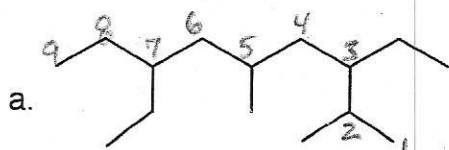


# EXAM 1 / Fall 2002

1. NOMENCLATURE: (15 points, 5 pts. each)

Give an acceptable IUPAC name for each of the following compounds. Be sure to indicate the stereochemistry where appropriate.



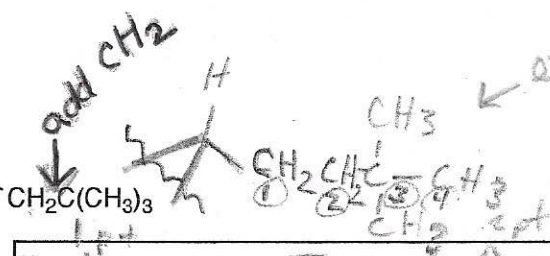
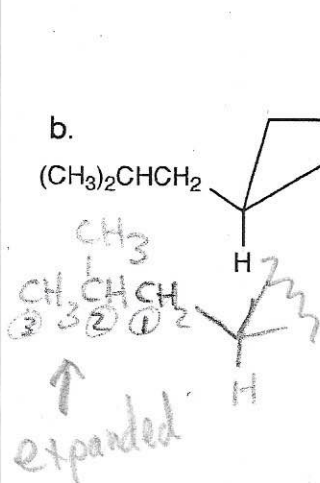
**3,7-diethyl-2,5-dimethylnonane**

2 pts

2 pts

1 pt

b.  $(\text{CH}_3)_2\text{CHCH}_2$



**trans-1-(3,3-dimethylbutyl)-4-(2-methylpropyl)cyclohexane**

OR

**trans-1-isobutyl-4-(3,3-dimethylbutyl)cyclohexane**

c.

**cis-1-tert-butyl-3-cyclobutylcyclooctane**

OR

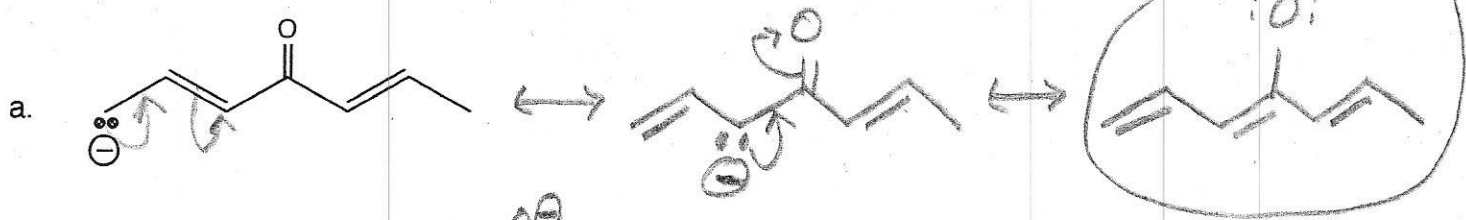
**cis-1-cyclobutyl-3-(1,1-dimethylethyl)cyclooctane**

