

Seat No. _____

Last Name WST

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
Spring 2007
Monday, April 30
7:30 to 9:30 a.m.**

Course Grade

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) = _____

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A 6pts	B 6 pts

= _____

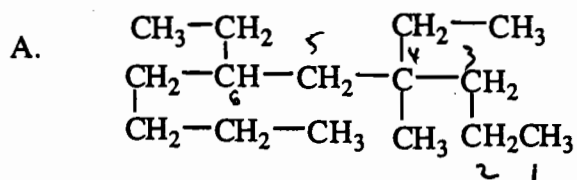
TOTAL FINAL EXAM (200 pts) = _____

To be filled in by graders:

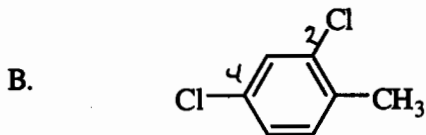
Number of quizzes taken (Cannot exceed 10) _____

Exams will be held until October 1, 2007.

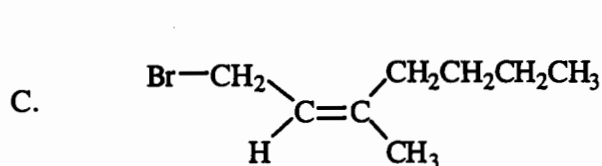
I. (24 pts) Provide a proper name for each of the following compounds. (Include R or S, cis or trans, or Z or E when required).



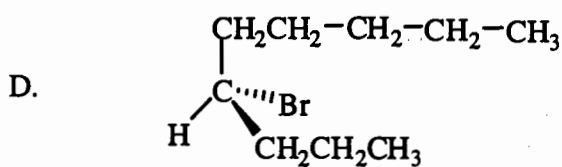
1 pt for parent
1 pt " substituents
1 pt for numbering
4,6-diethyl-4-methyldecane



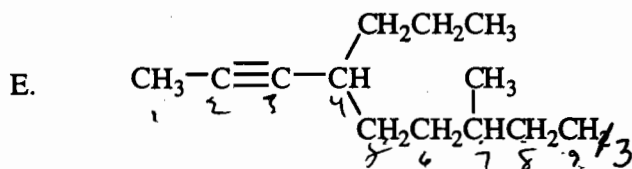
1,5-dichloro-2-methylbenzene
2,4-dichlorotoluene



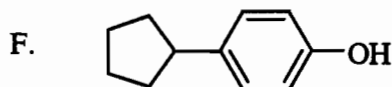
2 pts
Z-1-bromo-3-methyl-2-heptene
or 2 here or here



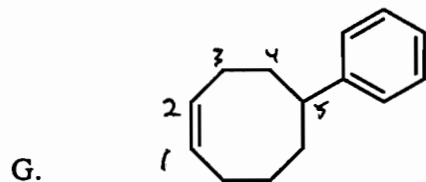
2 pts
S-4-bromononane



or 2 here or here
7-methyl-4-propyl-2-nonyne

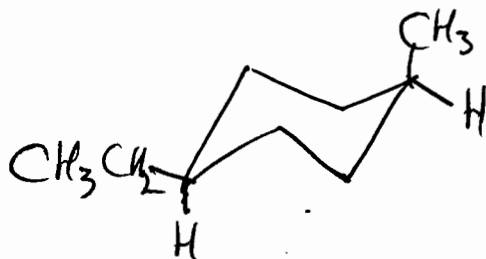


or 4
para-cyclopentylphenol
or 1-cyclopentyl-4-hydroxybenzene

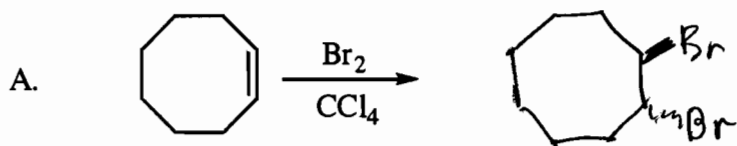


5-phenylcyclooctene

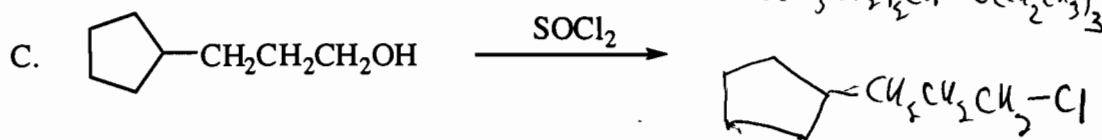
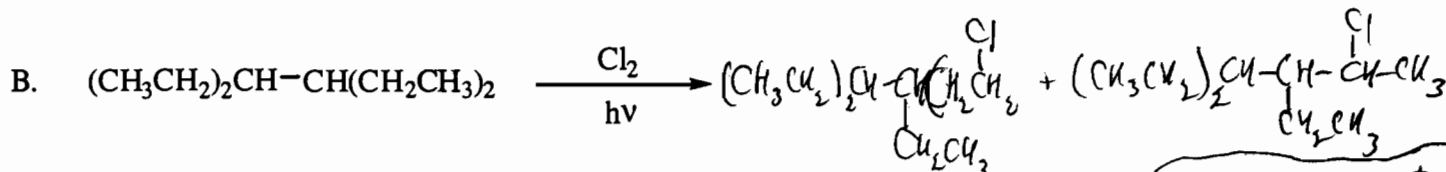
H. Draw the more stable chair conformation of cis-1-ethyl-4-methylcyclohexane.



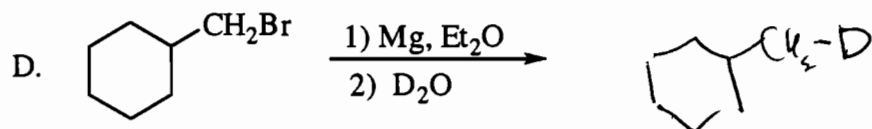
II. (72 pts) Complete the following equations giving all organic product(s) or reagents as required. Stereochemistry must be clearly indicated in reactions that are stereoselective.

