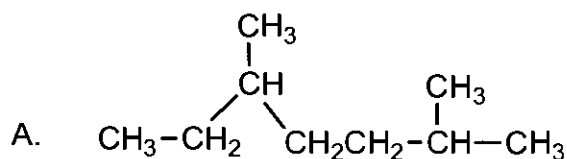


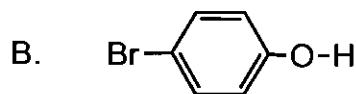
I. (24 pts) Provide a proper name for each of the following compounds. (Include R or S, cis or trans, or Z or E when required).



1 pt for parent; 1 pt for substituents;
1 pt for numbering

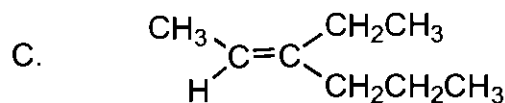
2,5-dimethylheptane

(or 4-) (or 1-bromo-4-hydroxy benzene)



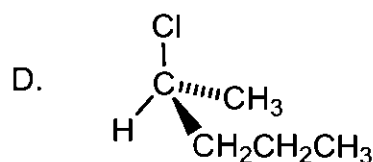
2 pts

para-bromophenol



E-3-ethyl-2-hexene

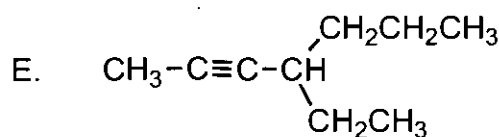
or 2 here or here



