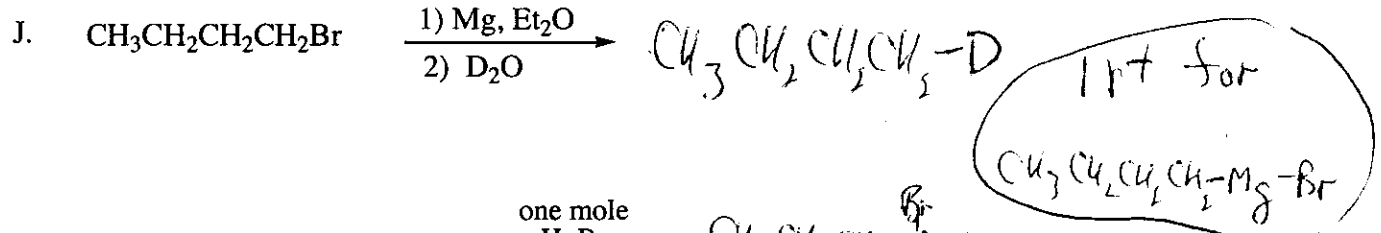
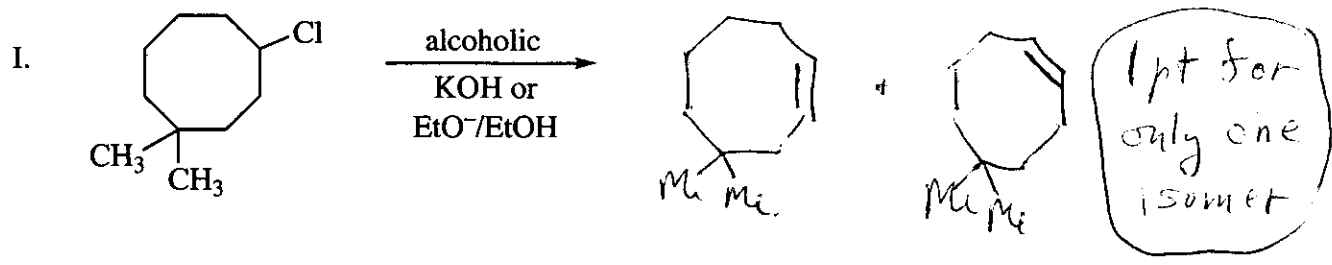
H. Draw the most stable chair conformation of the most stable stereoisomer of 1,2,3,5-tetramethylcyclohexane.