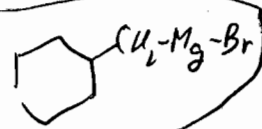


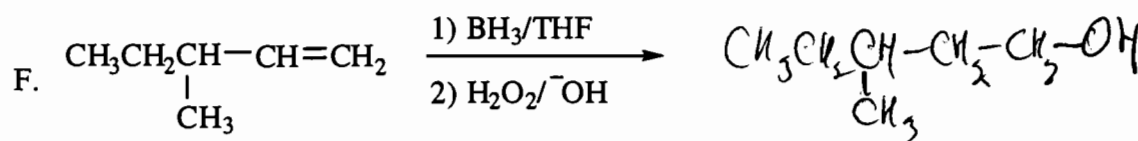
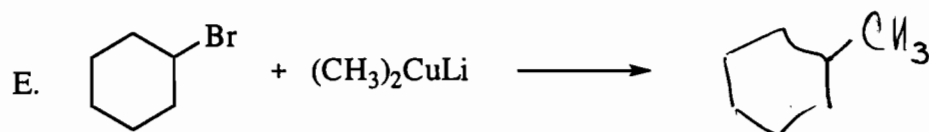
only 1 pt if not trans

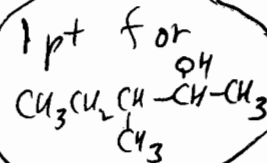


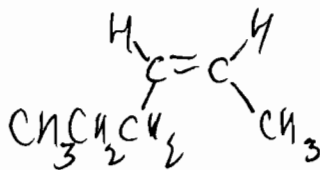
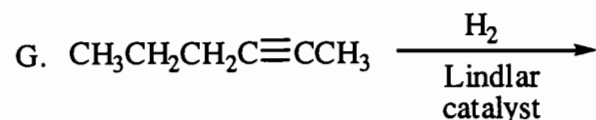
3 isomers = 3 pts
1 or 2 isomers = 1 pt
duplicate structures = -1 pt



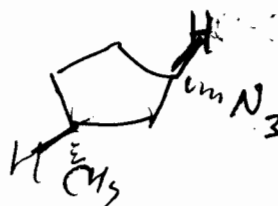
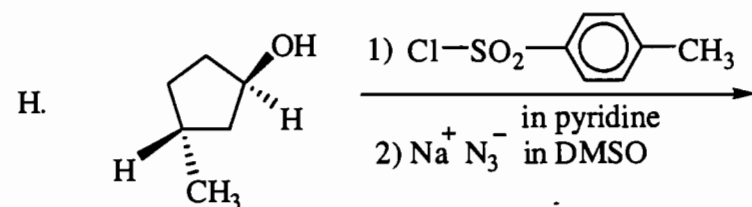
1 pt for 



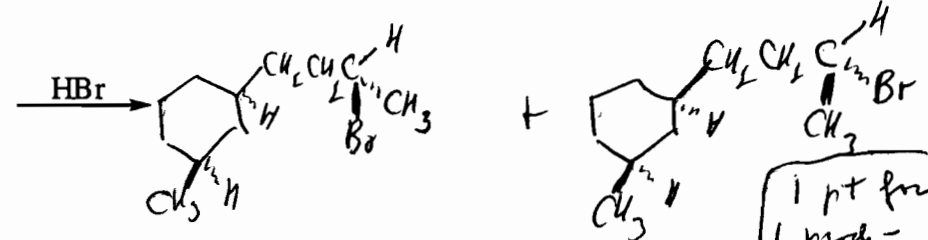
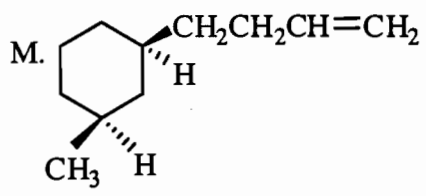
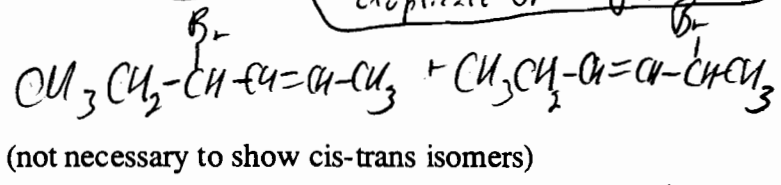
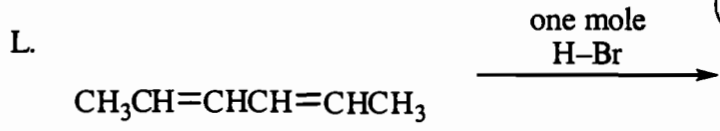
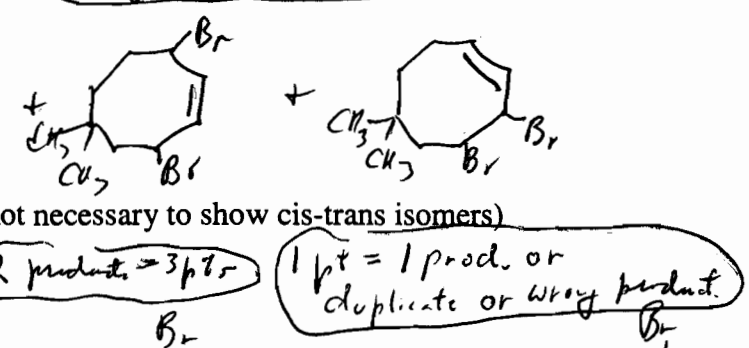
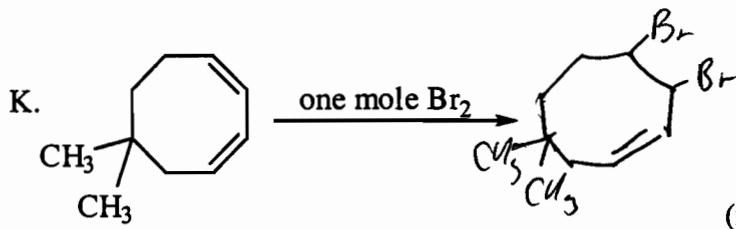
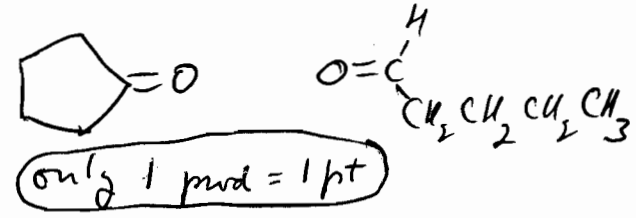
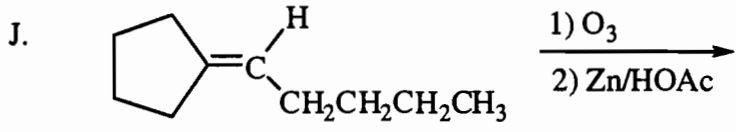
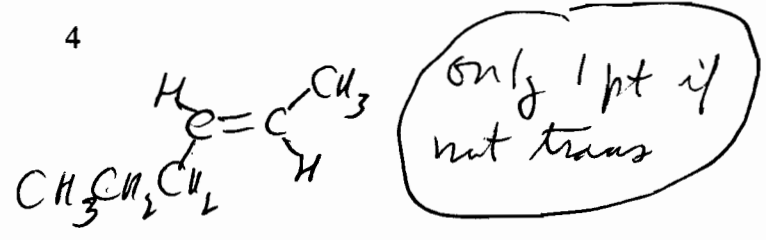
1 pt for 