not necessary

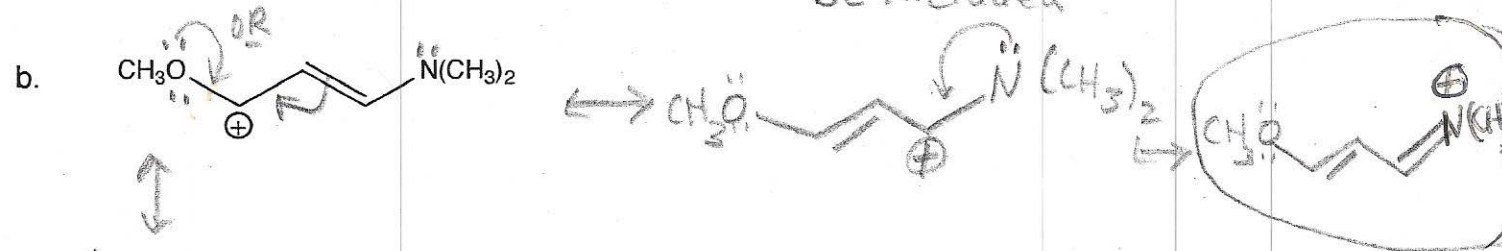
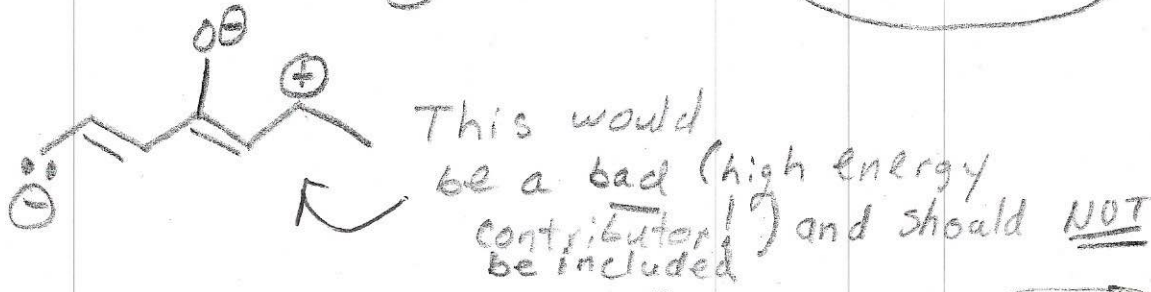
2 pt



2. For each structure given, draw the important resonance contributors. Circle the major contributor. (14 pts.) 2 pts each structure / 2 pts. each circle

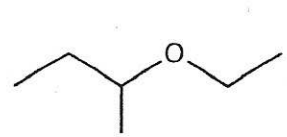


NOTE:

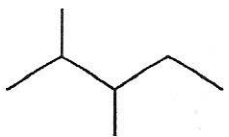


all have octets and  $\oplus$  on less EN N

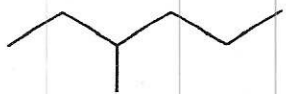
3. Place the following compounds in order of increasing boiling point. (1=lowest, 3=highest) (6 pts.)



3



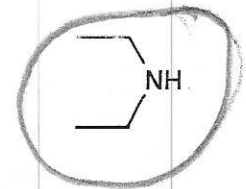
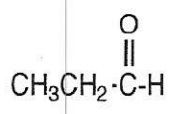
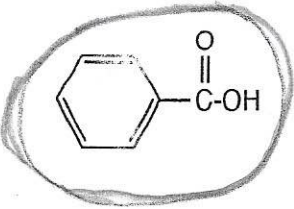
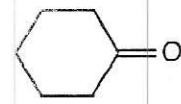
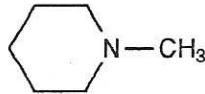
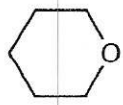
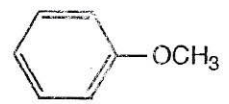
1



2

2 pts each

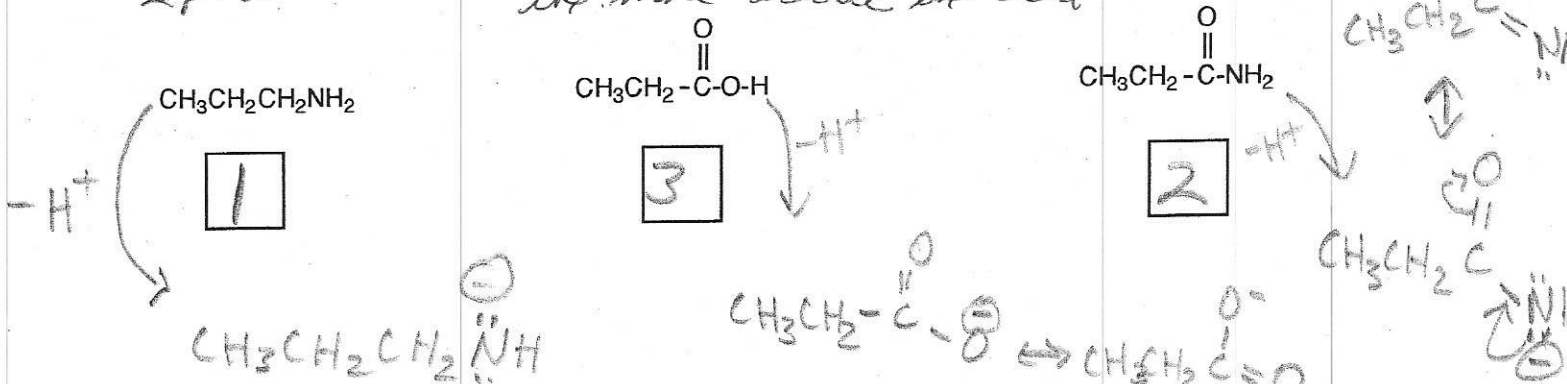
4. Circle the compounds that can form hydrogen bonds in a pure state. (4 pts.)



