

Chemistry 333

Examination #1

September 29, 2005

Professor Charonnat

Name: _____

Be certain that your examination has six (6) 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.

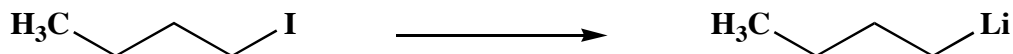
Molecular models are allowed for this examination. All electronic devices, including calculators, are unnecessary and are not allowed.

Name: _____

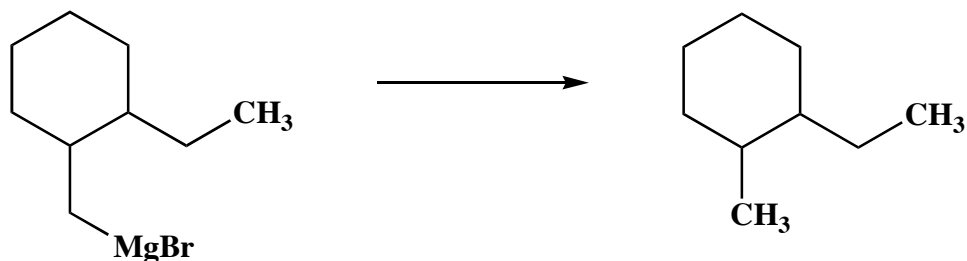
1. (25 points)

Draw the specific reagent(s) necessary to effect the following four (4) transformations. Specify correct stoichiometry for each reaction. If more than one reaction is involved in an answer, distinguish the individual steps clearly.

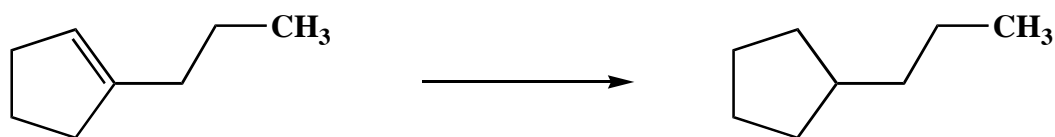
A.



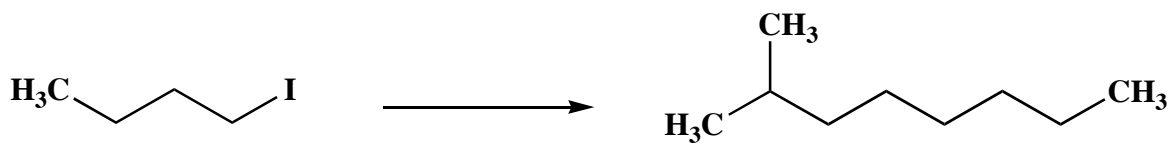
B.



C.



D.



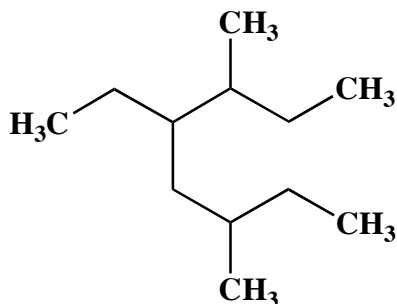
2. (10 points)

Use Lewis structures to draw all the important resonance structures of the carboxylate salt, potassium propionate ($\text{H}_3\text{CCH}_2\text{CO}_2\text{K}$). Draw all unshared electrons and nonzero formal charges for all structures.

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3. (10 points)

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



4. (20 points)

Draw a Newman projection of the least stable conformation of 2-methylpentane that is formed by rotation about the C2-C3 bond. Draw a second Newman projection of the most stable conformation of 2-methylpentane that is formed by rotation about the C2-C3 bond.



least stable

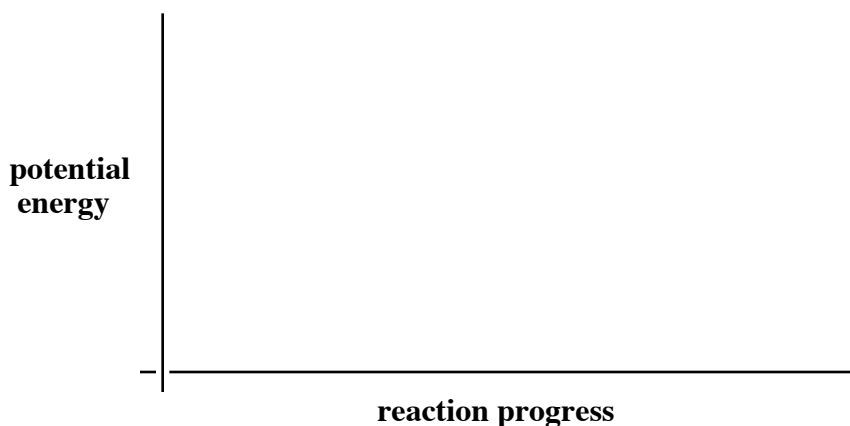


most stable

Name: _____

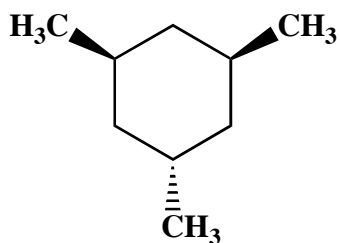
5. (10 points)

Draw a reaction-energy diagram (graph of potential energy versus reaction progress) for an overall exothermic, three-step process with a late transition state in the first step and an early transition state in the last step. Label the curve with each of the following: starting material (sm), transition states (ts_X), intermediates (int_X), product (p), activation energies (E_{aX}) and overall standard heat of reaction (ΔH°).