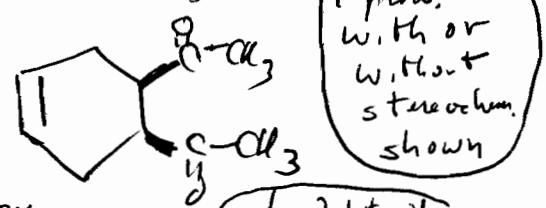
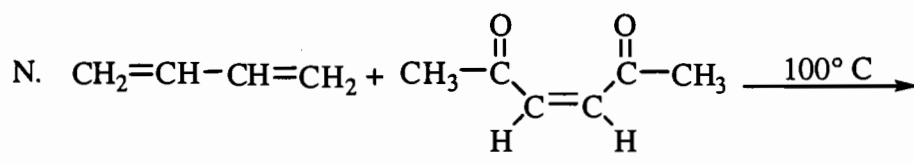
only 1 pt if not cis



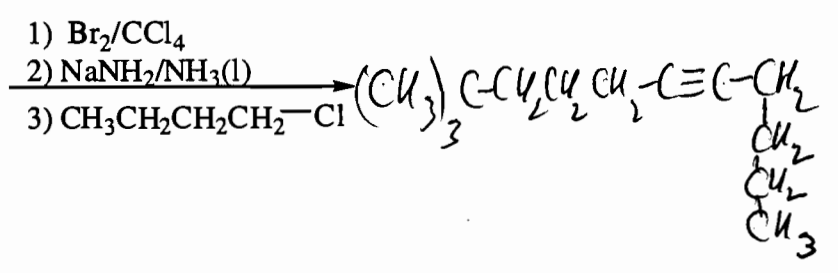
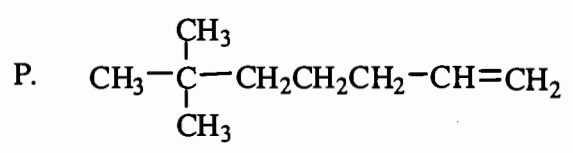
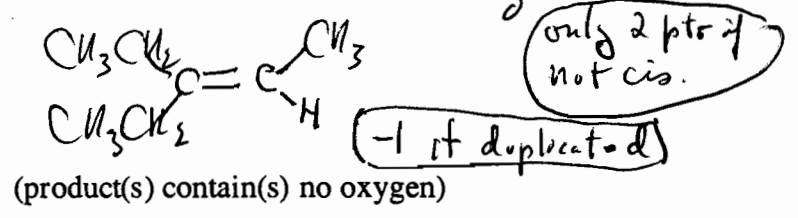
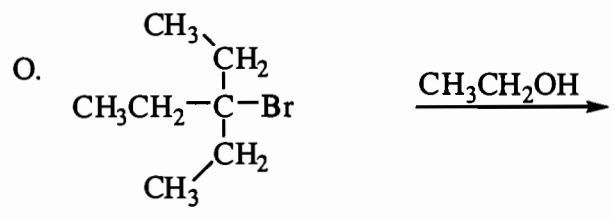
only 1 pt if No or wrong stereochemistry

