Chemistry 112A, Midterm 1

Thursday, October 9, 2008

Student name: Answer Key

Student signature: _____

Write TA's full name (section number) or Lecture Only: _____

1. Please make sure that the exam has eight pages including this one.
2. Please write your answers in the spaces provided.
3. Write clearly; illegible or ambiguous answers will be considered incorrect.
4. Only writing implements are allowed **(No Calculators)**.

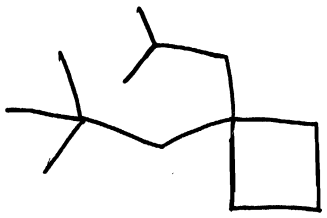
GOOD LUCK!

1.	12 points	_____
2.	50 points	_____
3.	40 points	_____
4.	13 points	_____
5.	10 points	_____
6.	10 points	_____
7.	20 points	_____
8.	20 points	_____
Total	**175 points**	_____

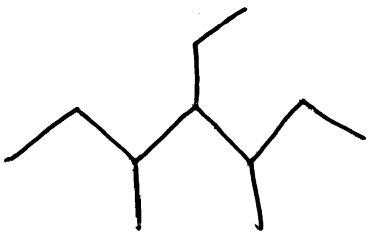
MINI-PERIODIC TABLE

I	II	III	IV	V	VI	VII	VIII
H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar
K	Ca	Ga	Ge	As	Se	Br	Kr

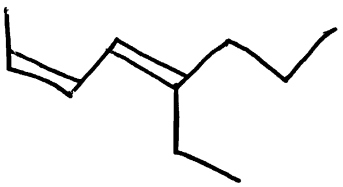
1. Provide structures for the following chemical names (12 points)



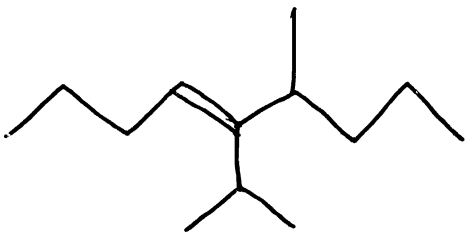
1-isobutyl-1-neopentylcyclobutane



4-ethyl-3,5-dimethylheptane



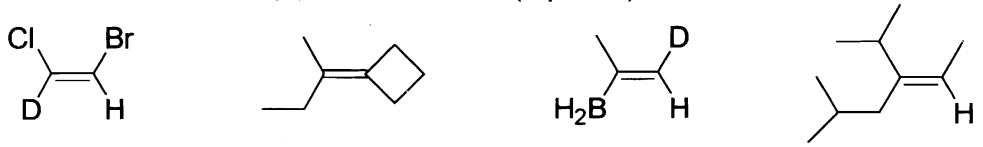
(2Z,4*E*)-5-ethyl-2,4-octadiene



(*E*)-5-isopropyl-6-methyl-4-nonene

2. Answer the following questions. Points will be taken off for incorrect answers (50 points).

(a). **Circle** the alkenes that are (Z) stereoisomers (6 points).



(b). **Circle** each alkene carbon that is a stereocenter (6 points).

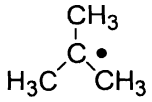
(c). **Circle** the energy difference in kcal/mole between the gauche and anti forms of butane (5 points):

0.9 1.4 3.0 4.5 5.4

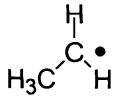
(d). **Circle** the correct statement(s) (5 points).

1. 1s, 2s, and 3s orbitals do not have any nodes
2. Conformational isomers have the same molecular formula.
3. π-bonds are cylindrically symmetric.
4. In concerted reactions all bonds are broken and formed at the same time.
5. The smaller the standard free energy of activation ($\Delta G^{\circ\neq}$), the faster a reaction proceeds.

(e). **Number** the radicals according to stability (**1** = **most stable**) (5 points).