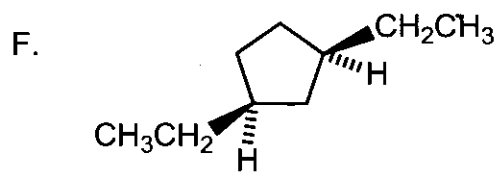
2 pts

S-2-chloropentane

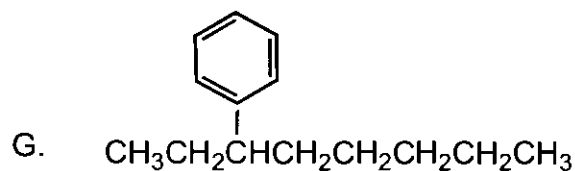
or 2 here or here



4-ethyl-2-heptyne

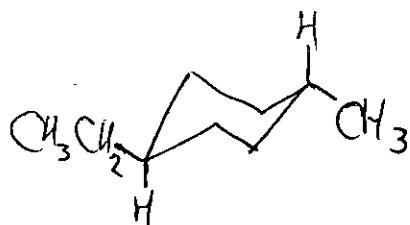


cis-1,3-diethylcyclopentane

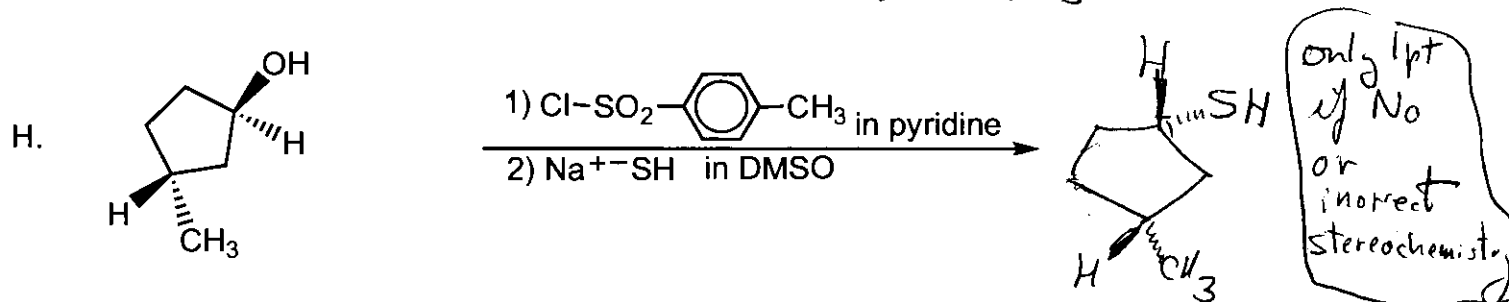
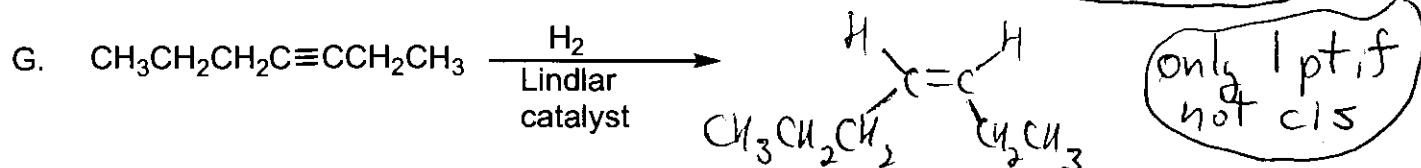
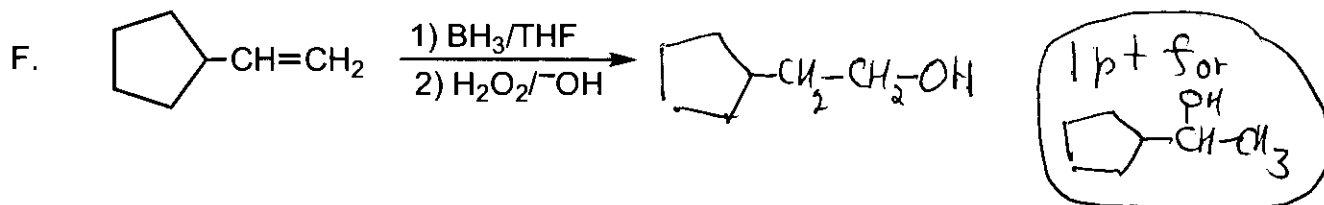
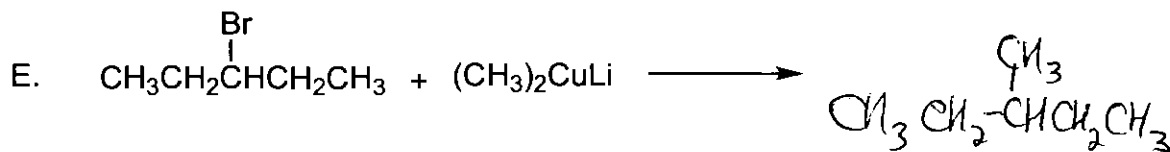
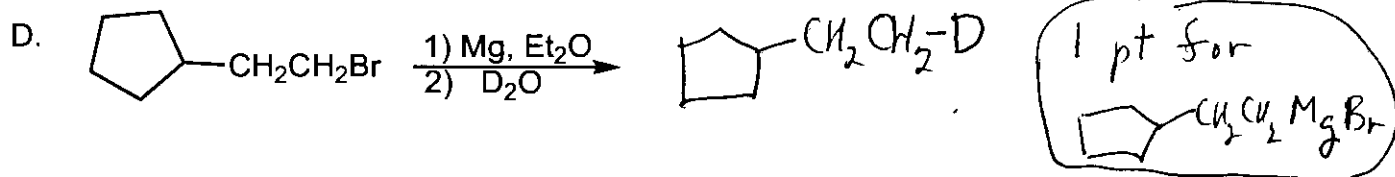
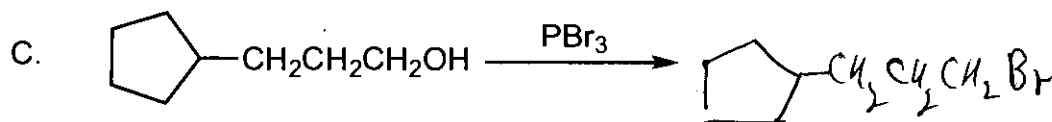
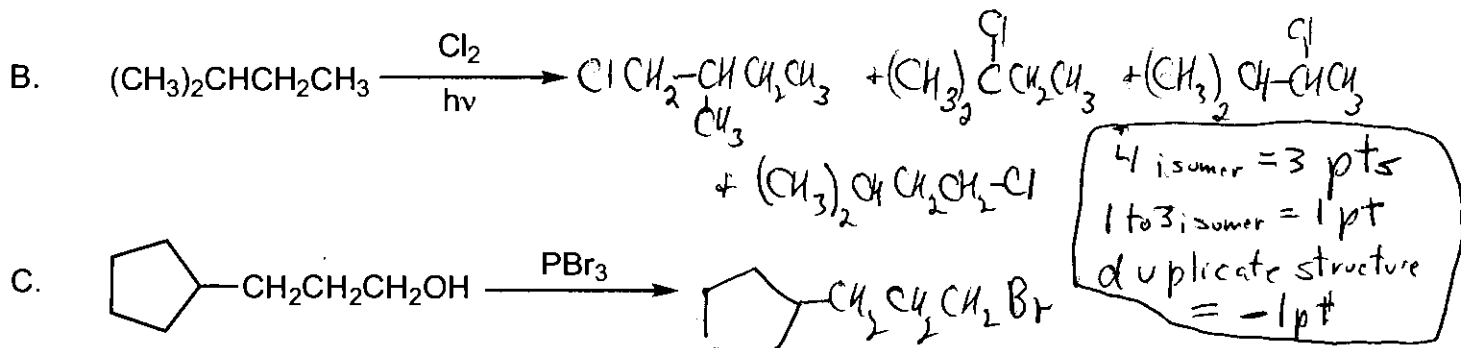
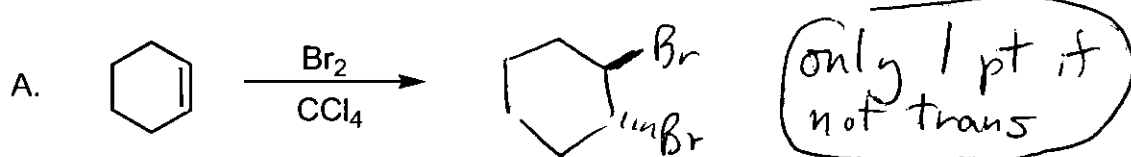


