Chemistry 333

Examination #1

June 20, 2005 Professor Charonnat

Name: _____

Be certain that your examination has seven (7) 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.

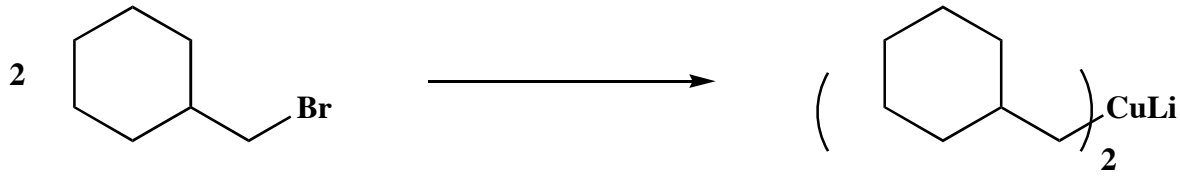
Molecular models are allowed for this examination. All electronic devices, including calculators, are unnecessary and are not allowed.

Name: _____

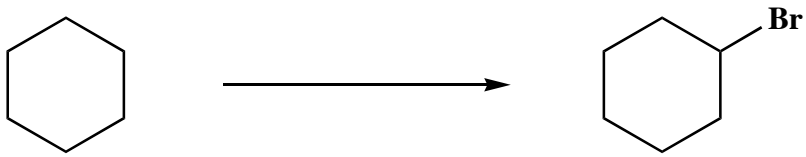
1. (25 points)

Draw the specific reagent(s) necessary to effect the transformation shown for each of the following three (3) questions. If more than one reaction is involved in an answer, be certain to distinguish the individual steps clearly. Specify the relative stoichiometry for each reagent.

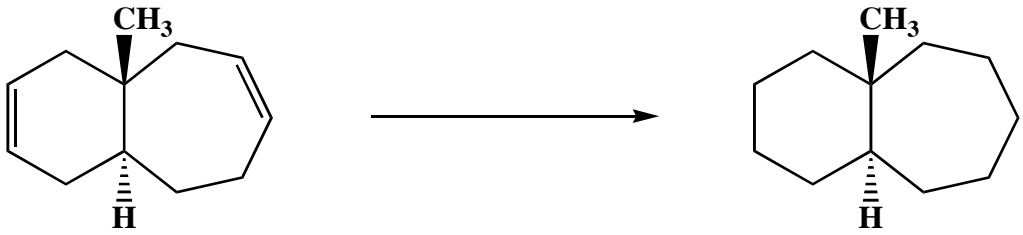
A.



B.

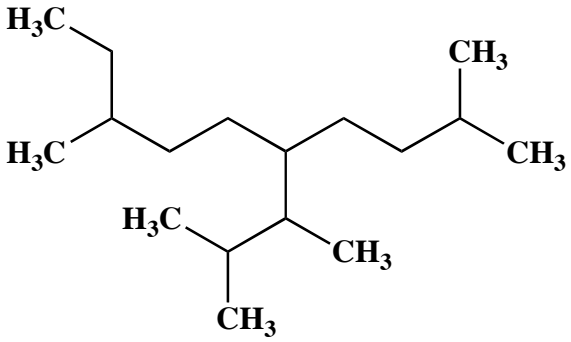


C.



2. (10 points)

Use IUPAC nomenclature to write the systematic name of the following alkane.



Name: _____

3. (50 points)

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

A. Which of the following compounds is the strongest acid?

1. CH_4
2. NH_3
3. H_2O

B. Which of the following compounds is the weakest acid?

1. HCl
2. HF
3. HBr

C. The conjugate acid of methylamine (H_3CNH_2) is

1. $H_4\overset{+}{C}NH_2$
2. $H_3C\overset{+}{N}H_3$
3. $H_3C\overset{-}{N}H$

D. If two related reactions with different activation energies are compared, the reaction with a larger activation energy will have

1. a faster rate
2. the same rate
3. a slower rate

E. If the temperature is increased by 20 °C, a typical reaction will proceed

1. two times slower
2. two times faster
3. nine times faster

Name: _____

3. (continued)

