Seat No. _____ Last Name: _____

First Name: _____

There are 8 pages to this exam. Check to make sure you have a complete exam.

PLEASE ALSO PRINT YOUR NAME ON THE TOP OF
THE **BACK** OF THE LAST PAGE OF THE EXAM

CHEMISTRY 331

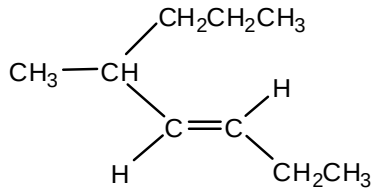
EXAM II

Spring 2007 (2/16/07)

I.	(15 Points)	_____
II.	(9 Points)	_____
III.	(15 Points)	_____
IV.	(6 Points)	_____
V.	(11 Points)	_____
VI.	(6 Points)	_____
VII.	(7 Points)	_____
VIII.	(14 Points)	_____
IX.	(8 Points)	_____
X.	(9 Points)	_____
TOTAL	(100 Points)	_____

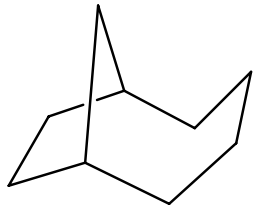
I. (15 points) Give the proper name for the following structures (including stereochemical designation when required; for stereoisomers use *E*-, *Z*-notations).

A.



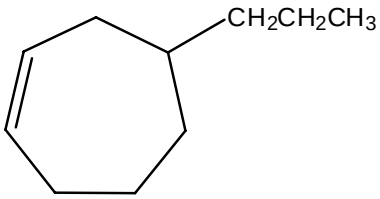
_____

B.



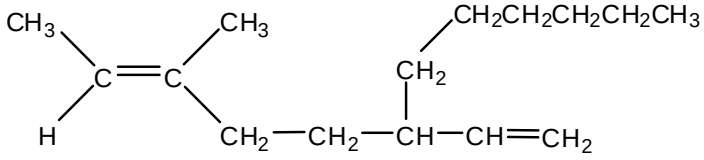
_____

C.



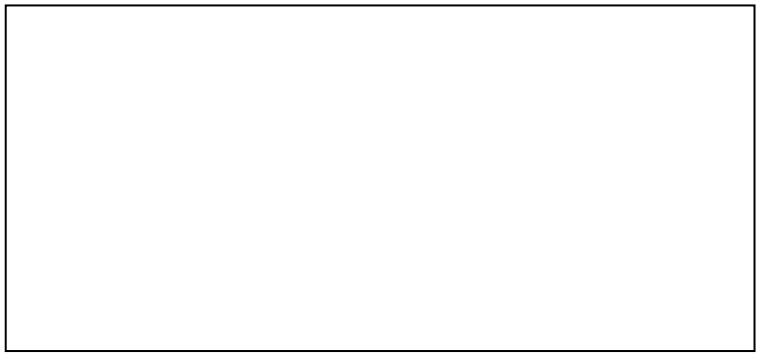
_____

D.

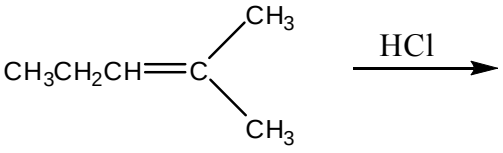


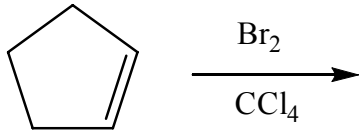
_____

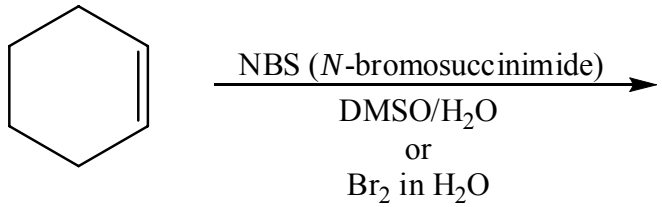
E. Give the structure of 3-allyl-1,4-cycloheptadiene.