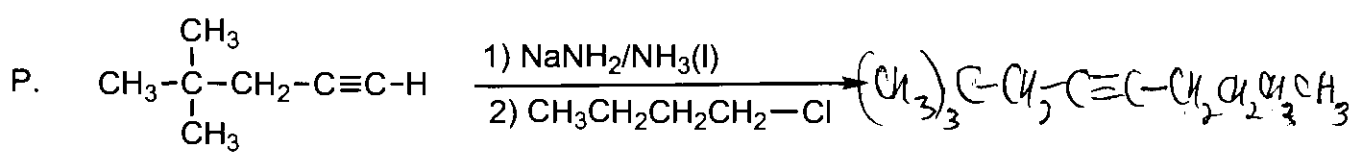
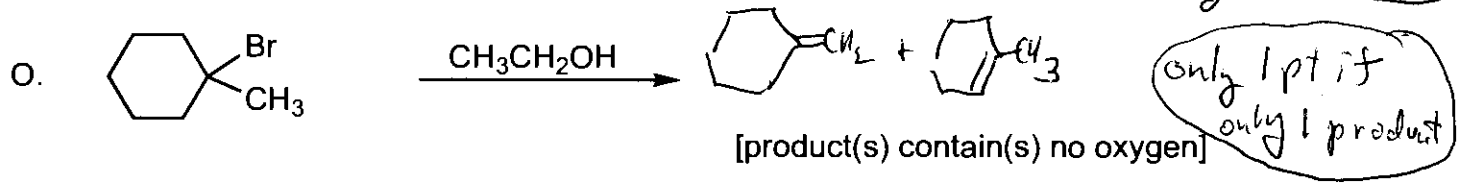
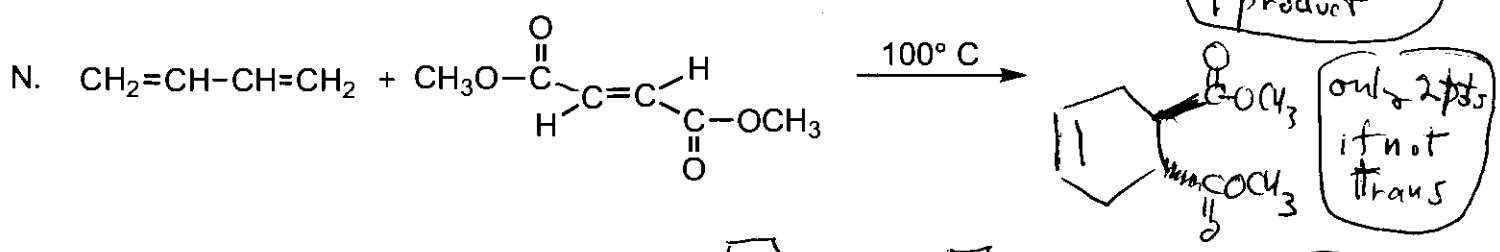
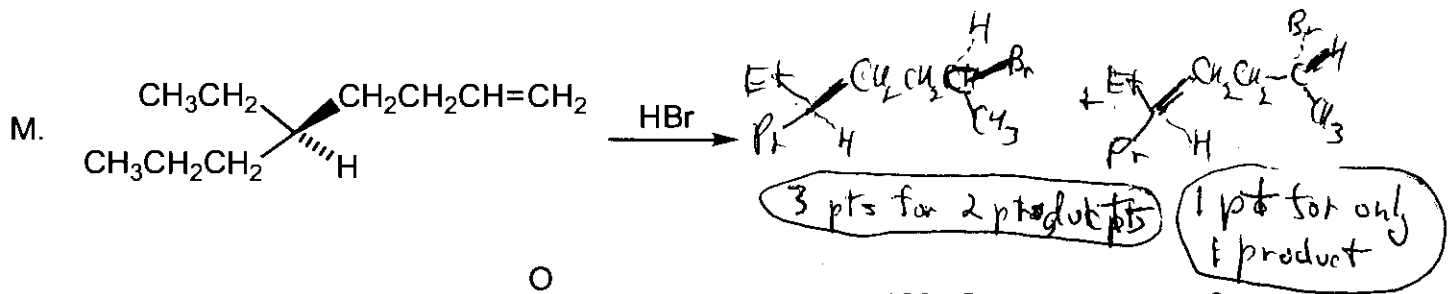
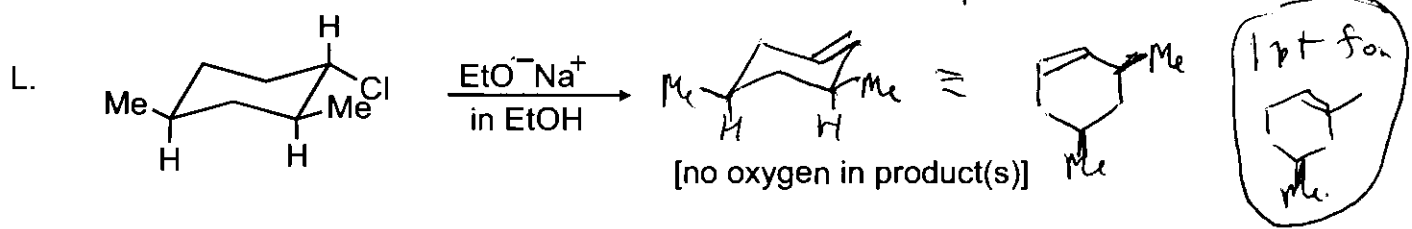
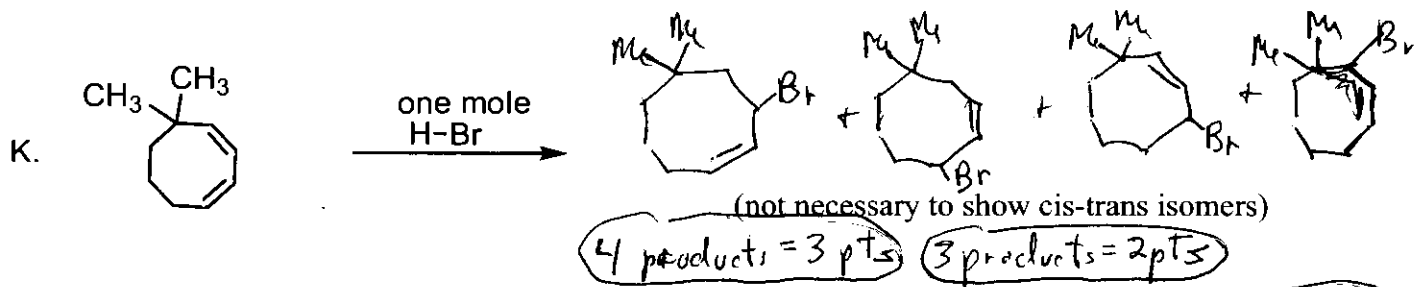
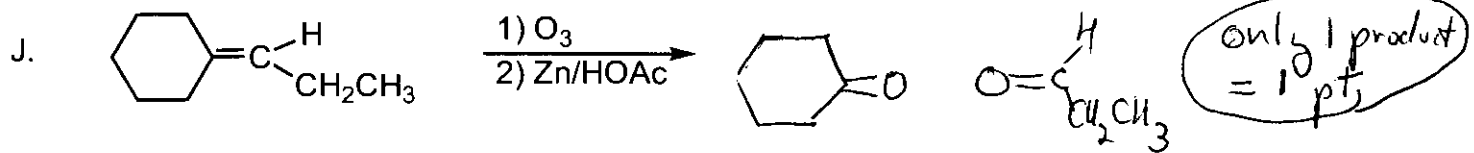
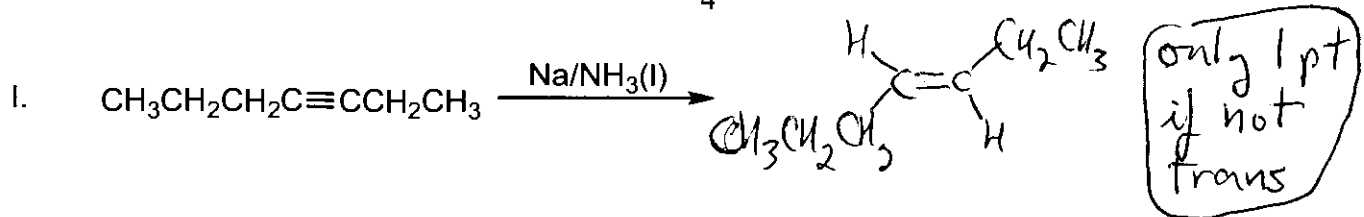
3-phenyloctane