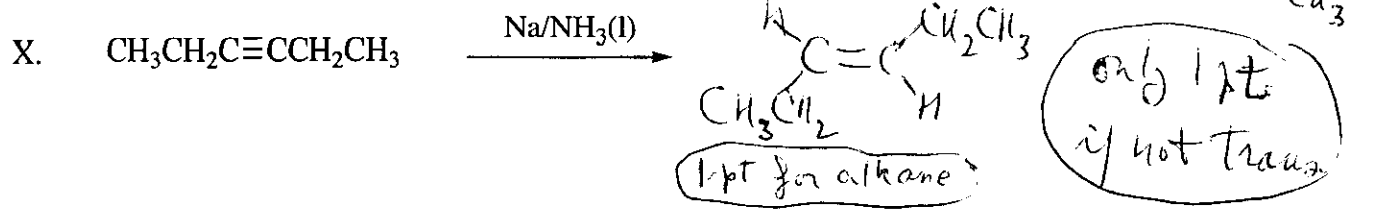
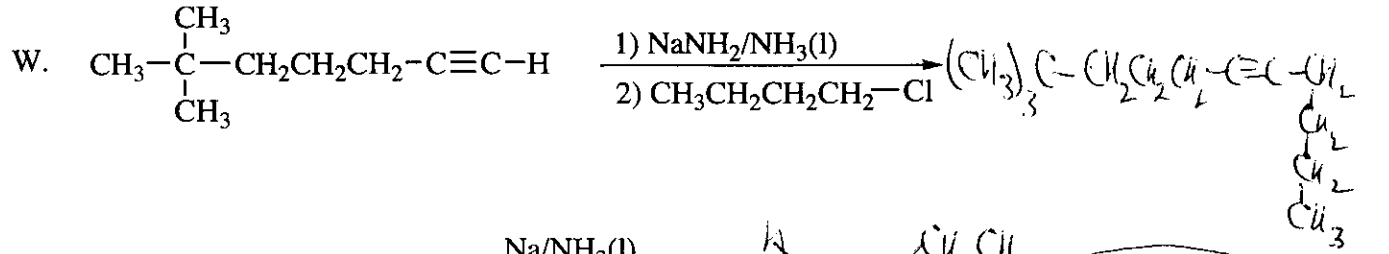
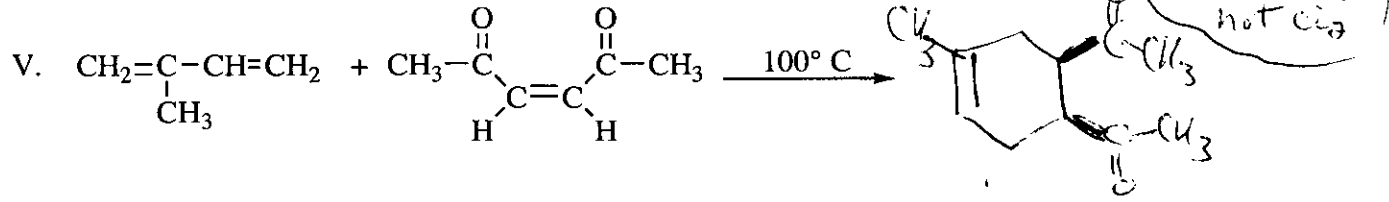
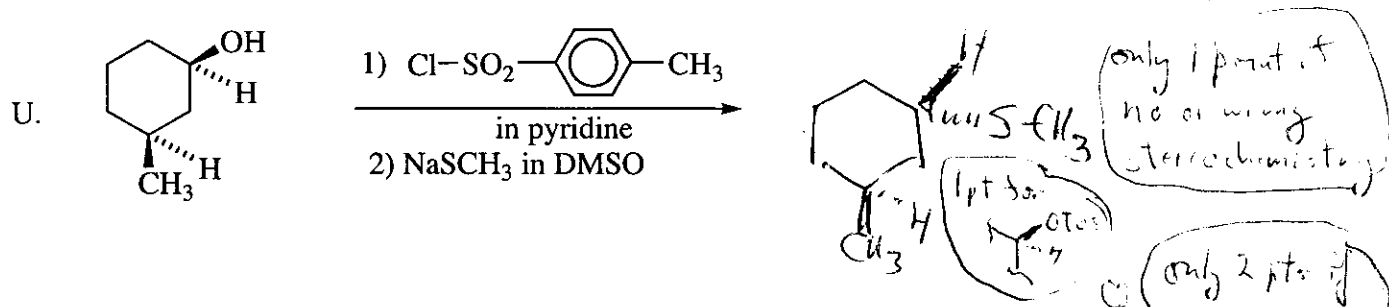
