

Seat No. \_\_\_\_\_

LAST NAME \_\_\_\_\_

Section     B    

FIRST NAME \_\_\_\_\_

**PLEASE REMOVE LAST PAGE OF EXAM BEFORE PRINTING YOUR NAME  
ON THE BACK OF PAGE 8.  
THERE ARE 9 PAGES TO THIS EXAM. CHECK TO MAKE SURE  
YOU HAVE A COMPLETE EXAM.**

**CHEMISTRY 331**

**EXAM V**

Fall 2006

December 5, 2006

I. (16 points) \_\_\_\_\_

II. (13 points) \_\_\_\_\_

III. ( 8 points) \_\_\_\_\_

IV. A, B & C (21 points) \_\_\_\_\_

D, E & F (21 points) \_\_\_\_\_

V. (21 points) \_\_\_\_\_

TOTAL (100 points) \_\_\_\_\_

Final exam for Chem 331 is scheduled for Wednesday, December 13, from 7:00 to 9:00 p.m.

First 4 exams scores (**to be filled in by graders**). Best 4 (including score above) will be counted in your final score.

\_\_\_\_\_ 1<sup>st</sup>

\_\_\_\_\_ 2<sup>nd</sup>

\_\_\_\_\_ 3<sup>rd</sup>

\_\_\_\_\_ 4<sup>th</sup>

\_\_\_\_\_ # of quizzes  
taken out of  
6 possible

I. (16 points). Give the correct structure for the following names (2 pts. each)

A. *ortho*-Chlorotoluene

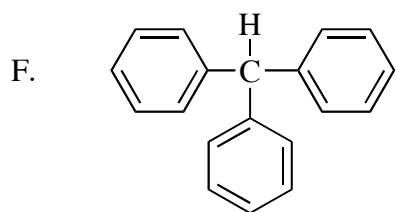
B. *meta*-Phenylbenzyl bromide

C. *para*-Iodobenzoic acid

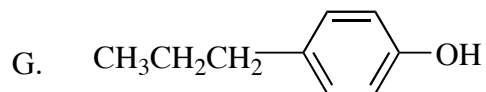
D. *para*-Ethylstyrene

E. 2,4-Difluorotoluene

Give the correct name for the following structures (3 pts. each)

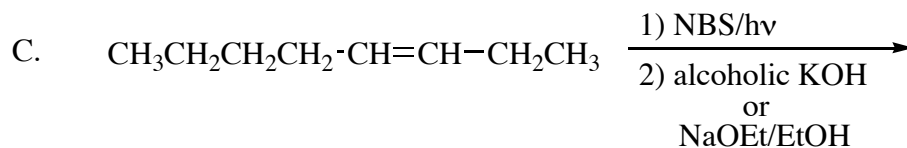
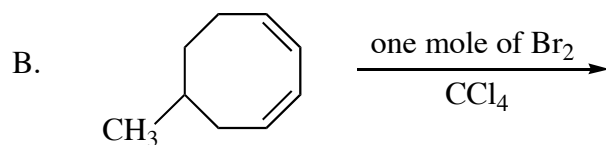
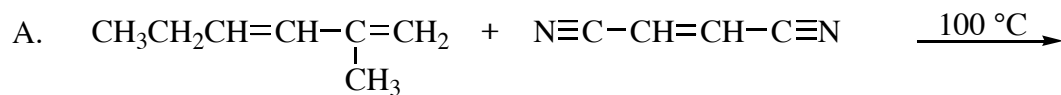


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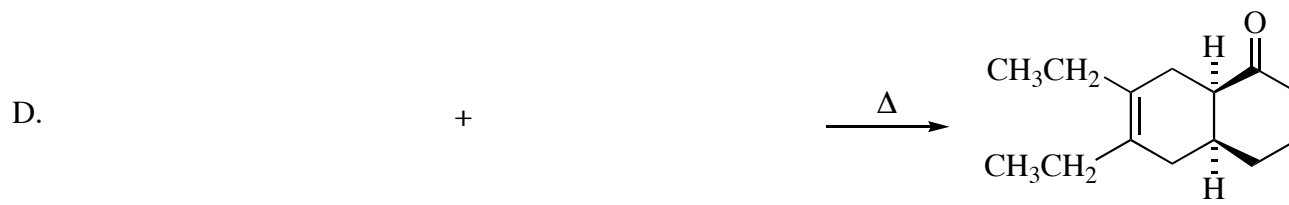


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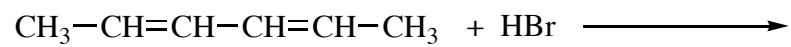
II. (13 pts) Complete the following equations, giving all organic product(s). **No stereochemistry required.**



Give the reactants for the following reaction. **Stereochemistry must be clear** (4 pts).

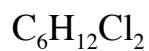


- III. (8 pts) Give the product(s) (neglect stereochemistry) and draw a stepwise mechanism for the following reaction (include all important resonance structures).