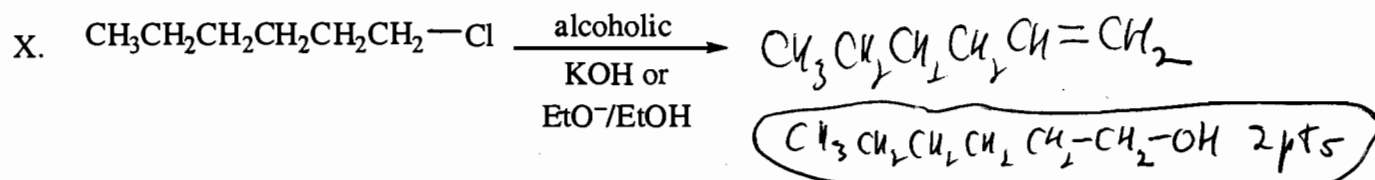
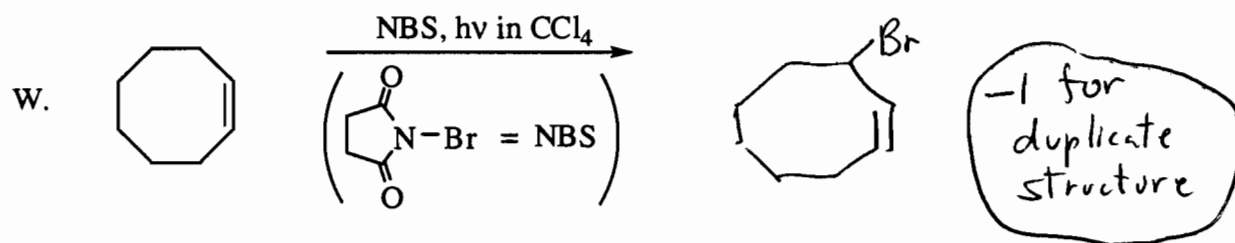
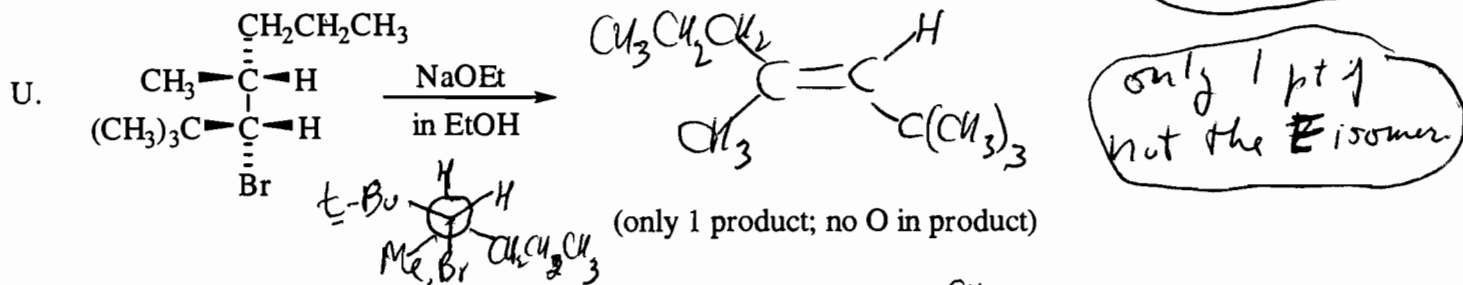
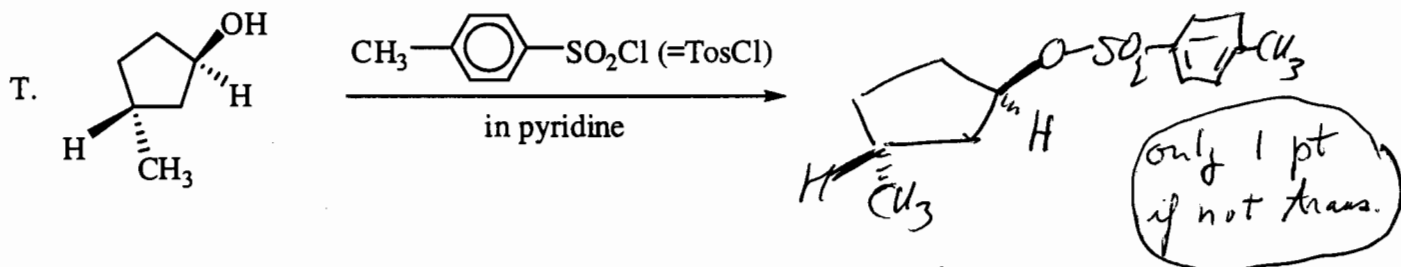
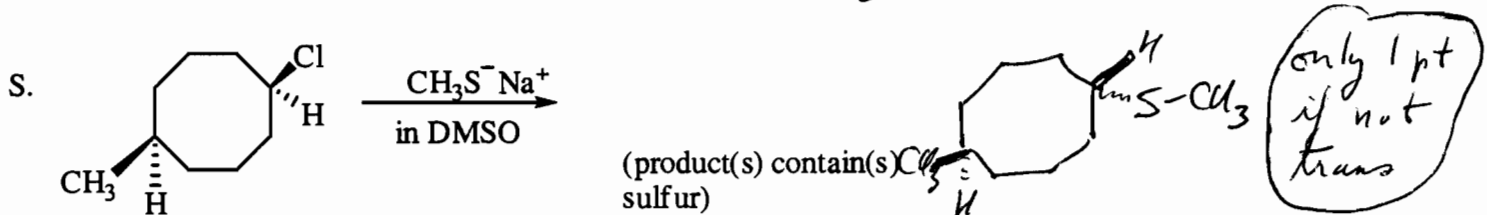
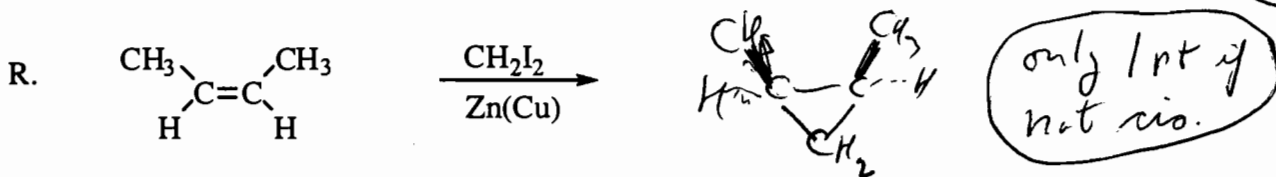
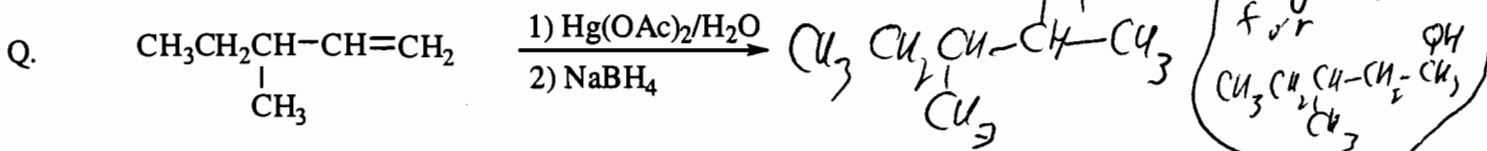