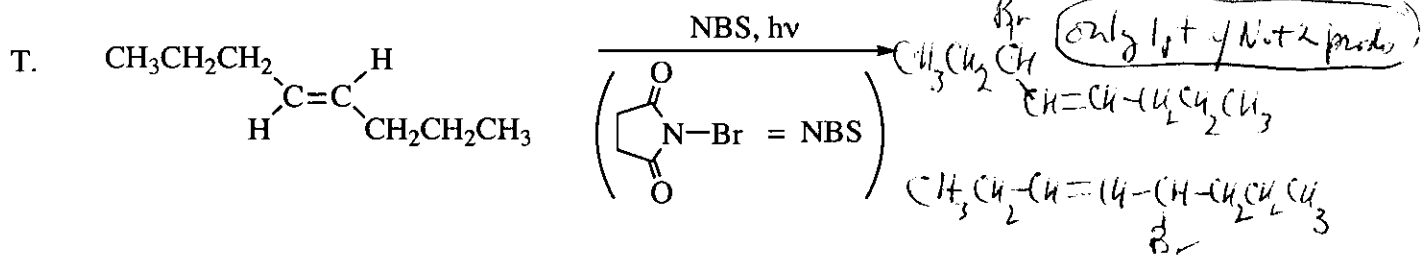
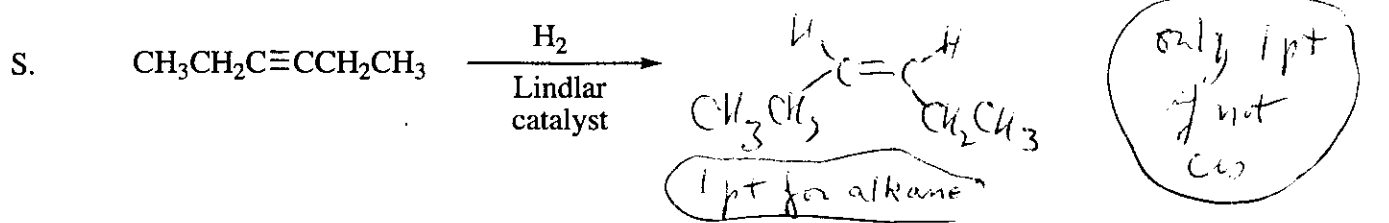
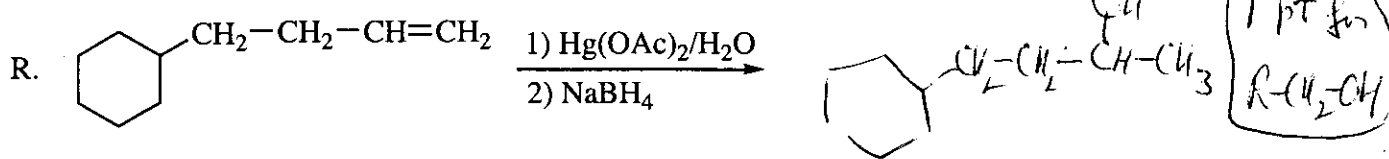
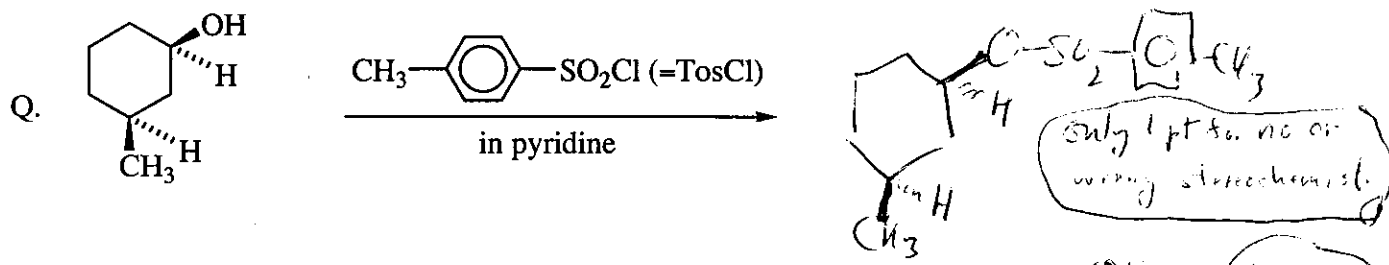