II. (9 points) Complete each of the following reactions by providing the products. Show the stereochemistry where required.

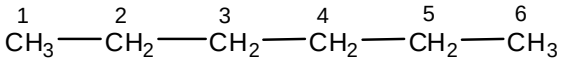
1. 

2. 

3. 

III. (15 points)

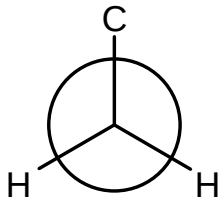
A. (6 points) Consider rotation about the C_3–C_4 bond of hydrocarbon **A**.



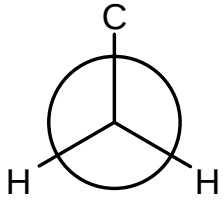
A

Complete the Newman projections to show conformations which fit the following descriptions.

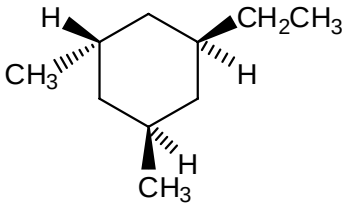
1. The **most** stable conformation.



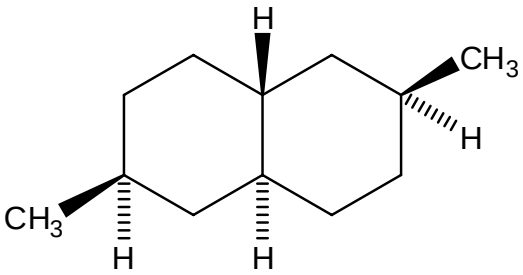
2. The **less** stable staggered conformation.



B. (6 points) Draw the two interconverting chair conformations of the following molecule and circle the more stable one.



C. (3 points) Draw the most stable conformation of the following molecule.



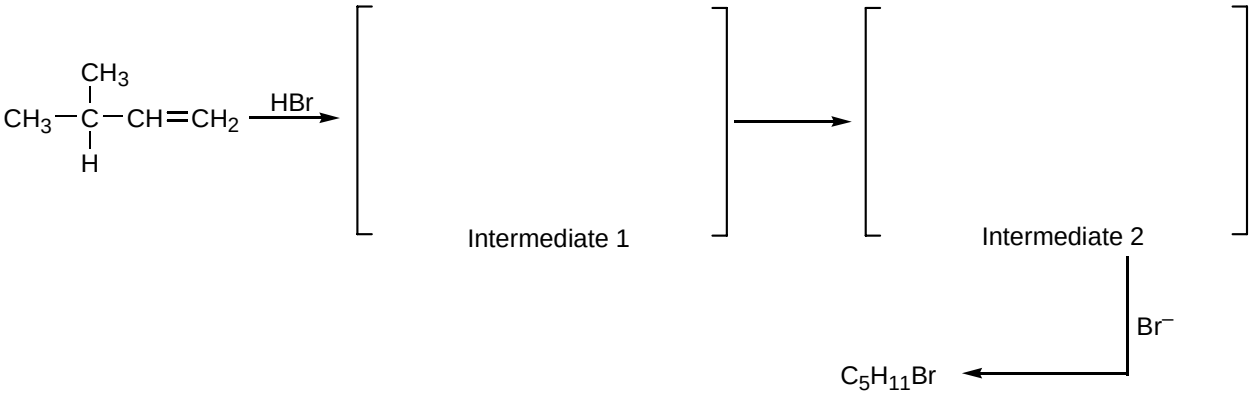
IV. (6 points) Calculate the degree of unsaturation for the following formulas.