1 pt for 1 prod. - with or without stereochem. shown



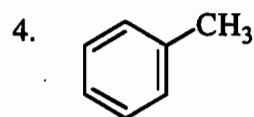
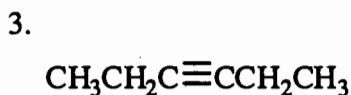
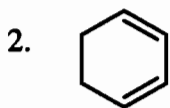
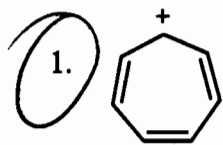
1 pt for 1 prod. - with or without stereochem. shown



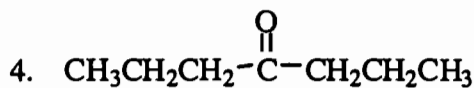
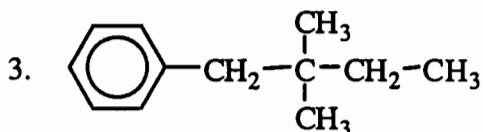
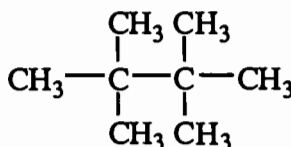
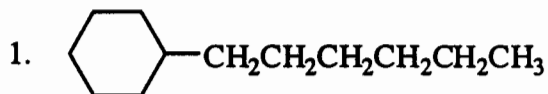


III. (30 pts) Circle the correct answer.

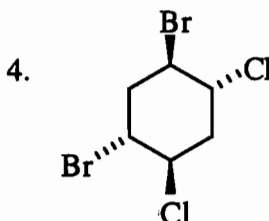
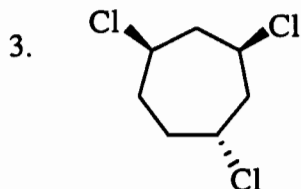
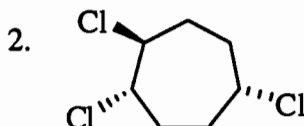
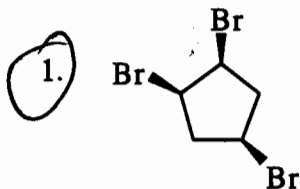
A. Which of the following molecules or ions has no atoms that can be described as sp^3 hybridized?



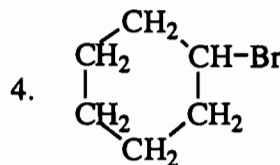
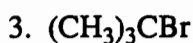
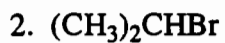
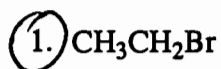
B. The compound which would be most likely to give a mass spectrum with a prominent peak at m/e 57 = is



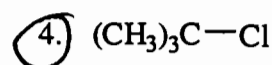
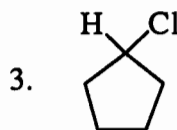
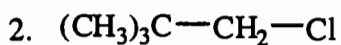
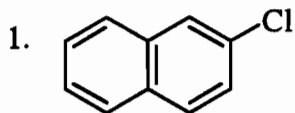
C. Which compound is a meso compound?



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



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



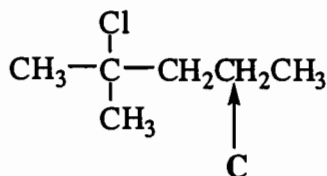
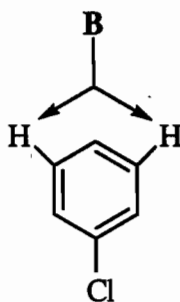
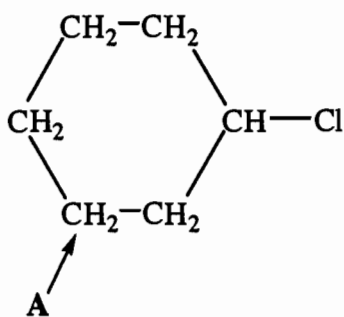
F. In the chemistry of vision, the absorption of light brings about

1. a substitution reaction.
2. an elimination reaction.
3. an isomerization reaction.
4. a free radical reaction.

G. The molecular formula of *para*-phenylaniline is

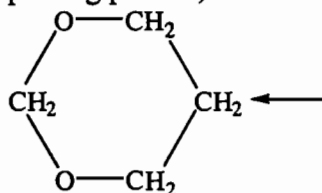
1. C_6H_7N
2. $C_{12}H_{11}N$
3. $C_{13}H_{13}N$
4. None of the formulas given.

H. The indicated pairs of hydrogen atoms **A**, **B**, and **C** are:



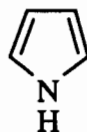
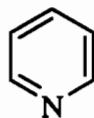
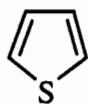
1. **A**-diastereotopic
B-enantiotopic
C-homotopic
2. **A**-enantiotopic
B-homotopic
C-diastereotopic
3. **A**-diastereotopic
B-homotopic
C-enantiotopic
4. **A**-homotopic
B-diastereotopic
C-enantiotopic