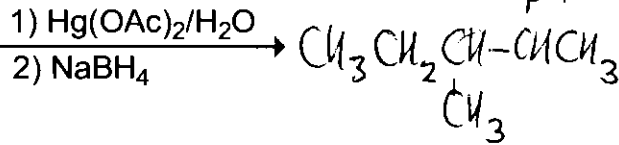
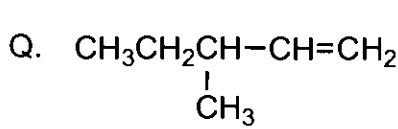
H. Draw the more stable chair conformation of *trans*-1-ethyl-4-methylcyclohexane.



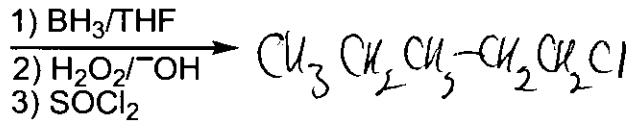
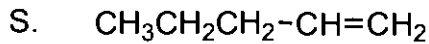
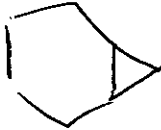
II. (72 pts) Complete the following equations giving all organic product(s) or reagents as required. Stereochemistry must be clearly indicated in reactions that are stereoselective.



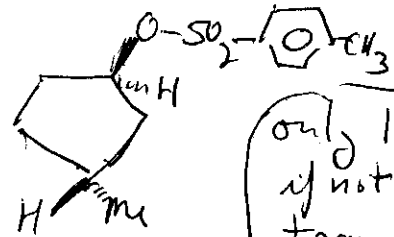
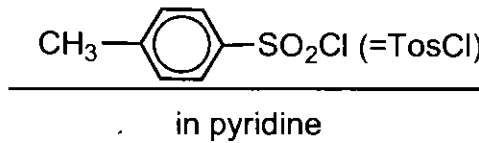
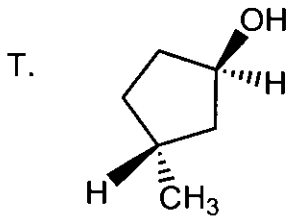




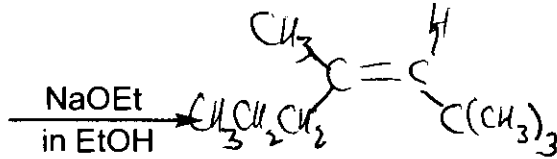
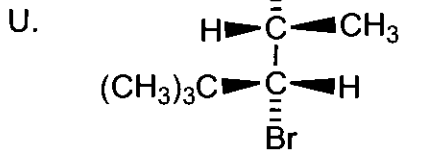
only 1 pt for R-CH₂CH₂OH



only 1 pt for R-CHCH₃

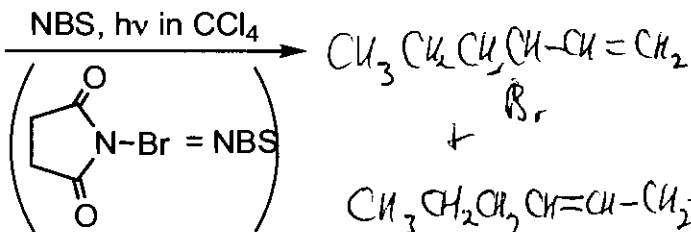
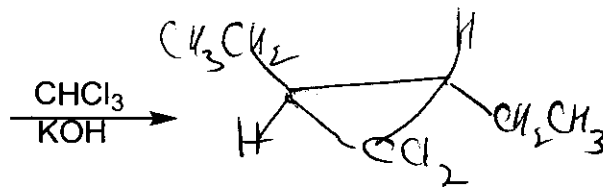
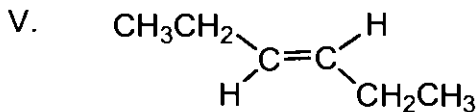


only 1 pt if not trans

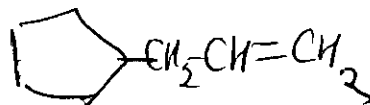
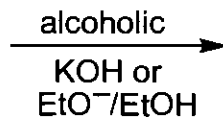
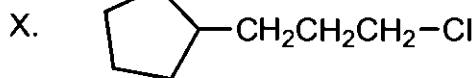