1 pt for correct chair

II. (72 pts) Complete the following equations giving all organic product(s) or reagents as required. Stereochemistry must be clearly indicated in reactions that are stereoselective.

- A. 
- B. $(\text{CH}_3\text{CH}_2)_2\text{CH}-\text{CH}_3 \xrightarrow[\text{hv}]{\text{Cl}_2}$ $\text{Cl}-\text{CH}_2\text{CH}_2-\underset{\text{CH}_3}{\text{CH}}-\text{CH}_3 + \text{CH}_3-\underset{\text{CH}_3}{\text{CH}}(\text{Cl})-\text{CH}_3 + (\text{CH}_3\text{CH}_2)_2\underset{\text{Cl}}{\text{C}}-\text{CH}_3$
 (product(s) contain(s) oxygen)
- C. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2-\underset{\text{H}}{\text{C}}=\underset{\text{H}}{\text{C}}-\begin{matrix} \text{CH}_2\text{CH}_3 \\ \text{CH}_2\text{CH}_3 \end{matrix} \xrightarrow[2) \text{Zn/HOAc}]{1) \text{O}_3}$ $(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2-\text{C}=\text{O}) + \text{O}=\text{C}-\begin{matrix} \text{CH}_2\text{CH}_3 \\ \text{CH}_2\text{CH}_3 \end{matrix}$
 (both products = 3 pts, only one product = 1 pt)
- D. 
- E. $\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}=\text{CHCH}_3 \xrightarrow[\text{CCl}_4]{1 \text{ mole Br}_2}$ $\text{CH}_3\text{CH}_2\text{CH}(\text{Br})=\text{CH}-\text{CH}(\text{Br})-\text{CH}_3$
 (2 pts = 2 products, 1 pt = 1 product, not necessary to show cis-trans isomers)
- F. $\text{CH}_3\text{CH}_2-\underset{\text{H}}{\text{C}}=\underset{\text{H}}{\text{C}}-\text{CH}_2\text{CH}_3 \xrightarrow[\text{Zn(Cu)}]{\text{CH}_2\text{I}_2}$ 
 (only 1 pt if not cis)
- G. 
- H. $\begin{matrix} \text{CH}_2\text{CH}_3 \\ | \\ \text{CH}_3-\text{C}-\text{H} \\ | \\ (\text{CH}_3)_3\text{C}-\text{C}-\text{Cl} \\ | \\ \text{H} \end{matrix} \xrightarrow[\text{in EtOH}]{\text{NaOEt}}$ $\begin{matrix} \text{CH}_3 & \text{CH}_2\text{CH}_3 \\ & \backslash / \\ & \text{C}=\text{C} \\ / & \backslash \\ \text{H} & \text{C}(\text{CH}_3)_3 \end{matrix}$
 (only 1 product; no O in product, only 1 pt if not the Z isomer)

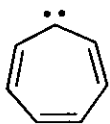




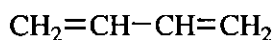
III. (30 pts) Circle the correct answer.

A. Which of the following molecules has no atoms that can be described as sp^2 hybridized?

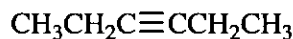
1.



2.



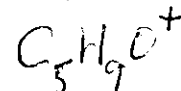
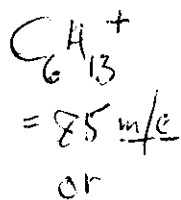
3.



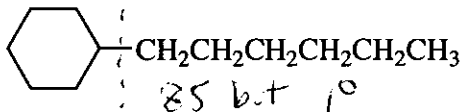
4.



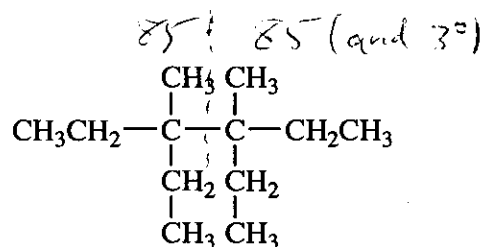
B. The compound which would be most likely to give a mass spectrum with a prominent peak at m/e 85 = is



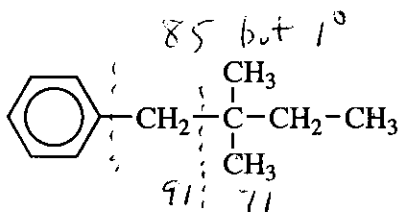
1.



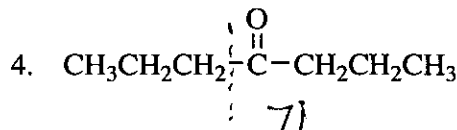
2.



