

**Chem 0310**  
**Dennis P. Curran**  
**January 30, 2009**  
**Exam 1**

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Answer all questions on this exam. If you need more space than that provided, use the back of any page.

1. \_\_\_\_\_ (20 points)

2. \_\_\_\_\_ (20 points)

3. \_\_\_\_\_ (20 points)

4. \_\_\_\_\_ (20 points)

5. \_\_\_\_\_ (20 points)

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

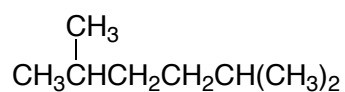
The test has **6** pages (including this cover page and Tables of BDEs on page 6). There are 5 questions. Each question has four parts. All parts are worth 5 points. Partial credit will be given. The exam ends at 10:55 am sharp.

Good Luck !!!

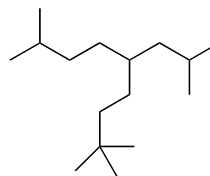
### 1) Structures and Names (20 points)

Provide IUPAC names for the following alkanes.

a)



b)



Draw clear structures for compounds with the following names. You can draw *either* a condensed structure (like "a" above) or a bond-line structure (like "b" above)

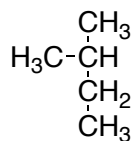
c) 1-chloro-4-isopropyl-4-methylheptane

d) isobutyl chloride

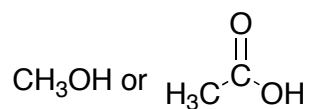
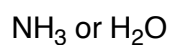
### 2) Short answer questions (20 points)

a) State the Hammond Postulate.

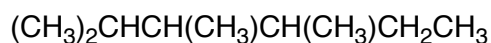
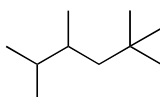
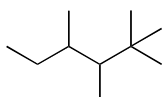
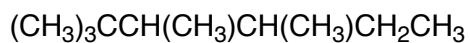
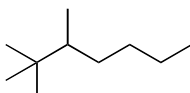
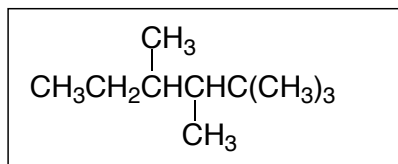
b) Indicate the primary ( $1^\circ$ ), secondary ( $2^\circ$ ) and tertiary ( $3^\circ$ ) hydrogens on the following compound.



c) Choose the *stronger* acid from the following pairs. *Briefly* explain your choice.

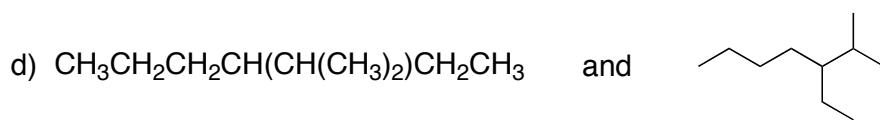
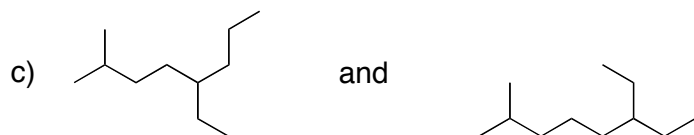
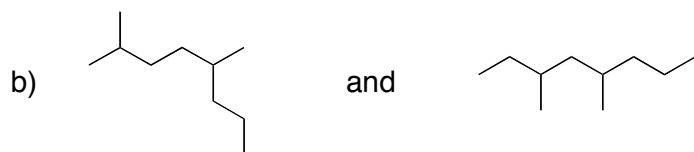
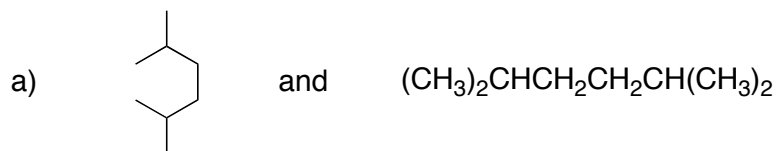


d) Circle all structures that are identical to the structure in the box.



### 3) Isomers (20 points)

What is the relationship between the following pairs of compounds. Are they: 1) the same, 2) constitutional isomers, or 3) neither?



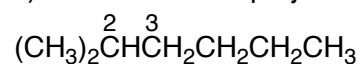
**4) Conformations (20 points)**

a) Define conformational isomers.

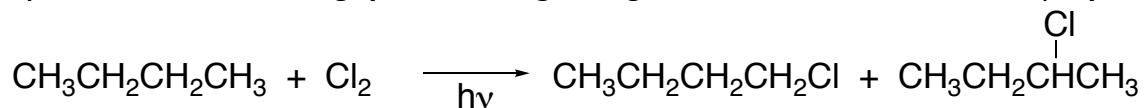
b) Draw Newman projections of the C–C bond of propane ( $\text{CH}_3\text{CH}_2\text{CH}_3$ ) in both eclipsed and staggered conformations.

c) Draw a reaction coordinate diagram for the bond rotation in "b". Locate on your diagram the eclipsed and staggered conformations and show the energy difference between them (in kcal/mol).

d) Draw Newman projections for all the staggered isomers of the C2-C3 bond of 2-methylhexane.



5) Answer the following questions regarding the chlorination of butane. (20 points)



a) Write the initiation step and *one* termination step for this reaction.

b) Write the propagation steps for *one* (not both) of the products. Use arrows to show electron movement.

c) Using the tables of bond dissociation energies on the next page, calculate the  $\Delta H^\circ$  for *one* (not both) of the products. Is the reaction exothermic or endothermic?

d) Which product is favored? Briefly explain why.

**TABLE 3-1** Bond-Dissociation Energies of Various A-B Bonds [ $DH^\circ$  in kcal mol<sup>-1</sup> (kJ mol<sup>-1</sup>)]

A in A-B	B in A-B						
	-H	-F	-Cl	-Br	-I	-OH	-NH <sub>2</sub>
H—	104 (435)	136 (569)	103 (431)	87 (364)	71 (297)	119 (498)	108 (452)
CH <sub>3</sub> —	105 (439)	110 (460)	85 (356)	70 (293)	57 (238)	93 (389)	84 (352)
CH <sub>3</sub> CH <sub>2</sub> —	101 (423)	111 (464)	84 (352)	70 (293)	56 (234)	94 (393)	85 (356)
CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> —	101 (423)	110 (460)	85 (356)	70 (293)	56 (234)	92 (385)	84 (352)
(CH <sub>3</sub> ) <sub>2</sub> CH—	98.5 (412)	111 (464)	84 (352)	71 (297)	56 (234)	96 (402)	86 (360)
(CH <sub>3</sub> ) <sub>3</sub> C—	96.5 (404)	110 (460)	85 (356)	71 (297)	55 (230)	96 (402)	85 (356)

Note: (a) These numbers are being revised continually because of improved methods for their measurement. (b) The trends observed for A-H bonds are significantly altered for polar A-B bonds because of dipolar contributions to  $DH^\circ$ .

**TABLE 3-4**  
 $DH^\circ$  Values for the  
Elemental Halogens

Halogen	$DH^\circ$
	[kcal mol <sup>-1</sup> (kJ mol <sup>-1</sup> )]
F <sub>2</sub>	38 (159)
Cl <sub>2</sub>	58 (243)
Br <sub>2</sub>	46 (192)
I <sub>2</sub>	36 (151)