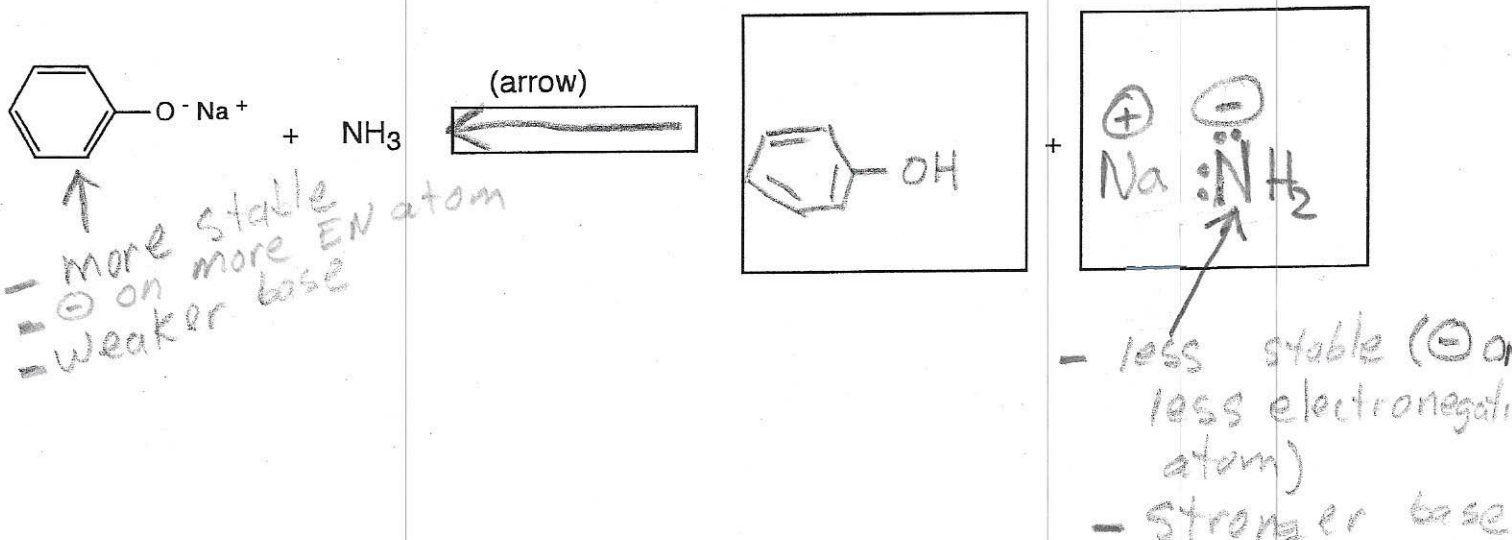
+2 pts. each correct answer  
-1 pt. each incorrect circle