3.

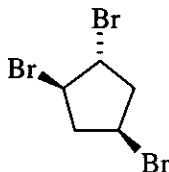


4.

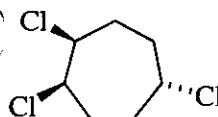


C. Which compound is a meso compound?

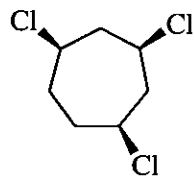
1.



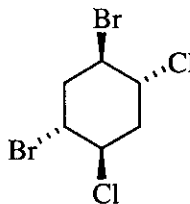
2.



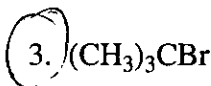
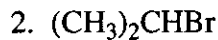
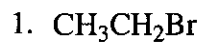
3.



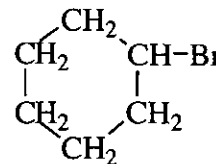
4.



D. The least reactive alkyl halide in an S_N2 reaction is

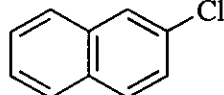


4.

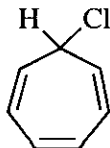


E. The reaction $\text{R}-\text{Cl} + \text{Ag}^+ \rightarrow \text{R}^+ + \text{AgCl}$ will happen most rapidly if $\text{R}-\text{Cl}$ is

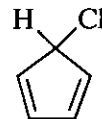
1.



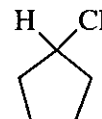
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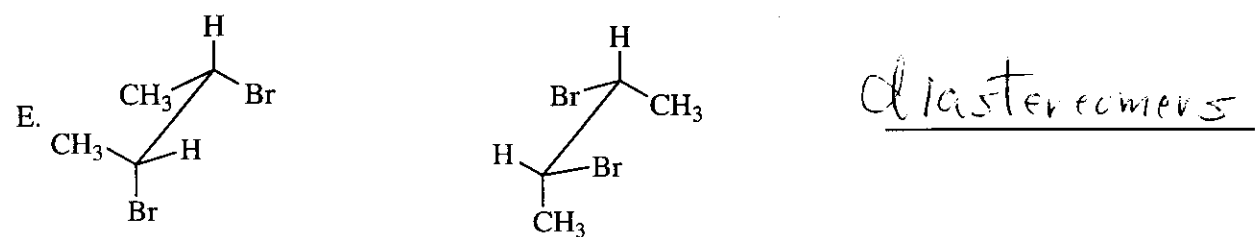
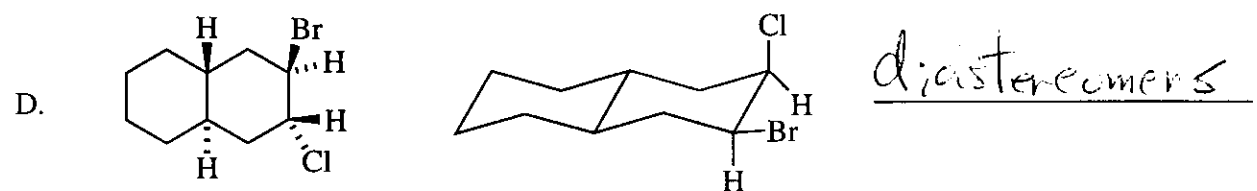
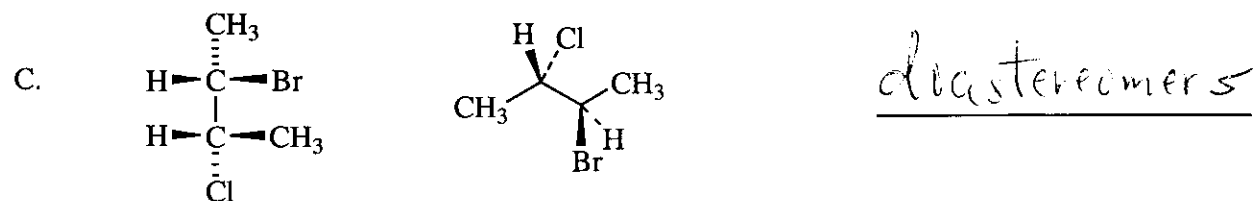
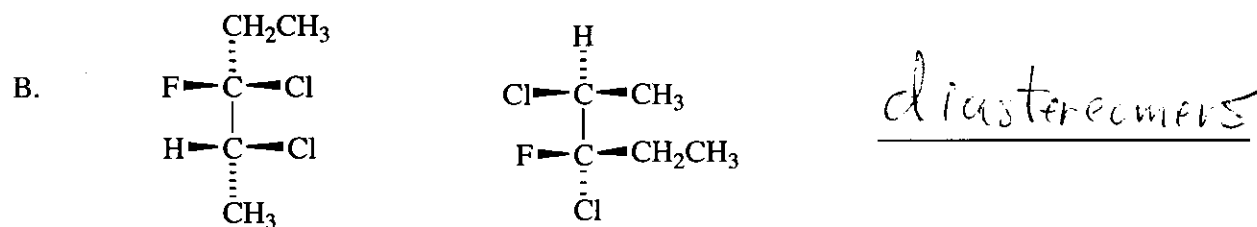
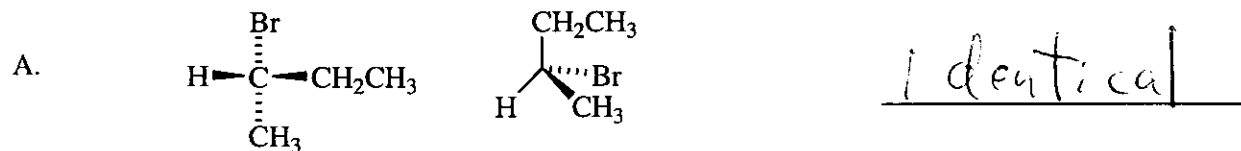
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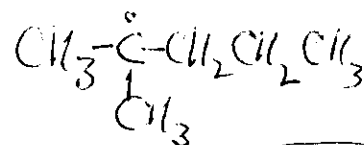
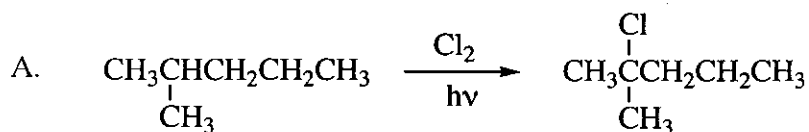
4.



