

Chemistry 333

Examination #1

June 18, 2007

Professor Charonnat

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

Be certain that your examination has eight (8) pages including this one.

Put your name on **each** page of this examination booklet.

By putting your name on this examination booklet you agree to abide by California State University, Northridge policies of academic honesty and integrity.

Molecular models are allowed for this examination. All electronic devices, including calculators, are unnecessary and are not allowed.

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

1. (20 points)

Define each of the following four (4) terms clearly. Draw a specific example for each term.

A. bonding molecular orbital

B. isotopes

C. nonbonding electron pair

D. ionic bond

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2. (50 points)

Circle the number that corresponds to the correct answer for each of the following ten (10) questions.

A. Covalent bond homolysis affords

1. ions
2. radicals
3. both ions and radicals

B. Which of the following is not a Lewis base?

1.  $\text{H}_3\text{CCH}_2\text{CH}_2\text{CH}_3$
2.  $\text{H}_3\text{CCH}_2\text{OCH}_3$
3.  $\text{H}_3\text{CCH}_2\text{NHCH}_3$

C. Isohexane and *n*-hexane are

1. identical
2. structural isomers
3. conformational isomers

D. Boat cyclohexane and twist-boat cyclohexane are

1. identical
2. structural isomers
3. conformational isomers

E. Which of the following has the largest torsional strain?

1. an H/H eclipsing interaction
2. a  $\text{CH}_3/\text{H}$  eclipsing interaction
3. a  $\text{CH}_3/\text{CH}_3$  eclipsing interaction

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2. (continued)

F. Which of the following is the least stable radical?

1. 1-heptyl radical
2. 2-heptyl radical
3. 3-heptyl radical

G. The relative stability of radicals is due to

1. induction
2. hyperconjugation
3. both induction and hyperconjugation

H. What is the molecular shape of water?

1. bent
2. tetrahedral
3. linear

I. A late transition state is structurally similar to the

1. starting material
2. product
3. neither the starting material nor the product

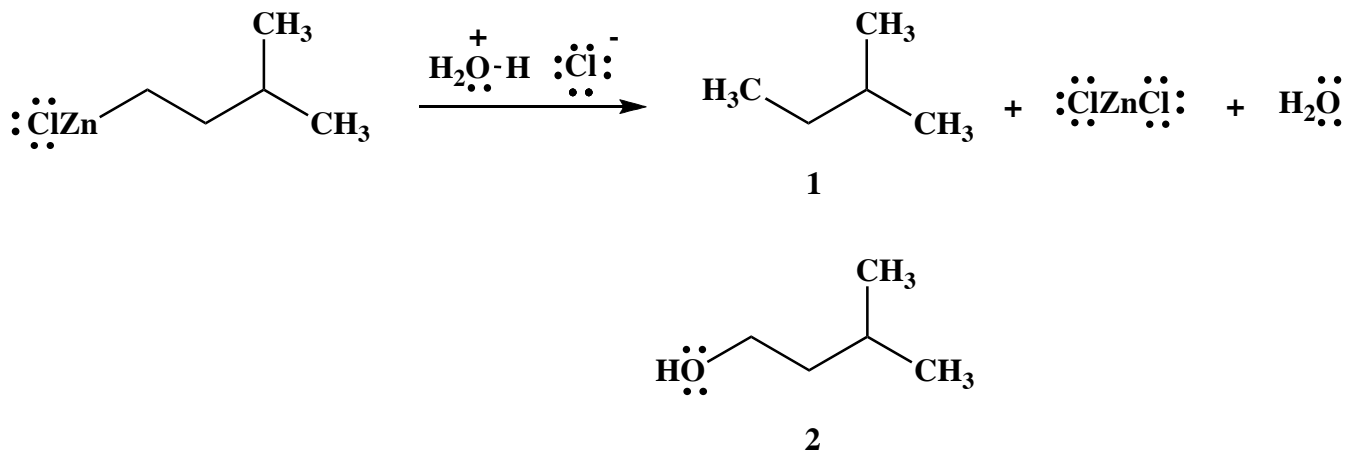
J. Which of the following molecules has a molecular dipole moment?