5. Place the following compounds in order of increasing acidity. (1=least acidic, 3=most acidic) (6 pts.)

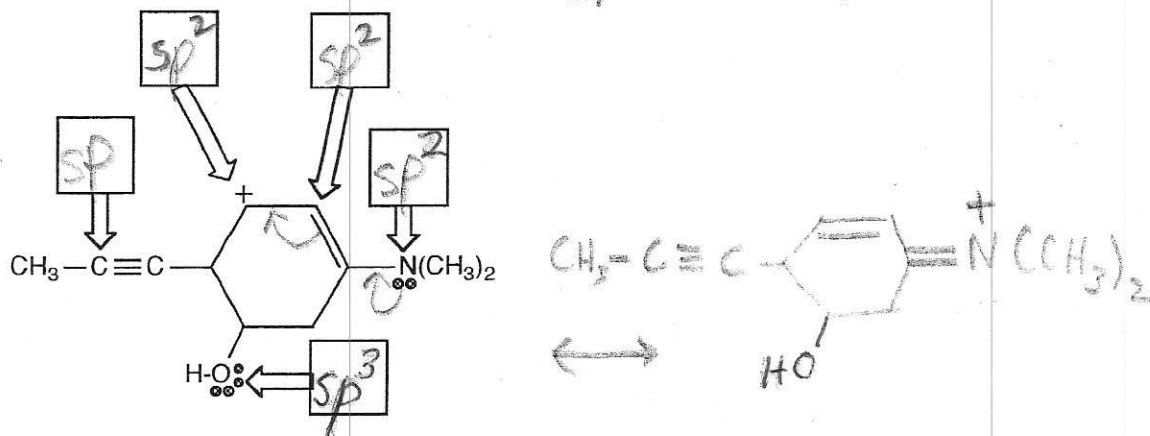
2 pts. each - the more stable the anion formed, the more acidic the acid



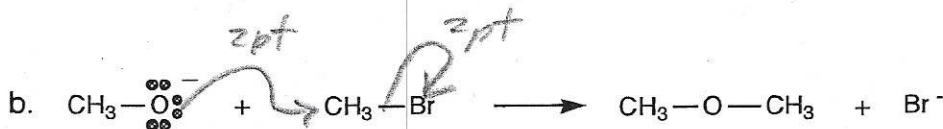
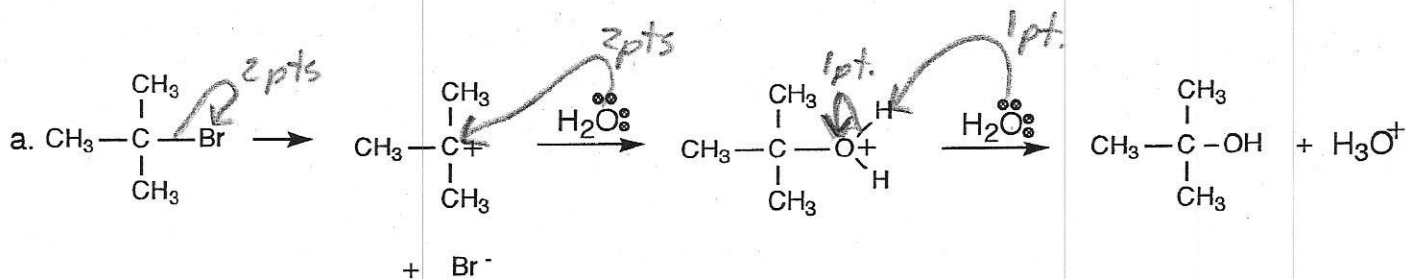
6. Predict the products that would result from an acid/base reaction between the two compounds below and place the answers in the boxes provided. Predict the direction of the equilibrium, and indicate the direction by placing an arrow in the box. (6 pts.) 2 pts. each



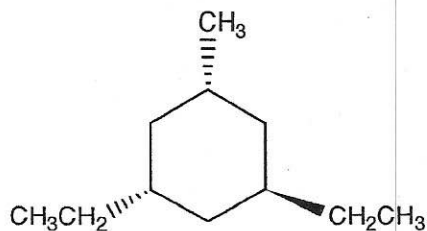
7. For the molecule below determine the hybridization of the indicated atoms and place the answers in the boxes provided. (10 pts.)



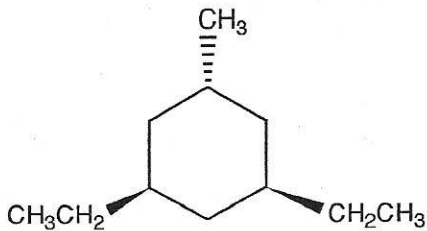
8. For the reactions below, provide curved arrows to indicate the movements of electron pairs associated with bond breaking and bond forming, i.e., provide the mechanisms. (10 pts.)



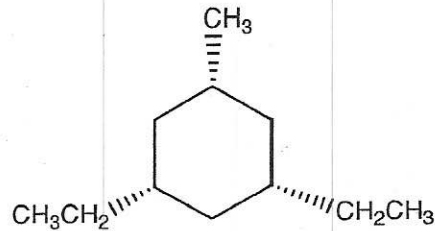
9. For each of the following substituted cyclohexanes, draw the more stable conformation in the large box. Place the cyclohexanes in order of increasing stability (1=least stable, 3=most stable). (12 pts.)