A. $C_{18}H_{26}Br_2Cl_2$ _____

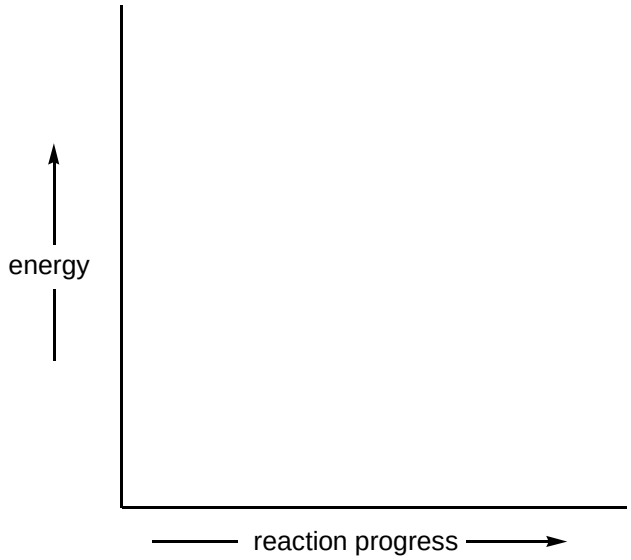
B. $C_{11}H_{11}Cl_3N_2O_3$ _____

V. (11 points)

A. (6 points) In the brackets provided draw the organic intermediates of the following 3-step reaction (two high energy intermediates are involved in this reaction).



B. (5 points) On the following graph draw the reaction energy diagram for the **first step** of the above reaction. This diagram should be consistent with the Hammond postulate. Label the position of the transition state with "TS" and the intermediate with "I".



VI. (6 points)

Table 1. Some Bond Dissociation Energies.

Bond	**D (kJ/mol)**
CH_3–H	438
C_2H_5–H	420
CH_3-Cl	351
C_2H_5–Cl	338
CH_3-Br	293
C_2H_5–Br	285
CH_3–CH_3	376
H–Cl	432
H–Br	366
Cl–Cl	243
Br–Br	193

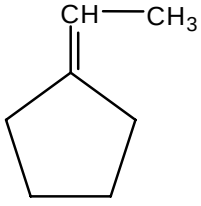
Use data presented in Table 1 to calculate ΔH° for the following reaction (show your calculations).

VII. (7 points)

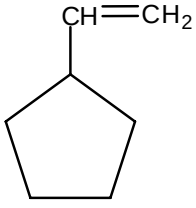
A. (4 points) Write two good termination steps for the light-induced chlorination of methane.

B. (3 points) The combustion (alkene + $O_2 \rightarrow CO_2 + H_2O$) of which alkene would produce the least heat?

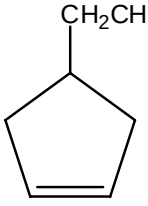
a)



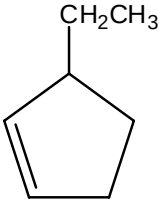
b)



c)



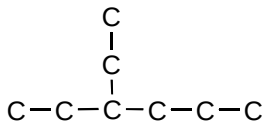
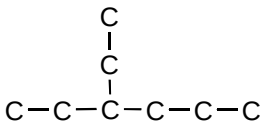
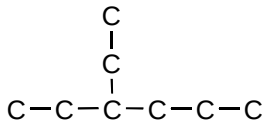
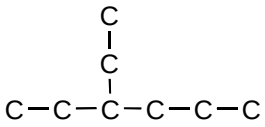
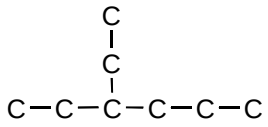
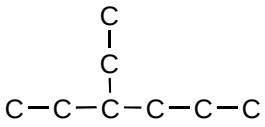
d)



VIII. (14 points)

A. Complete the structures below to show ALL constitutional isomers (note: constitutional isomers only, no stereoisomers) of C_8H_{16} that have a carbon-carbon double bond and the carbon skeleton of 3-ethylhexane (this is the carbon skeleton given in the boxes; there are no more than six correct constitutional isomers and there may be fewer; DO NOT DRAW OTHER ISOMERS OF C_8H_{16}). **Be sure to show all hydrogens. Cross out any boxes that are not used.** Points will be deducted for duplicate or incorrect structures.