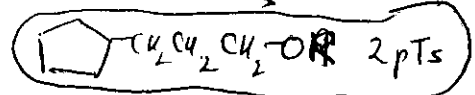
only one pt, if not the E isomer

(only 1 product; no O in product)



only 1 pt for only 1 product



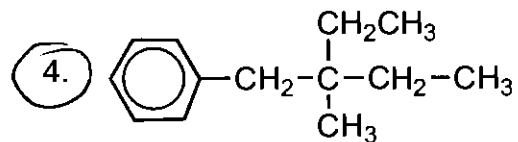
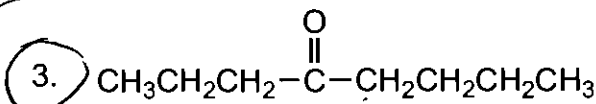
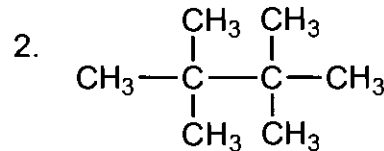
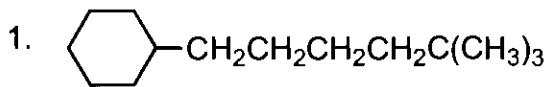
 2 pts

III. (30 pts) Circle the correct answer.

A. The polycyclic carbon framework of a normal steroid has:

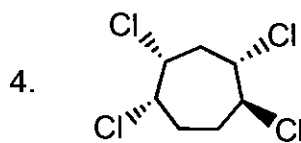
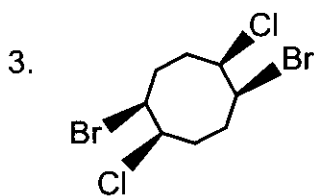
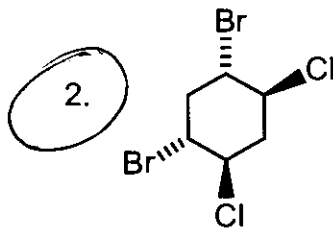
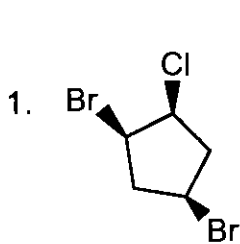
1. 2 5-membered rings
2 6-membered rings
2. 1 5-membered ring
3 6-membered rings
3. 3 5-membered rings
1 6-membered ring
4. 4 6-membered rings

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

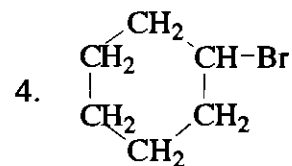
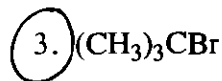
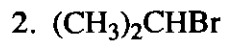
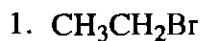


Full credit
for
either
3 or 4

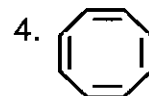
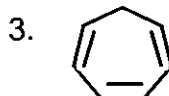
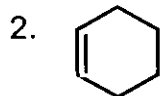
C. Which compound is a meso compound?



D. The most reactive alkyl halide in an E_1 dehydrohalogenation is



E. In the reaction $\text{RH} + \text{EtO}^- \rightarrow \text{R}^- + \text{EtOH}$, the most reactive compound is:



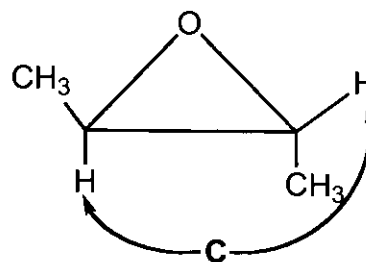
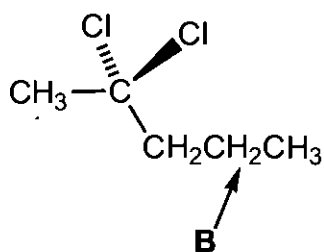
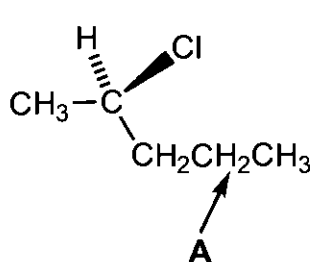
F. In the chemistry of vision, the absorption of light brings about

1. a free radical reaction.
2. a trans to cis isomerization.
3. a cis to trans isomerization.
4. A substitution reaction.

G. The molecular formula of 1-phenylnaphthalene is

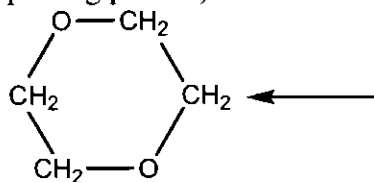
1. $C_{10}H_8$
2. $C_{12}H_{10}$
3. $C_{16}H_{12}$
4. $C_{18}H_{14}$

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?