1.  $\text{H}_3\text{CC}\equiv\text{CCH}_3$
2.  $\text{CH}_2\text{Br}_2$
3.  $\text{CBr}_4$

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3. (20 points)

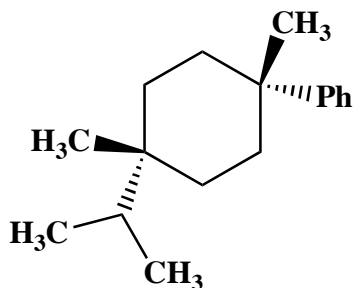
Draw the mechanism of the following reaction, using the curved-arrow notation to indicate the reorganization of electron density. Explain why the observed product is the alkane **1**, not the corresponding alcohol **2**.



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4. (20 points)

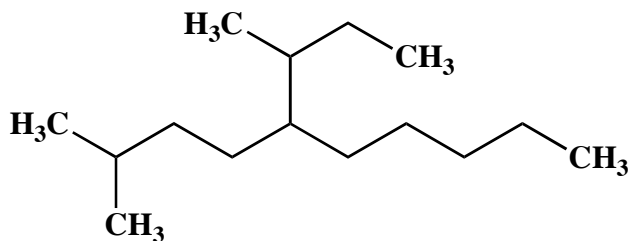
Draw the most stable chair conformation of the following tetrasubstituted cyclohexane. Clearly denote all 1,3-diaxial interactions. Then calculate the total strain energy for this conformation. (See the tables on page 8 for reference.)



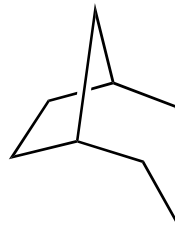
5. (20 points)

Use IUPAC nomenclature to write the systematic names of the following two (2) alkanes.

A.



B.



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6. (20 points)

Answer the following two (2) questions precisely, succinctly and with correct grammar.

A. Why is  $\text{H}_3\text{CSO}_3\text{H}$  a stronger Lowry-Brønsted acid than  $\text{H}_3\text{COH}$ ?

B. Describe what happens on a molecular level when a nonpolar, covalent solid dissolves in a nonpolar solvent.

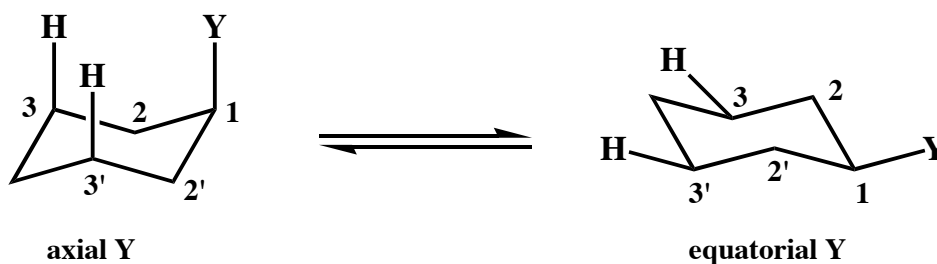
**Congratulations!**

1	/20
2	/50
3	/20
4	/20
5	/20
6	/20
total:	/150

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**Calculated Equilibrium Values at T = 298 K**

<u>energy difference (kJ/mol)</u>	<u>% more stable isomer</u>	<u>% less stable isomer</u>	<u>K</u>
0.000	50	50	1.00
0.497	55	45	1.22
1.00	60	40	1.50
1.53	65	35	1.86
2.10	70	30	2.33
2.72	75	25	3.00
3.43	80	20	4.00
4.30	85	15	5.67
5.44	90	10	9.00
7.30	95	5	19.0
11.4	99	1	99.0
17.1	99.9	0.1	999



<u>substituent Y</u>	<u>total strain due to two H-Y 1,3-diaxial interactions (kJ/mol)</u>	<u>strain due to one H-Y 1,3-diaxial interaction (kJ/mol)</u>
-F	1.4	0.70
-Cl	2.4	1.2
-Br	2.4	1.2
-OH	4.4	2.2
-CH <sub>3</sub>	7.3	3.7
-CH <sub>2</sub> CH <sub>3</sub>	7.5	3.8
-CH(CH <sub>3</sub> ) <sub>2</sub>	9.2	4.6
-C(CH <sub>3</sub> ) <sub>3</sub>	20.	10.
-Ph	12	6.0
-CO <sub>2</sub> H	5.9	3.0
-CO <sub>2</sub> CH <sub>3</sub>	5.2	2.6
-CH=CH <sub>2</sub>	7.0	3.5
-C≡CH	2.0	1.0
-C≡N	0.8	0.4