1

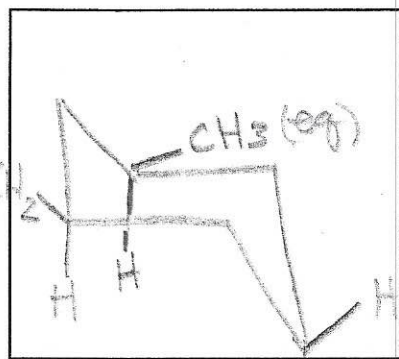


2

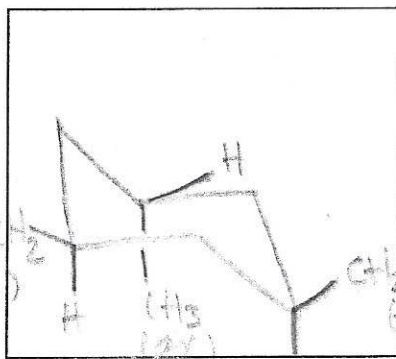


3

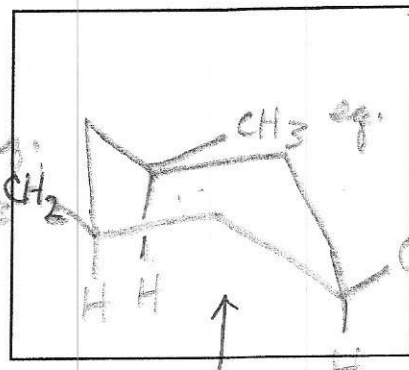
1 pt each



2 groups eq, 1 apial



2 groups eq. → larger groups equatorial  
1 apial



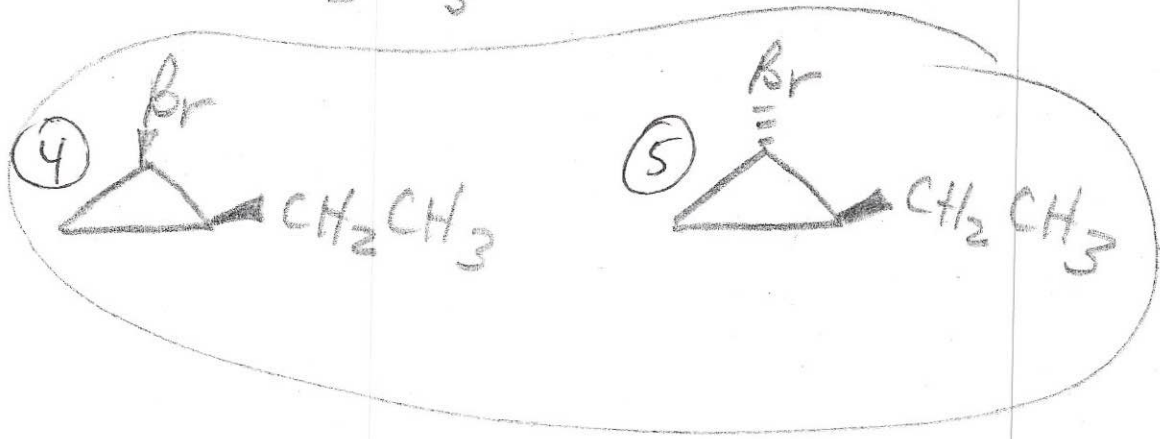
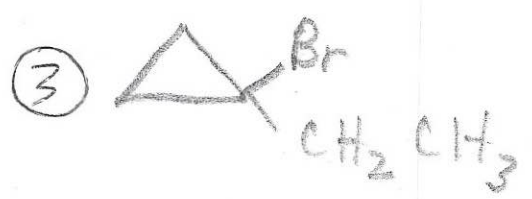
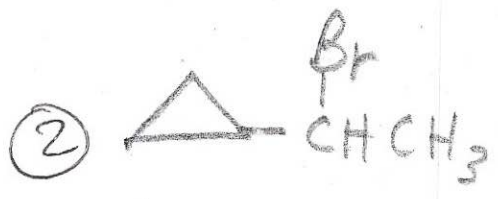
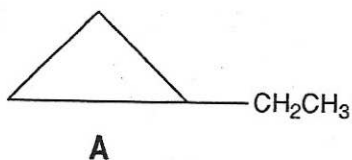
all equatorial