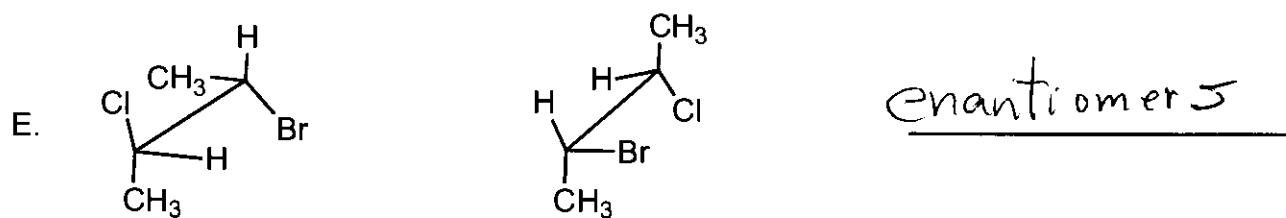
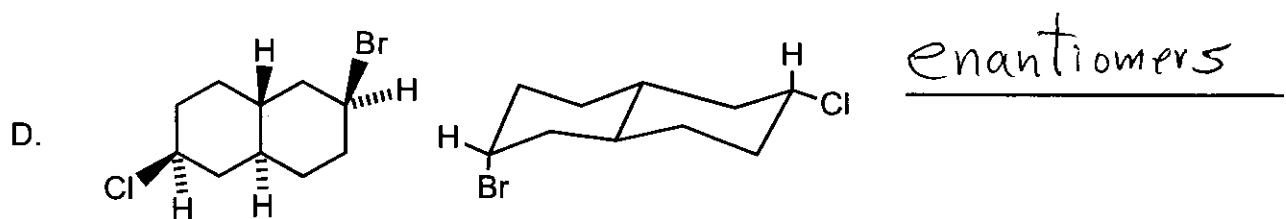
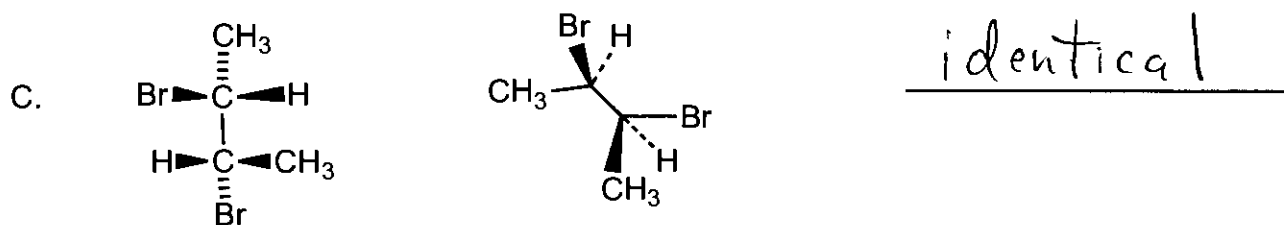
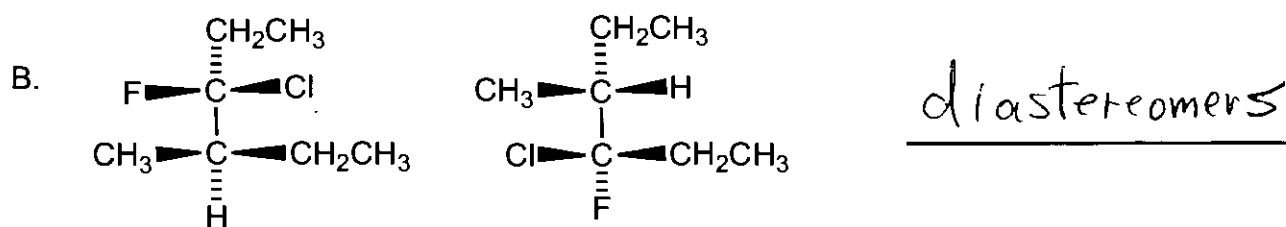
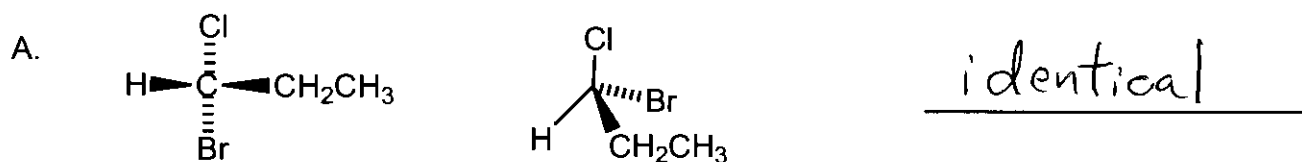


1. singlet
2. doublet
3. triplet
4. quartet

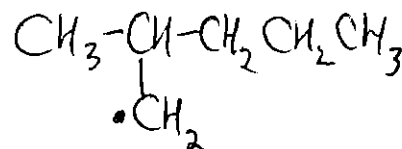
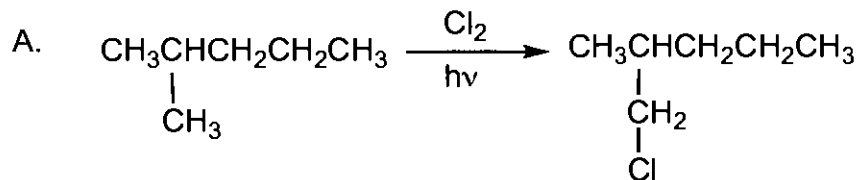
J. The molecular formula of ~~1~~⁴-chloropyridine is