I. What multiplicity (splitting pattern) is observed in the 1H NMR spectrum for the indicated hydrogen?



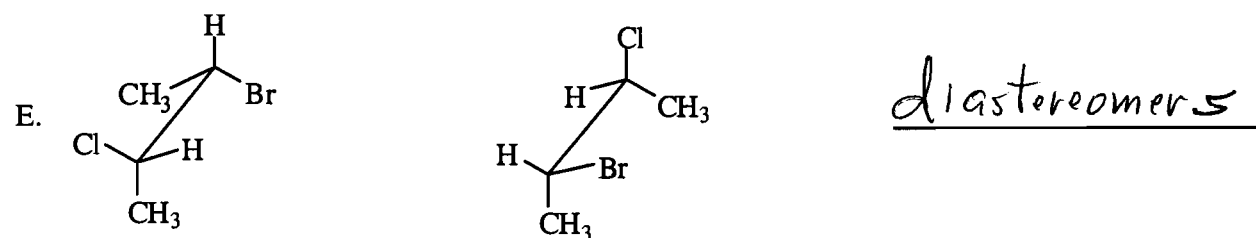
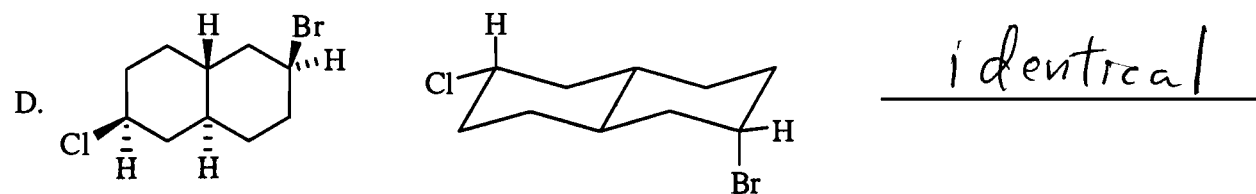
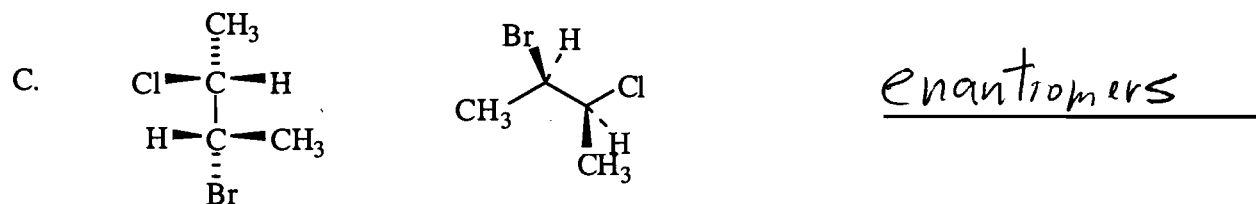
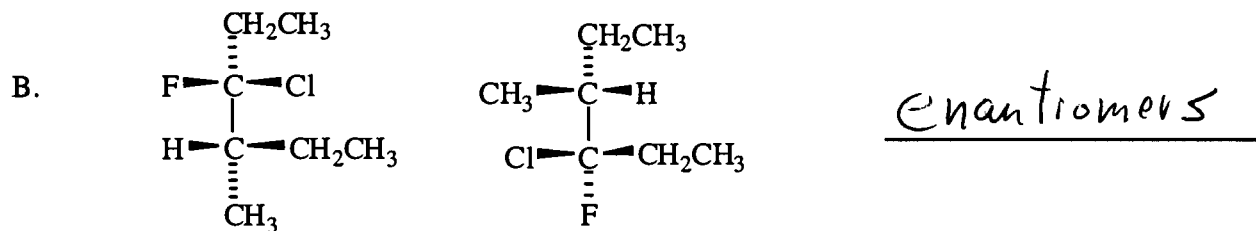
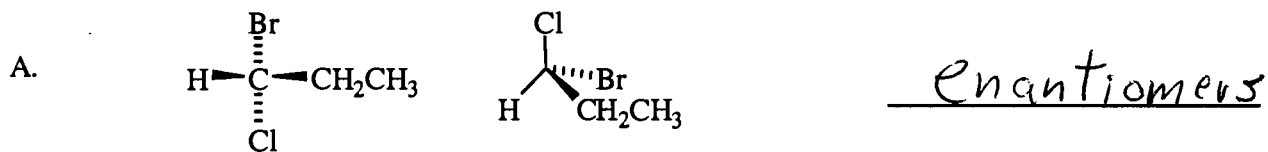
1. doublet
2. triplet
3. quartet
4. quintet

J. The names for the following three compounds are in which list?

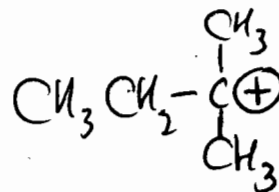
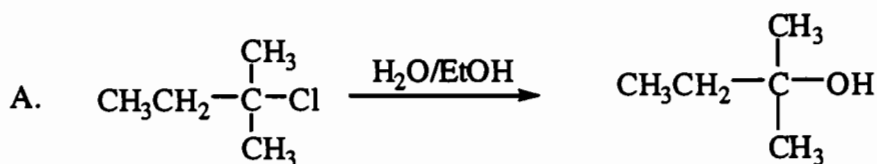


1. furan
naphthalene
pyrrole
2. furan
pyridine
pyrrole
3. pyrrole
pyridine
thiophene
4. pyran
pyrrole
styrene

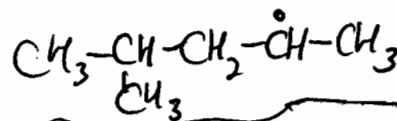
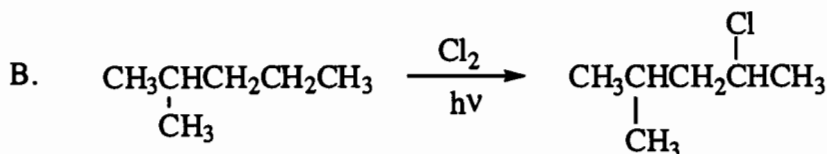
IV. (15 pts) For each of the following pair of compounds, label them as enantiomers, diastereomers, or identical. These are not frozen structures. Rotation around any single bond is possible.