\*3 pts. each structure 4:

4

mono

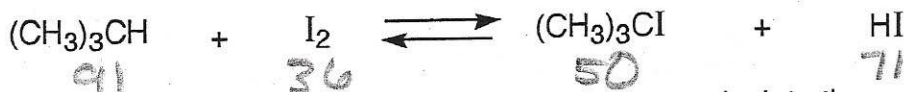
10. Draw all structural isomers and geometric isomers (cis/trans) resulting from the dibromination of ethylcyclopropane (structure A). Place geometric isomers next to each other and circle them. (11 pts.)



2 pts each structure  
1 pt for circle



11. Consider the following reaction:



a. Given the bond dissociation energies (BDE) below, calculate the overall  $\Delta H^\circ$  in the box provided. (4 pts.)

$$\Delta H = (91 + 36) - (50 + 71) = +6 \text{ Kcal/mol} \quad 4 \text{ pts}$$

$$\Delta H = (91 + 36) + (-50 + -71) = +6 \text{ Kcal/mol} \quad \text{OR}$$

b. Are the products or reactants favored at equilibrium? (2 pts.)

reactants 2 pts

Bond-Dissociation Energy		Bond-Dissociation Energy	
Bond	kcal/mol	Bond	kcal/mol
H—X bonds and X—X bonds		Bonds to secondary carbons	
H—H	104	(CH <sub>3</sub> ) <sub>2</sub> CH—H	95
D—D	106	(CH <sub>3</sub> ) <sub>2</sub> CH—F	106
F—F	38	(CH <sub>3</sub> ) <sub>2</sub> CH—Cl	80
Cl—Cl	58	(CH <sub>3</sub> ) <sub>2</sub> CH—Br	68
Br—Br	46	(CH <sub>3</sub> ) <sub>2</sub> CH—I	53
I—I	36	(CH <sub>3</sub> ) <sub>2</sub> CH—OH	91
H—F	136	Bonds to tertiary carbons	
H—Cl	103	(CH <sub>3</sub> ) <sub>3</sub> C—H	91
H—Br	88	(CH <sub>3</sub> ) <sub>3</sub> C—F	106
H—I	71	(CH <sub>3</sub> ) <sub>3</sub> C—Cl	79
HO—H	119	(CH <sub>3</sub> ) <sub>3</sub> C—Br	65
HO—OH	51	(CH <sub>3</sub> ) <sub>3</sub> C—I	50
Methyl bonds		(CH <sub>3</sub> ) <sub>3</sub> C—OH	91
CH <sub>3</sub> —H	104	Other C—H bonds	
CH <sub>3</sub> —F	109	PhCH <sub>2</sub> —H (benzylic)	85
CH <sub>3</sub> —Cl	84	CH <sub>2</sub> =CHCH <sub>2</sub> —H (allylic)	87
CH <sub>3</sub> —Br	70	CH <sub>2</sub> =CH—H (vinyl)	108
CH <sub>3</sub> —I	56	Ph—H (aromatic)	110
CH <sub>3</sub> —OH	91	C—C bonds	
Bonds to primary carbons		CH <sub>3</sub> —CH <sub>3</sub>	88
CH <sub>3</sub> CH <sub>2</sub> —H	98	CH <sub>3</sub> CH <sub>2</sub> —CH <sub>3</sub>	85
CH <sub>3</sub> CH <sub>2</sub> —F	107	CH <sub>3</sub> CH <sub>2</sub> —CH <sub>2</sub> CH <sub>3</sub>	82
CH <sub>3</sub> CH <sub>2</sub> —Cl	81	(CH <sub>3</sub> ) <sub>2</sub> CH—CH <sub>3</sub>	84
CH <sub>3</sub> CH <sub>2</sub> —Br	68	(CH <sub>3</sub> ) <sub>3</sub> C—CH <sub>3</sub>	81
CH <sub>3</sub> CH <sub>2</sub> —I	53		
CH <sub>3</sub> CH <sub>2</sub> —OH	91		
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> —H	98		
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> —F	107		
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> —Cl	81		
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> —Br	68		
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> —I	53		
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> —OH	91		