IV. (42 pts) For each of the following compounds, propose a structure in the box provided that fits the data presented.

A. (7 pts)



$^1\text{H}$  NMR:

$\delta$  3.55 (4H, triplet)

$\delta$  1.8 (4H, multiplet)

$\delta$  1.5 (4H, multiplet)

Broadband-decoupled  $^{13}\text{C}$  NMR:

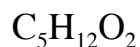
$\delta$  44.88

$\delta$  32.44

$\delta$  26.19



B. (7 pts)



$^1\text{H}$  NMR:

$\delta$  4.7 (2H, singlet)

$\delta$  3.6 (4H, quartet)

$\delta$  1.2 (6H, triplet)

Broadband-decoupled  $^{13}\text{C}$  NMR:

$\delta$  94.87

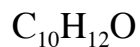
$\delta$  63.11

$\delta$  15.21

IR:  $1100\text{ cm}^{-1}$



C. (7 pts)



$^1\text{H}$  NMR:

$\delta$  7.3 (5H, multiplet)

$\delta$  3.7 (2H, singlet)

$\delta$  2.4 (2H, quartet)

$\delta$  1.0 (3H, triplet)

Broadband-decoupled  $^{13}\text{C}$  NMR:

$\delta$  208.79       $\delta$  126.86

$\delta$  134.43       $\delta$  49.77

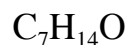
$\delta$  129.31       $\delta$  35.16

$\delta$  128.61       $\delta$  7.75

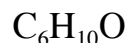
IR:  $1710\text{ cm}^{-1}$



D. (7 pts)

 $^1H$  NMR: $\delta$  2.6 (1H, septet) $\delta$  2.4 (2H, triplet) $\delta$  1.6 (2H, sextet) $\delta$  1.1 (6H, doublet) $\delta$  0.9 (3H, triplet)Broadband-decoupled  $^{13}C$  NMR: $\delta$  214.77 $\delta$  42.26 $\delta$  40.80 $\delta$  18.23 $\delta$  17.24 $\delta$  13.81IR:  $1710\text{ cm}^{-1}$ 

E. (7 pts)



This is one stereoisomer. Either stereoisomer is an acceptable answer.

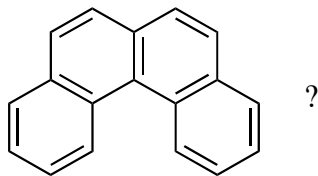
 $^1H$  NMR: $\delta$  9.4 (1H, singlet) $\delta$  6.5 (1H, quartet) $\delta$  2.3 (2H, quartet) $\delta$  2.0 (3H, doublet) $\delta$  0.95 (3H, triplet)Broadband-decoupled  $^{13}C$  NMR: $\delta$  194.72 $\delta$  149.10 $\delta$  146.33 $\delta$  16.93 $\delta$  14.47 $\delta$  12.93IR:  $1700\text{ cm}^{-1}$ 

F. (7 pts) The following compound is characterized by a  $^1H$  NMR spectrum that consists of only a single peak (a singlet) having the chemical shift indicated. Some additional data are given. Write the correct formula for the compound in the appropriate box.

 $^1H$  NMR: $\delta$  8.0Broadband-decoupled  $^{13}C$  NMR: $\delta$  145.77 $\delta$  125.72 $\delta$  96.33

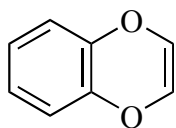
V. (21 pts) Circle the correct answer (think carefully).

A. How many signals are present in the broadband-decoupled  $^{13}\text{C}$  NMR spectrum of



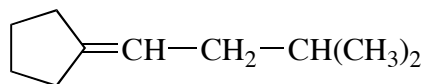
- 1.) 8                      2.) 10                      3.) 16                      4.) 18

B. How many signals are present in the  $^1\text{H}$  NMR spectrum of



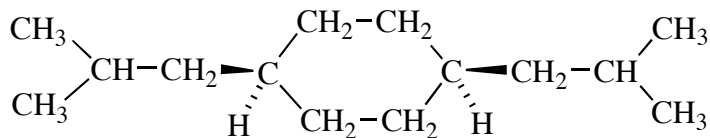
- 1.) 3                      2.) 4                      3.) 5                      4.) 6

C. How many signals are present in the broadband-decoupled  $^{13}\text{C}$  NMR spectrum of



- 1.) 7                      2.) 8                      3.) 9                      4.) 10

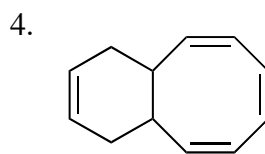
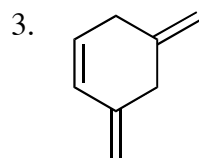
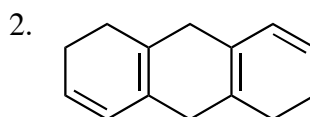
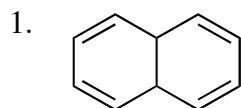
D. The DEPT 90  $^{13}\text{C}$  NMR spectrum of



would show how many signals?

- 1.) 1                      2.) 2                      3.) 4                      4.) 5

E. Which compound would have the highest  $\lambda_{\max}$  in its UV-visible spectrum?



F. The fundamental reaction of vision involves

1. carbon-carbon bond cleavage
2. cis-trans isomerization
3. rotation of a methyl group
4. elimination of water

G. For a normal Diels-Alder reaction, which molecule would be the best dienophile?