- 1) C_4H_4ClN
- 2) C_4H_4ClO
- 3) C_5H_4ClN
- 4) C_6H_5ClN

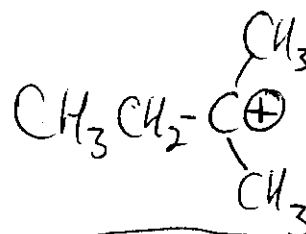
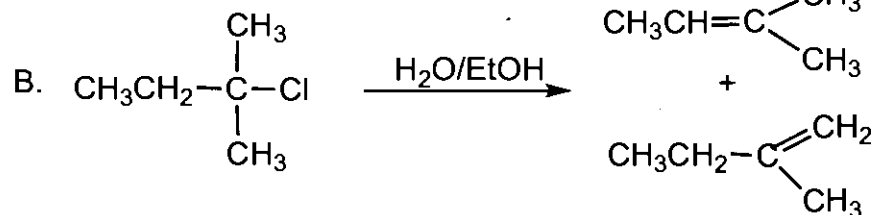
IV. (15 pts) For each of the following pair of compounds, label them as enantiomers, diastereomers, or identical. These are not frozen structures. Rotation around any single bond is possible.



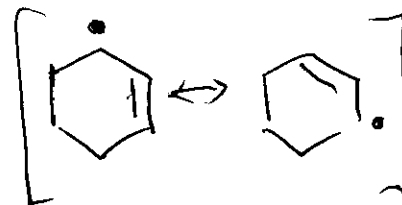
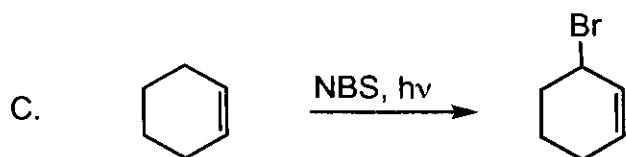
V. (16 pts) Give only the **organic reactive intermediate** for the following reactions. If the intermediate is a resonance hybrid, give all major contributing structures. Do not give the entire mechanism. Place your answer in the appropriate box.



0 pts for + or -

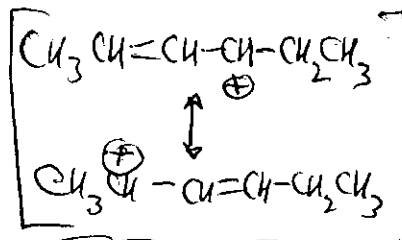
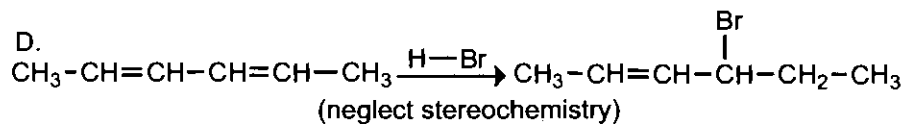


0 pts for • or -



0 pts for + or -

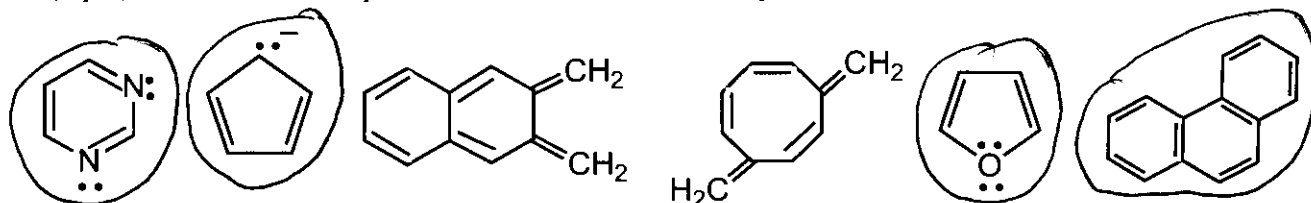
only 2 pts for 1 structure?



0 pts for • or -

only 2 pts for 1 structure.

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) $C_{11}H_{16}$

1H NMR:

δ 7.3 (2H, multiplet)

δ 7.1 (2H, multiplet)

δ 2.4 (3H, singlet)

δ 1.3 (9H, singlet)

Broadband decoupled ^{13}C NMR:

δ 148.0

δ 134.7

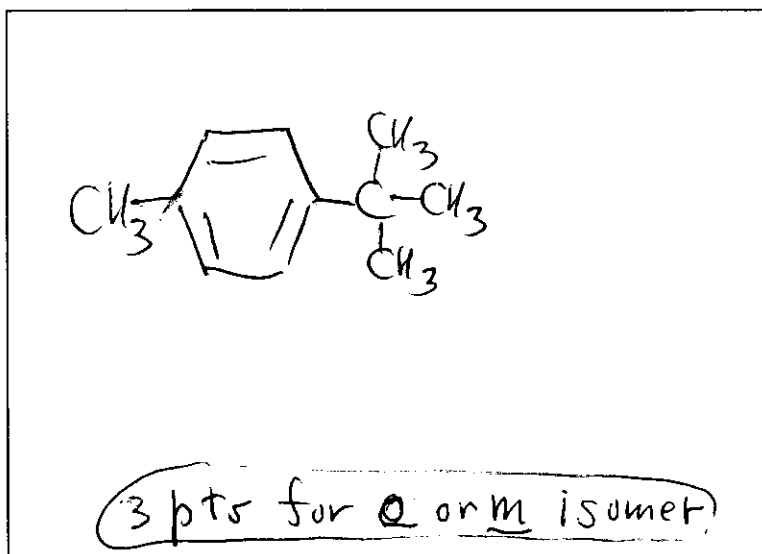
δ 128.7

δ 125.1

δ 34.3

δ 31.4

δ 20.8



B. (6 pts) $C_7H_{14}O$

1H NMR:

δ 2.30 (2H, singlet)

δ 2.10 (3H, singlet)

δ 1.02 (9H, singlet)

Broadband decoupled ^{13}C NMR:

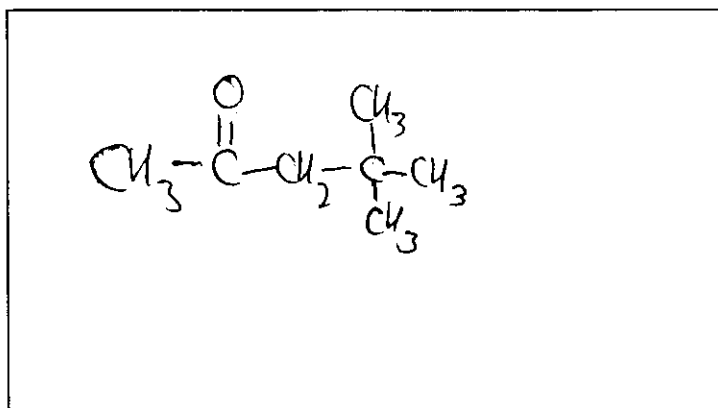
δ 208.4

δ 56.0

δ 32.3

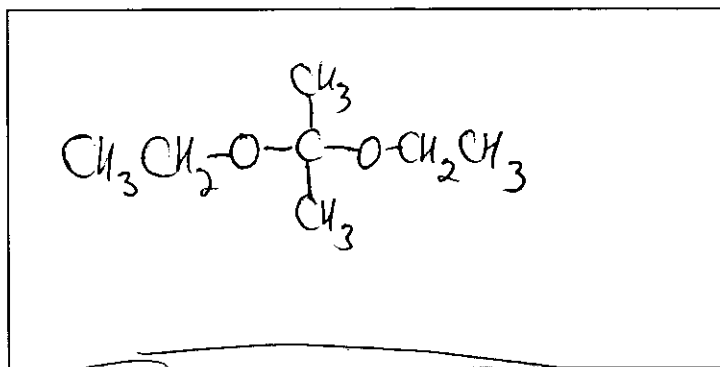
δ 30.9

δ 29.8



IR: 1710 cm^{-1}

2 pts for C=O

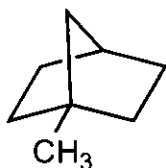
C. (6 pts) $C_7H_{16}O_2$ 1H NMR δ 3.50 (4H, quartet) δ 1.35 (6H, singlet) δ 1.20 (6H, triplet)Broadband decoupled ^{13}C NMR δ 99.7 δ 55.9 δ 25.1 δ 15.5IR: 1100 cm^{-1} 

2 pts for ether linkages

D. (7 pts) How many ^{13}C signals would each of the following compounds show? Put your answer in the blank provided.1. $(CH_3)_3C-CH_2CH_2CH_2-C(CH_3)_3$

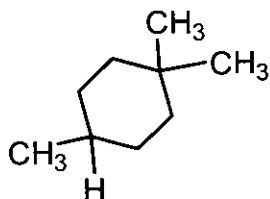
4

2.

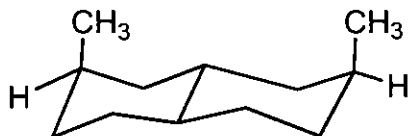


6

3.

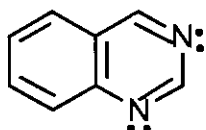
~~6~~ 7

4.



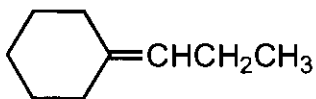
7

5.



8

6.



9

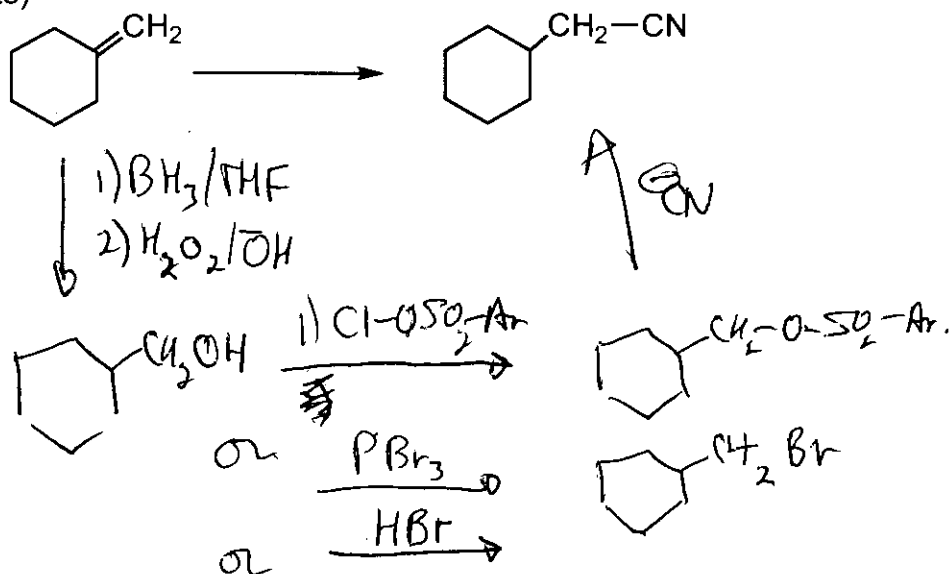
7.



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)