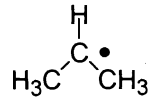


1



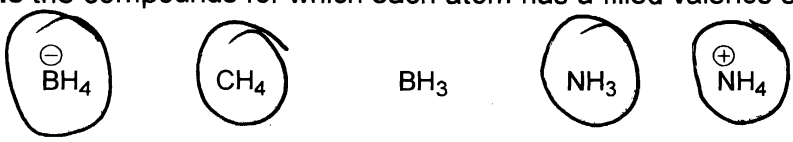
3

4

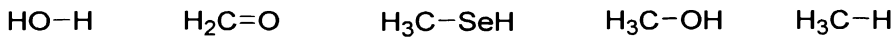


2

(f). **Circle** the compounds for which each atom has a filled valence shell (5 points):

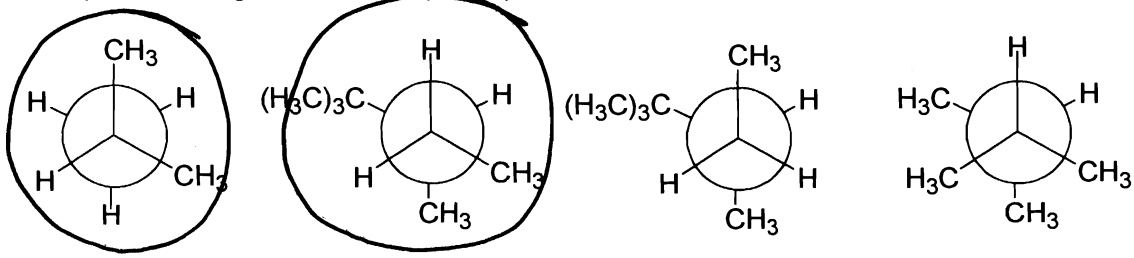


(g). **Number** the bonds shown from longest to shortest [1 = **longest**] (5 points).

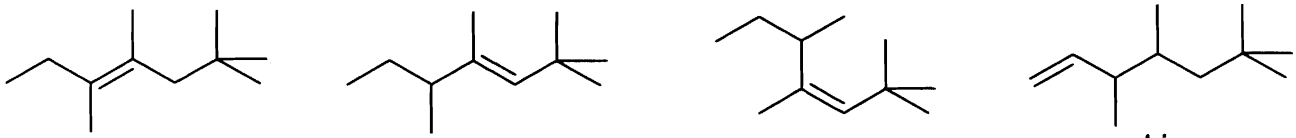


5 3 1 2 4

(h). **Circle** the Newman projection(s) that represent a **lowest** energy conformation for each compound being illustrated (8 points).

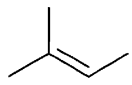
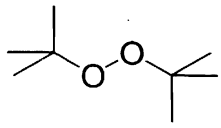
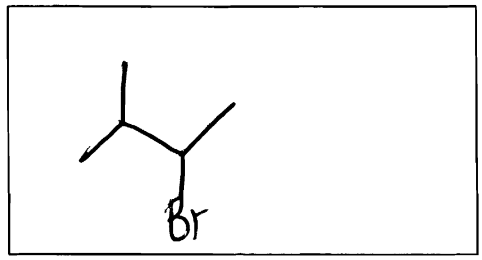


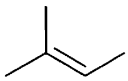
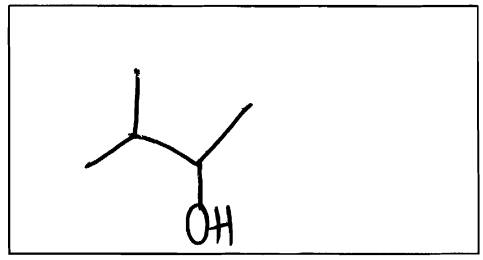
(i). **Number** the alkenes from most to least stable (**1** = **most**) (5 points).

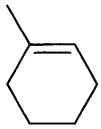
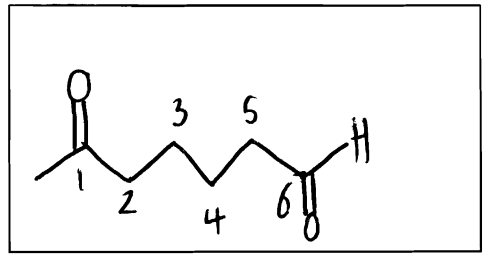


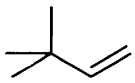
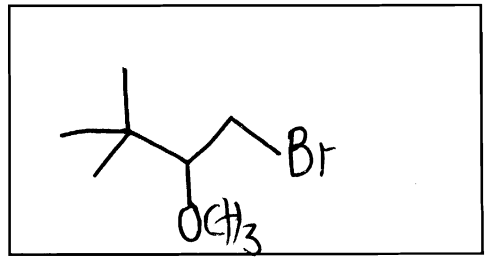
1 2 3 4

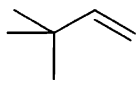
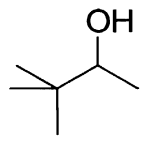
3. For each of the following reactions supply the missing starting materials, reagents, or major organic products in the space provided. If no reaction is expected indicate by N.R. (40 points total).