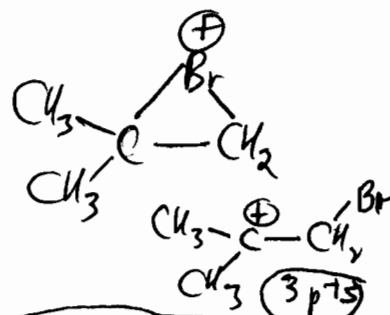
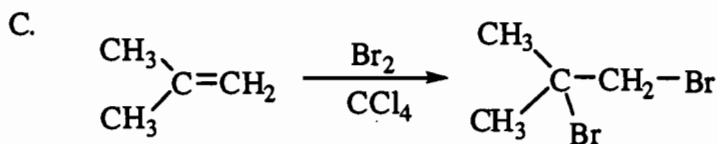
V. (16 pts) Give only the organic reactive intermediate for the following reactions. If the intermediate is a resonance hybrid, give all major contributing structures. Do not give the entire mechanism. Place your answer in the appropriate box.



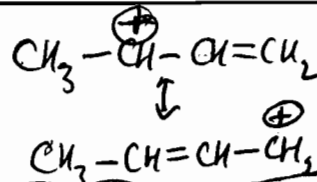
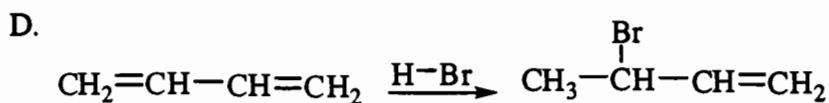
Any other structure = 0 pts
0 pts for • or -



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

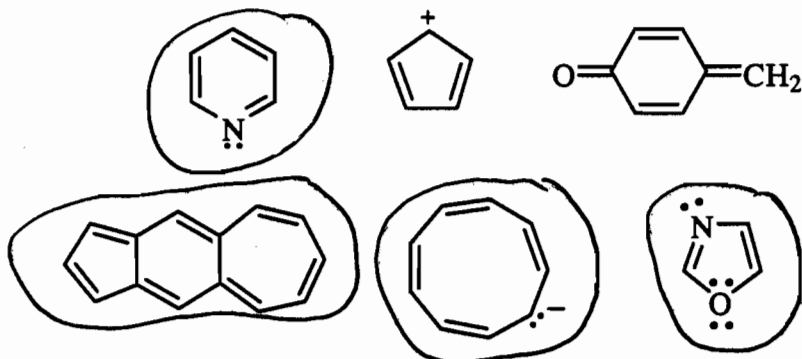


0 pts for • or -



2 pts for one resonance st,
4 pts for two " sts
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) $C_6H_{12}O_3$

1H NMR:

δ 4.8 (1H, triplet)

δ 3.4 (6H, singlet)

δ 2.7 (2H, doublet)

δ 2.2 (3H, singlet)

Broadband decoupled ^{13}C NMR:

δ 205.2

δ 101.5

δ 53.8

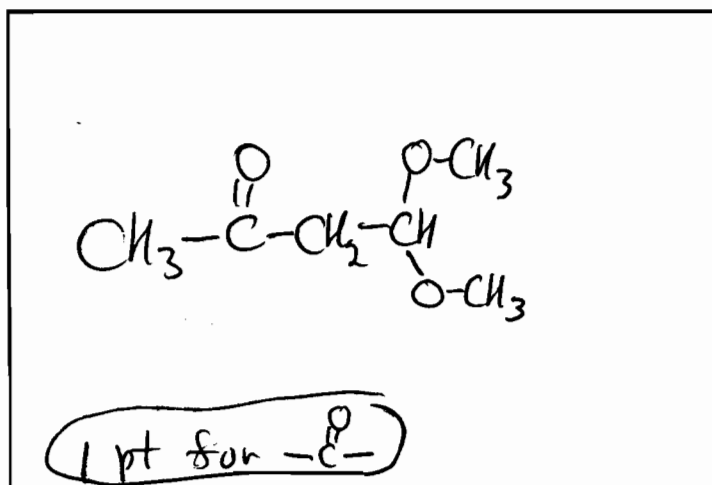
δ 47.3

δ 31.0

IR:

1710 cm^{-1}

1100 cm^{-1}



B. (6 pts) $C_{11}H_{16}O$

1H NMR:

δ 7.2 (2H, doublet)

δ 6.8 (2H, doublet)

δ 5.4 (1H, singlet)

δ 1.6 (2H, quartet)

δ 1.2 (6H, singlet)

δ 0.7 (3H, triplet)

Broadband decoupled ^{13}C NMR:

δ 152.8

δ 37.3

δ 141.8

δ 37.0

δ 127.1

δ 28.6

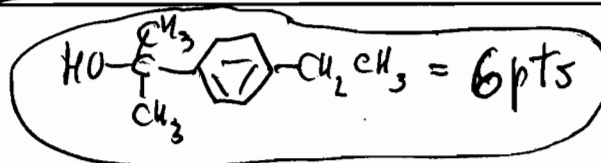
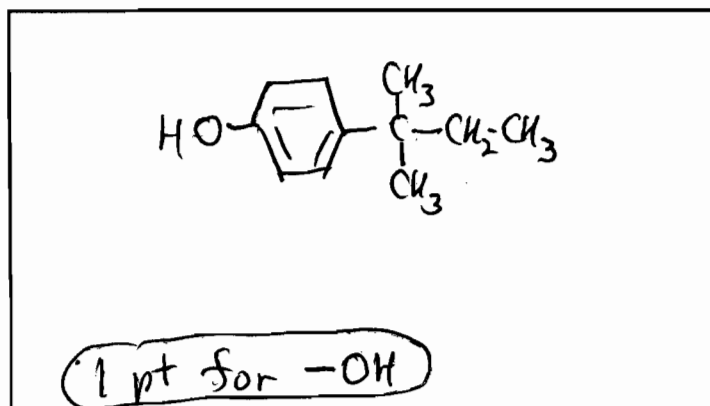
δ 114.8