6. (25 points)

Draw the two possible chair conformations of the following trisubstituted cyclohexane. Clearly denote all 1,3-diaxial interactions for both conformations. Calculate the total strain energy for each conformation. Put a star next to the more stable conformation. Finally, determine the ratio of the two conformations at 298 K. (See the tables that are included separately. Additional note: a methyl/methyl 1,3-diaxial interaction is worth 3.7 kcal/mol.)



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7. (30 points)

Circle the number that corresponds to the correct answer for each of the following six (6) questions.

A. The electronic configuration of phosphorus is:

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

B. Which of the following is a termination step in the free-radical chlorination of methane?

1. reaction of a methyl radical with a chlorine molecule
2. reaction of a methyl radical with a chlorine atom
3. reaction of a chlorine atom with methane

C. The molecular shape of ammonia is:

1. planar
2. a trigonal pyramid
3. tetrahedral

D. An S-H bond is:

1. very polar
2. weakly polar
3. nonpolar

E. Which of the following is a Lewis acid?

1. $H_3COCH_2CH_3$
2. BF_3
3. $H_3CCH_2CH_3$

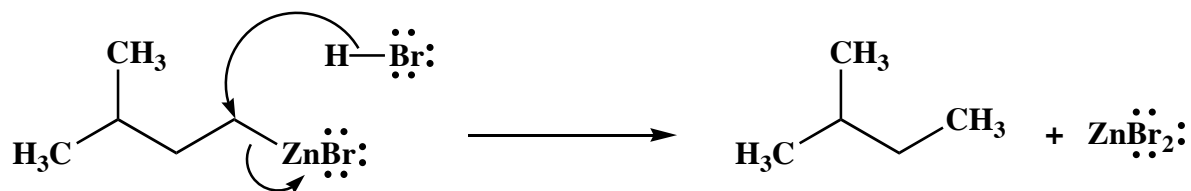
F. Which of the following is a Lewis base?

1. $H_3COCH_2CH_3$
2. BF_3
3. $H_3CCH_2CH_3$

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8. (20 points)

State in words what is wrong with the following mechanism. Then use the curved-arrow notation to draw the correct mechanism.

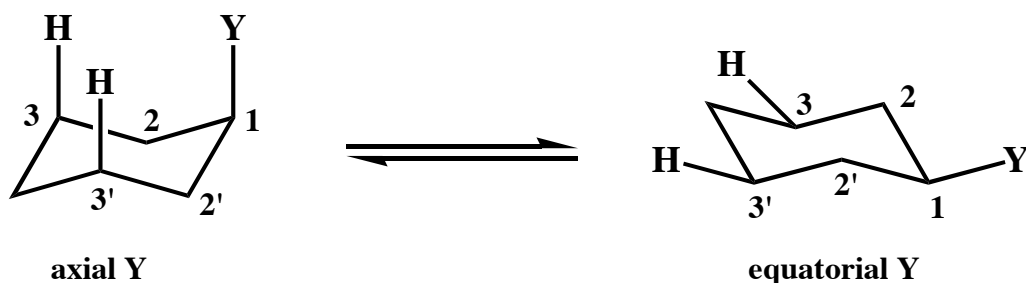


Congratulations!

1	/25
2	/10
3	/10
4	/20
5	/10
6	/25
7	/30
8	/20
Total:	/150

Calculated Equilibrium Values at T = 298 K

<u>energy difference (kcal/mol)</u>	<u>% more stable isomer</u>	<u>% less stable isomer</u>	<u>K</u>
0.000	50	50	1.00
0.119	55	45	1.22
0.240	60	40	1.50
0.367	65	35	1.86
0.502	70	30	2.33
0.651	75	25	3.00
0.821	80	20	4.00
1.028	85	15	5.67
1.302	90	10	9.00
1.745	95	5	19.0
2.723	99	1	99.0
4.092	99.9	0.1	999



<u>substituent Y</u>	<u>steric strain due to one H-Y</u>	<u>total steric strain due to two H-Y</u>
	<u>1,3-diaxial interaction (kcal/mol)</u>	<u>1,3-diaxial interactions (kcal/mol)</u>
-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 ₂ CH ₃	0.95	1.9
-CH(CH ₃) ₂	1.1	2.2
-C(CH ₃) ₃	2.7	5.4
-C ₆ H ₅	1.5	3.0
-CO ₂ H	0.70	1.4
-CN	0.1	0.2