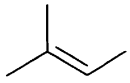
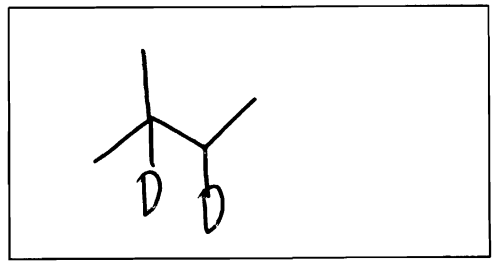
(a)  HBr,  

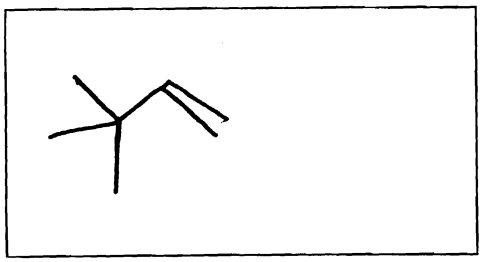
(b)  1. BH_3 2. $NaOH, H_2O_2$ 

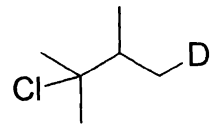
(c)  1. O_3 2. Me_2S 

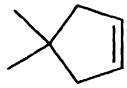
(d)  Br_2, CH_3OH 

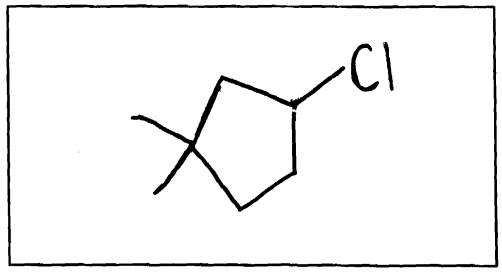
(e)  1. $Hg(OAc)_2$, H_2O 2. $NaBH_4$, $NaOH$ 

(f)  D_2, Pt (cat) 

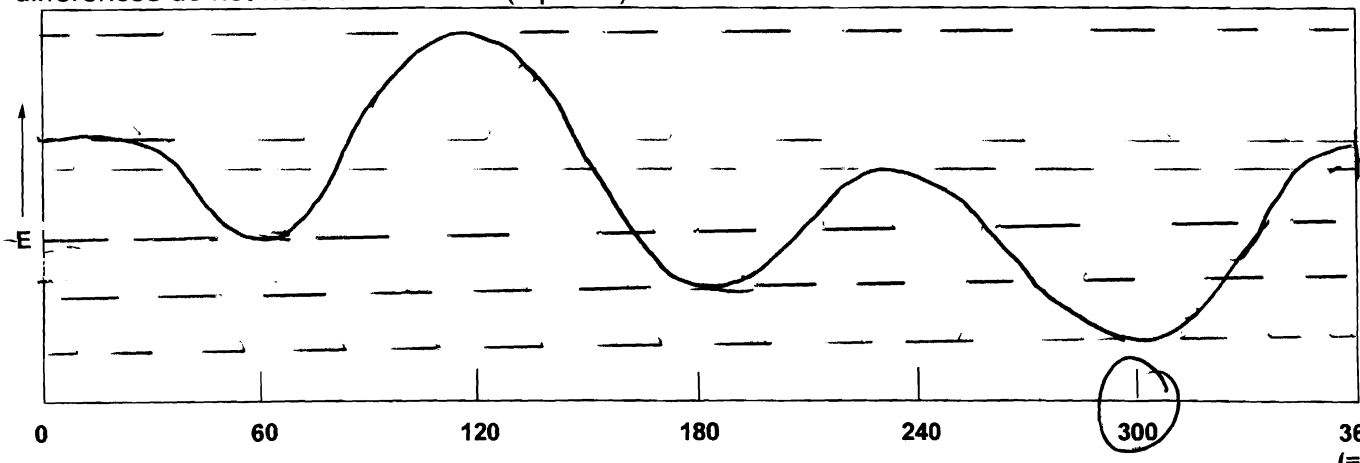
(g) 