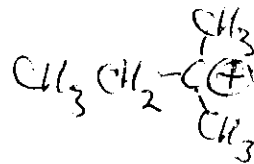
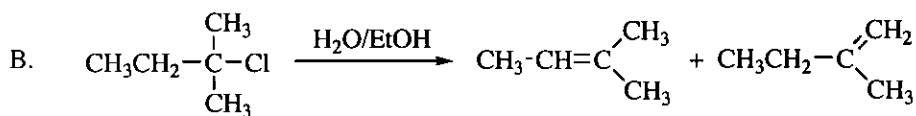
IV. (15 pts) For each of the following pair of compounds, label them as enantiomers, diastereomers, or identical. These are not frozen structures. Rotation around any single bond is possible.



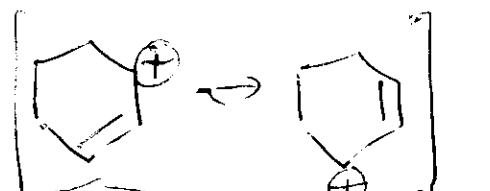
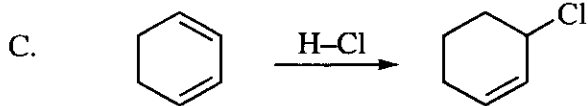
V. (16 pts) Give only the **organic reactive intermediate** for the following reactions. If the intermediate is a resonance hybrid, give all major contributing structures. Do not give the entire mechanism. Place your answer in the appropriate box.