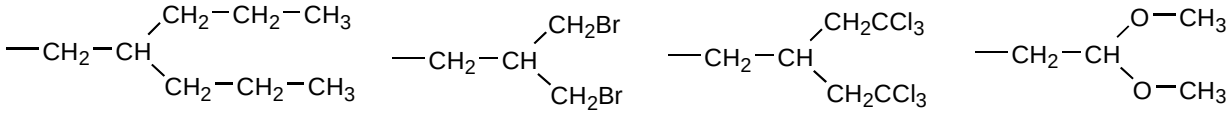
B. Circle all the structures that can exist as cis-trans isomers (points will be deducted for circling structures that cannot exist as cis-trans isomers).

IX. (8 points) For each set of substituents, using the Cahn-Ingold-Prelog rules, put a circle (O) around the group with the highest priority, put an (X) through the group with the lowest priority.

A. $-CH_2CH_3$ $-CH=CH_2$ $-CH_2CH_2CH_2OH$ $-CH_2CH_2OCH_3$

B.

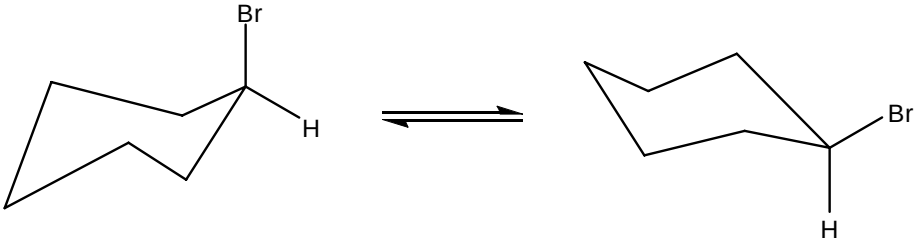


Periodic Table of the Elements

1A																	8A
1																	18
1 H 1.01	2A 2											3A 13	4A 14	5A 15	6A 16	7A 17	2 He 4.00
3 Li 6.94	4 Be 9.01							8B				5 B 10.8	6 C 12.0	7 N 14.0	8 O 16.0	9 F 19.0	10 Ne 20.2
11 Na 23.0	12 Mg 24.3	3B 3	4B 4	5B 5	6B 6	7B 7	8	9	10	1B 11	2B 12	13 Al 27.0	14 Si 28.1	15 P 31.0	16 S 32.1	17 Cl 35.4	18 Ar 39.9
19 K 39.1	20 Ca 40.1	21 Sc 45.0	22 Ti 47.9	23 V 50.9	24 Cr 52.0	25 Mn 54.9	26 Fe 55.8	27 Co 58.9	28 Ni 58.7	29 Cu 63.5	30 Zn 65.4	31 Ga 69.7	32 Ge 72.6	33 As 74.9	34 Se 79.0	35 Br 79.9	36 Kr 83.8
37 Rb 85.5	38 Sr 87.6	39 Y 88.9	40 Zr 91.2	41 Nb 92.9	42 Mo 95.9	43 Tc (98)	44 Ru 101	45 Rh 103	46 Pd 106	47 Ag 108	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
55 Cs 133	56 Ba 137	57 La 139	72 Hf 178	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 Tl 204	82 Pb 207	83 Bi 209	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226	89 Ac 227	104 Rf (261)	105 Ha (262)	106 Unh (263)	107 Uns (262)	108 Uno (265)	109 Une (266)									

X. (9 points)

A. (3 points) The energy barrier for the following interconversion is approximately how much?



a) 3 kcal/mol b) 10 kcal/mol. c) 25 kcal/mol. d) 50 kcal/mol.

B. (3 points) How much more stable is *trans*-2-butene than *cis*-2-butene at room temperature?

a) about 1 kcal/mol b) about 10 kcal/mol. c) about 25 kcal/mol. d) about 50 kcal/mol.

C. (3 points) In the following reaction, water is functioning as

$$H_2O + (CH_3)_3C^+ \longrightarrow (CH_3)_3C{-}\overset{+}{O}H_2$$

a) an electrophile b) an acid c) a nucleophile d) a carbocation