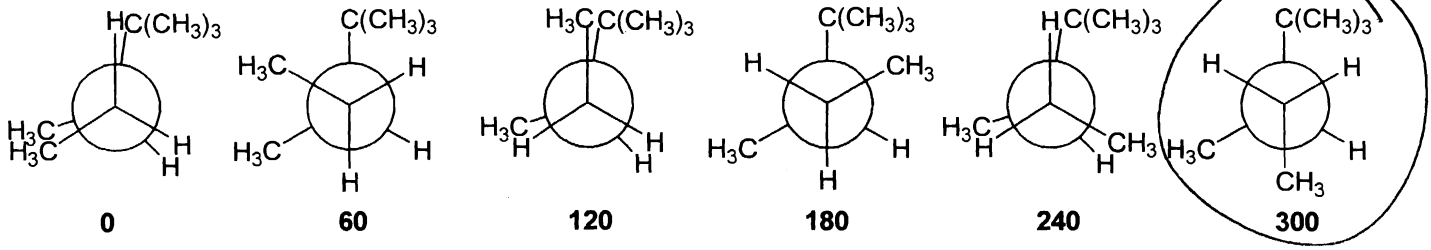


(h) 



4a. **Draw** an energy diagram for the different conformations of the alkane shown below. The energy diagram should reflect the **relative** energy differences between the conformations, but exact energy differences do not need to be shown (8 points).





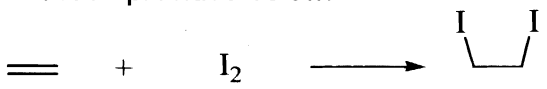
4b. Specify whether the three energy minima have one, two or three different energies (2 points)?

three

4c. Provide a **brief** explanation of your answer above and **circle** the **lowest** energy minima (3 points).

The t-butyl group is bulkier than the methyl groups so the gauche interaction at 180° is larger than the one at 300°.

5. Answer the questions for the reaction provided below.



Bond	DH° (kcal/mole)
= (π-bond)	65
— (σ-bond)	90
I—I	36
H—I	71
C—I	53
C—H	100

5a. Calculate the ΔH° for the above transformation using the approximate DH° given above (8 points).

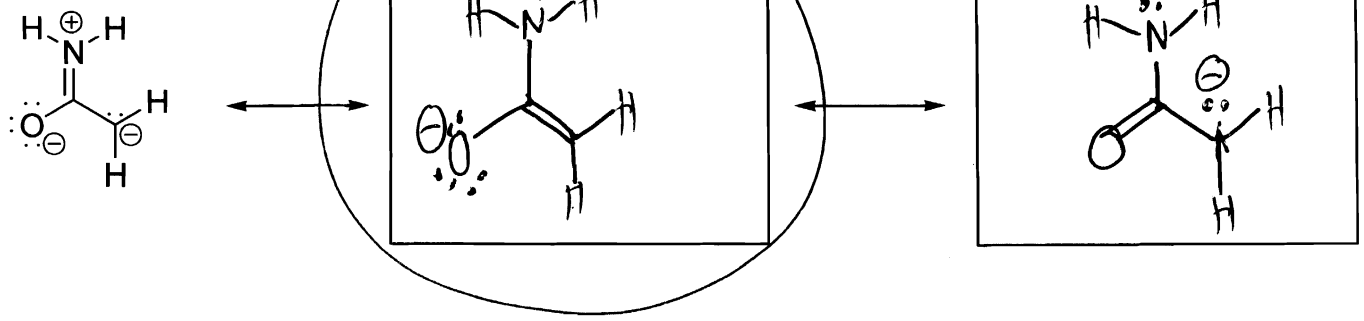
$\Delta H^\circ = DH^\circ(\pi\text{-bond}) + DH^\circ_{(I-I)} - 2\,DH^\circ(C\text{-}I)$

$= 65 + 36 - 2(53) \Longrightarrow \ominus 5$

5b. Is the reaction endothermic or exothermic (2 points)?