F. The electronic configuration of phosphorus is

1. $1s^2 2s^2 2p_x^1 2p_y^1 2p_z^1$
2. $1s^2 2s^2 2p_x^2 2p_y^2 2p_z^2 3s^2 3p_x^2 3p_y^1$
3. $1s^2 2s^2 2p_x^2 2p_y^2 2p_z^2 3s^2 3p_x^1 3p_y^1 3p_z^1$

G. A 2p orbital contains

1. zero nodal planes
2. one nodal plane
3. two nodal planes

H. A C-H bond is

1. completely nonpolar
2. very weakly polar
3. very polar

I. Which bonds are cylindrically symmetrical about the internuclear axis?

1. pi bonds
2. sigma bonds
3. both pi and sigma bonds

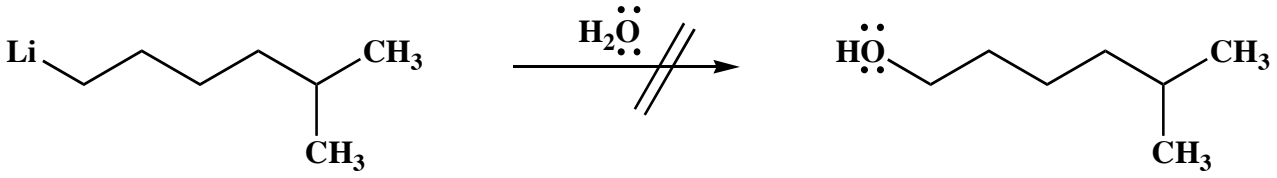
J. When an alkane dissolves in an organic solvent

1. covalent bonds within each alkane molecule dissociate
2. covalent bonds between alkane molecules dissociate
3. secondary intermolecular interactions between alkane molecules dissociate

Name: _____

4. (15 points)

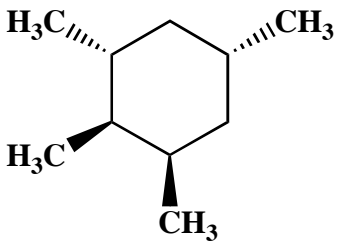
Why does the following reaction not afford the alcohol **1**? What is the actual product, instead?



1

5. (25 points)

Draw the two possible chair conformations of the following 1,2,3,5-tetrasubstituted cyclohexane. Clearly denote all 1,3-diaxial interactions for both conformations. Then calculate the total strain energy for each conformation. Finally, put a star next to the more stable conformation. (See the table on page 7. Additional note: a methyl/methyl 1,3-diaxial interaction is worth 3.7 kcal/mole.)



Name: _____

6. (25 points)

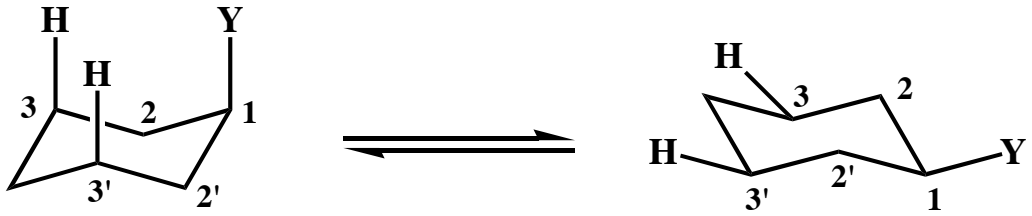
State the Hammond postulate and use it to characterize both an early and a late transition state. Draw reaction-energy diagrams (graphs of potential energy versus reaction progress) to illustrate your answer.

early transition state:

late transition state:

Congratulations!

1	/25
2	/10
3	/50
4	/15
5	/25
6	/25
Total:	/150



axial Y **equatorial Y**

substituent Y	steric strain due to one H-Y 1,3-diaxial interaction (kcal/mol)	total steric strain due to two H-Y 1,3-diaxial interactions (kcal/mol)
-F	0.12	0.24
-Cl	0.25	0.50
-Br	0.25	0.50
-OH	0.50	1.0
$-CH_3$	0.90	1.8
$-CH_2CH_3$	0.95	1.9
$-CH(CH_3)_2$	1.1	2.2
$-C(CH_3)_3$	2.7	5.4
$-C_6H_5$	1.5	3.0
$-CO_2H$	0.70	1.4
-CN	0.1	0.2