any other structure = 0 pts
0 pts for + or -

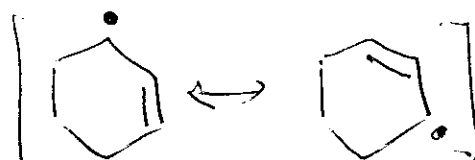
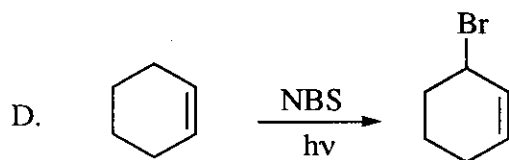


Any other structure = 0 pts
0 pts for + or -



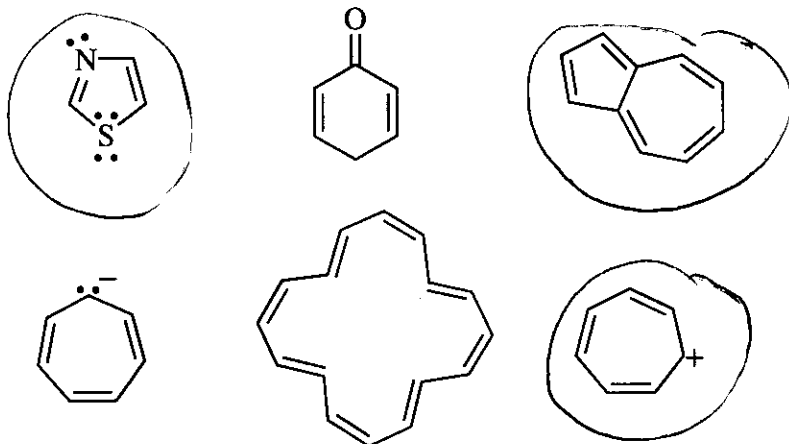
2 pt for one resonance str.
4 pts for two resonance structures

0 pts for + or -



2 pt for one resonance str.
4 pts for two resonance str.
0 pts for + or -

VI. (6 pts) Circle all of the species shown that would be expected to be aromatic.



VII. (25 pts) For each of the following compounds, propose a structure in the box provided that fits the data presented.

A. (6 pts) $C_6H_{14}O$

1H NMR:

δ 3.4 (4H, triplet)

δ 1.6 (4H, sextet)

δ 0.9 (6H, ~~quartet~~ triplet)

Broadband decoupled ^{13}C NMR:

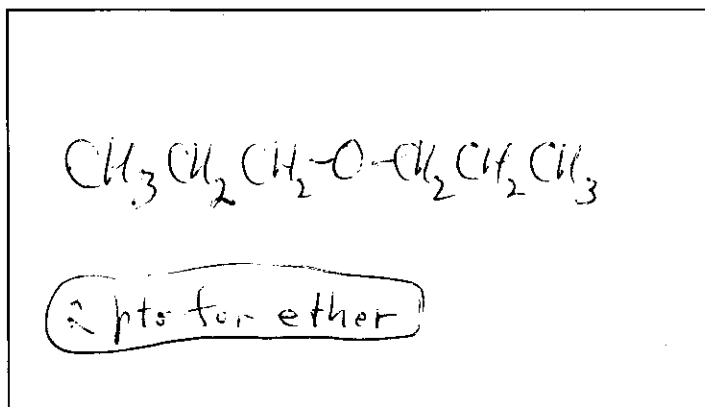
δ 72.73

δ 23.20

δ 10.80

IR:

1100 cm^{-1}



B. (6 pts) $C_9H_{10}O$

1H NMR:

δ 7.9 (2H, doublet)

δ 7.5 (3H, multiplet)

δ 3.0 (2H, quartet)

δ 1.2 (3H, triplet)

Broadband decoupled ^{13}C NMR:

δ 200.63 δ 127.90

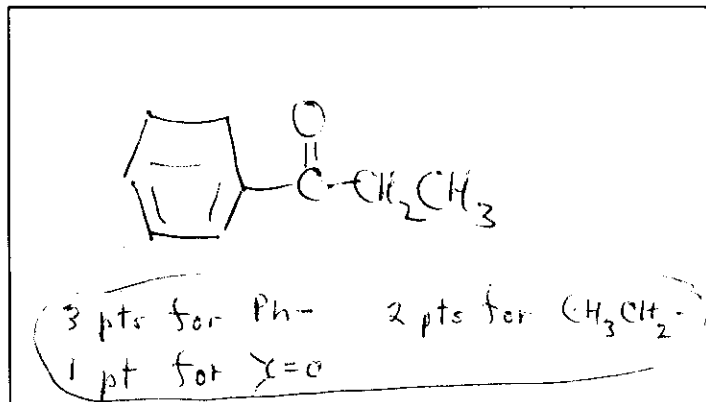
δ 136.87 δ 31.75

δ 132.79 δ 8.23

δ 128.48

IR:

1700 cm^{-1}



C. (6 pts) C_7H_9N

1H NMR

δ 7.4 (1H, triplet)

δ 6.9 (2H, doublet)

δ 2.5 (6H, singlet)

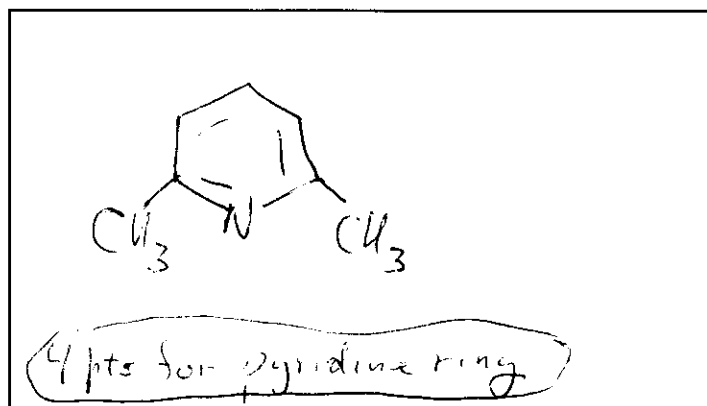
Broadband decoupled ^{13}C NMR

δ 157.54

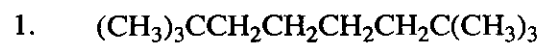
δ 136.40

δ 120.04

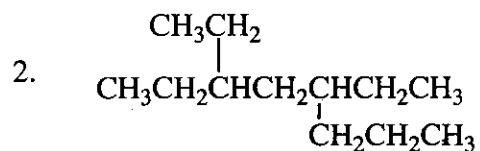
δ 24.47



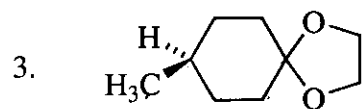
D. (7 pts) How many ^{13}C signals would each of the following compounds show? Put your answer in the blank provided.



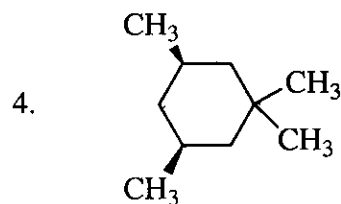
4



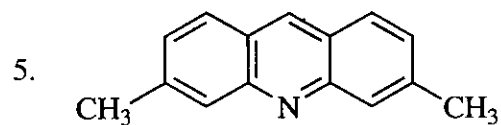
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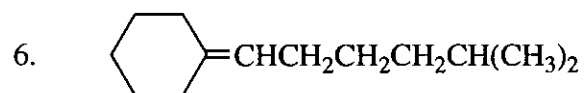
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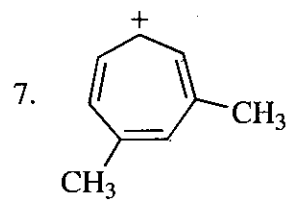
7



8



12



5

VIII. (12 pts) Beginning with the starting material indicated, show how to achieve each of the following syntheses by showing all the reactions that are needed (for each reaction, give the starting material, conditions over the arrow, and the products). You may use any inorganic compound or organic compound with one or two carbon atoms.