exothermic

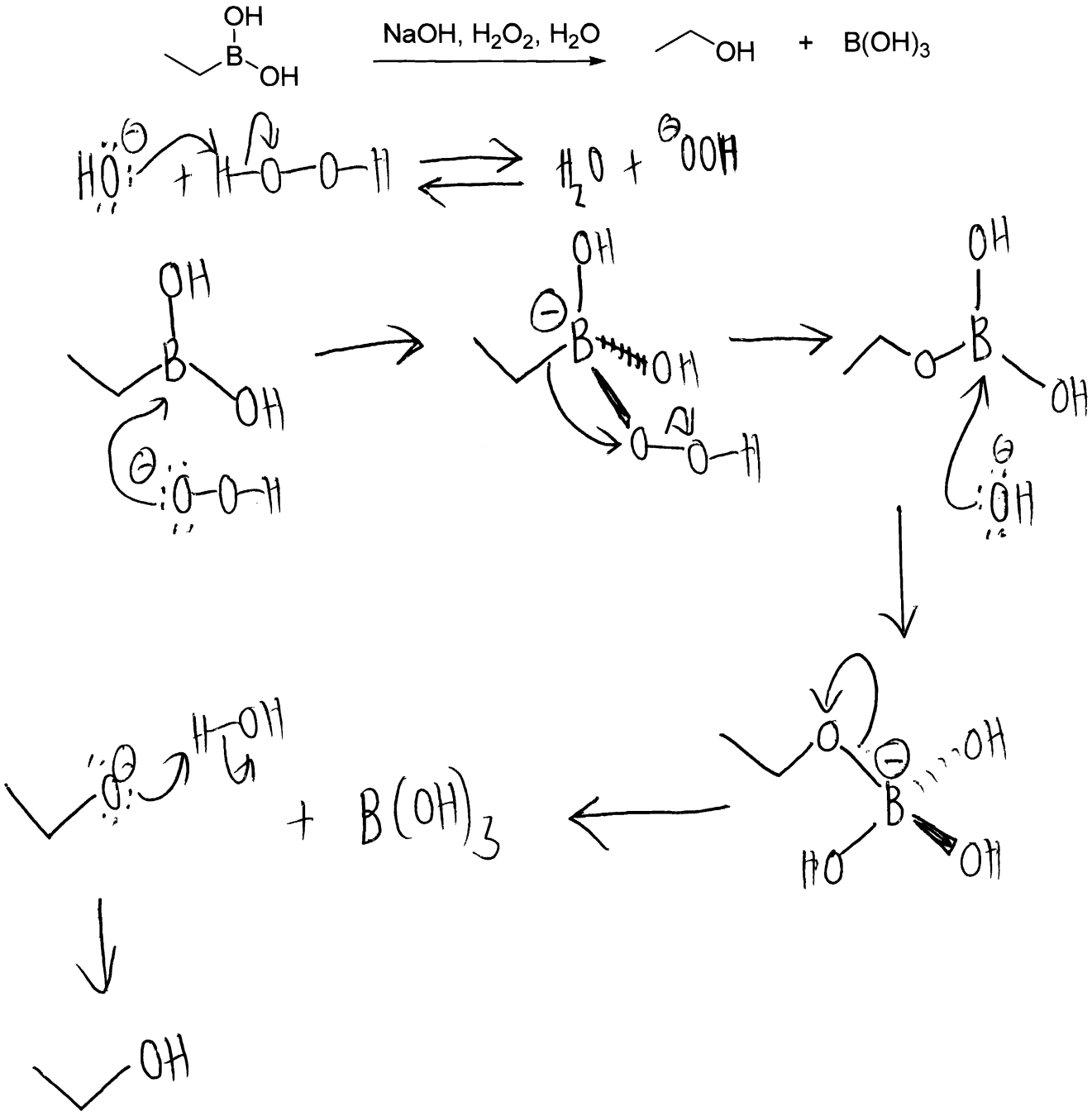
6a. **Draw two** additional resonance ~~structures that~~ are more significant contributors than the structure shown (5 points).



6b. **Circle** the **major** resonance contributor and **briefly** explain your answer (5 points).

Oxygen is more electronegative than carbon, so ⊖ charge on oxygen is preferred. The first resonance structure is by far the worst due to charge separation.

7. Provide a mechanism for the reaction shown below (20 points).



8. Provide a mechanism for the reaction shown below (20 points).