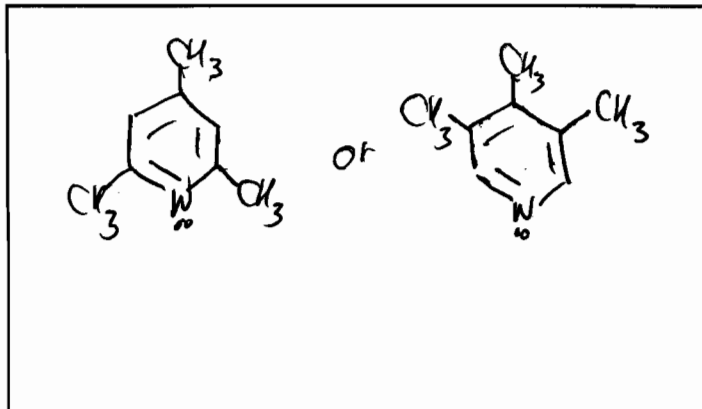
δ 9.1

IR:

3500 cm^{-1}

1100 cm^{-1}



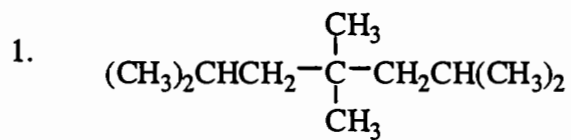
C. (6 pts) $C_8H_{11}N$ 1H NMR δ 6.8 (2H, singlet) δ 2.5 (6H, singlet) δ 2.2 (3H, singlet)Broadband decoupled ^{13}C NMR δ 157.3 δ 147.3 δ 121.1 δ 24.3 δ 20.8

(At least two structures fit the data, only one needs to be given.)

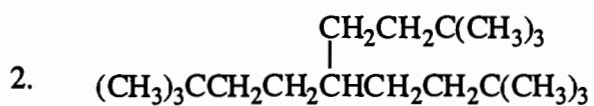
2 pts for

A hand-drawn structure of indole, consisting of a benzene ring fused to a pyrrole ring.

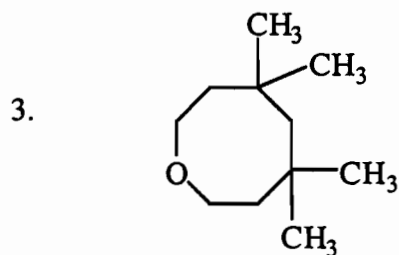
D. (7 pts) How many ^{13}C signals would each of the following compounds show? Put your answer in the blank provided.



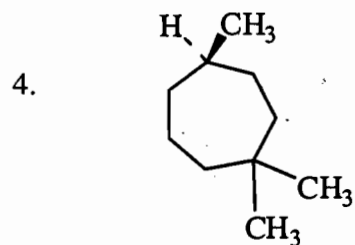
5



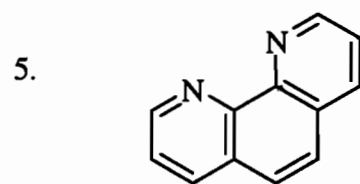
5



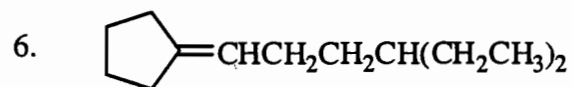
5



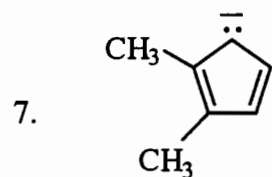
10



6



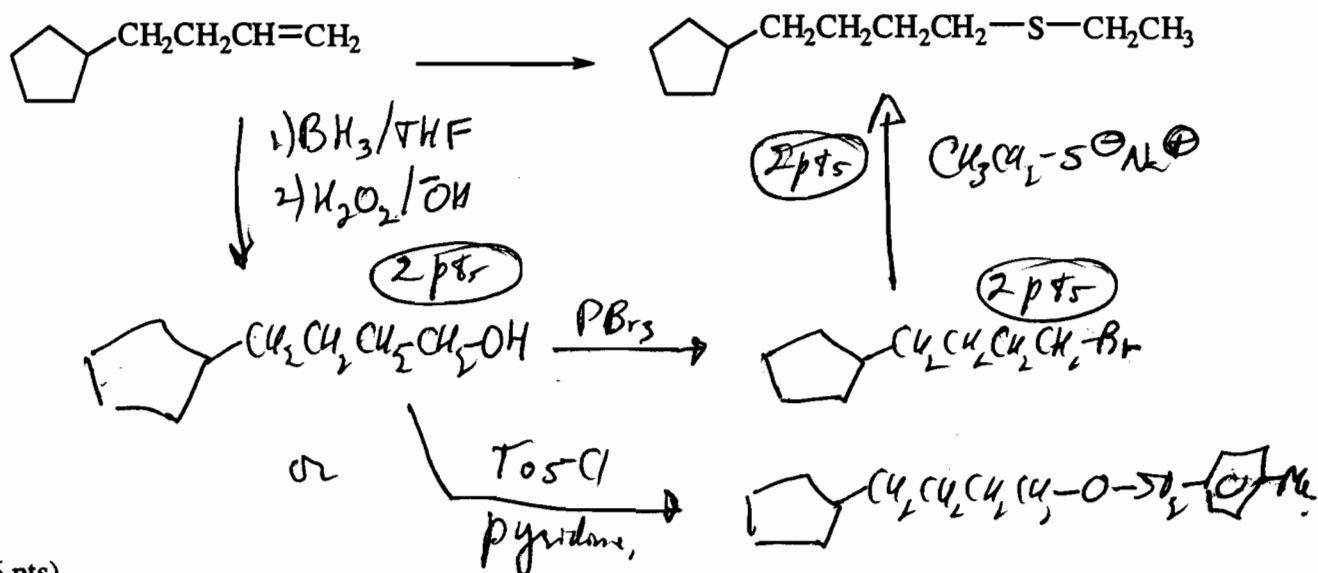
11



4

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.

A. (6 pts)



B. (6 pts)

