

Chemistry 333

Examination #1

March 3, 2003

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.

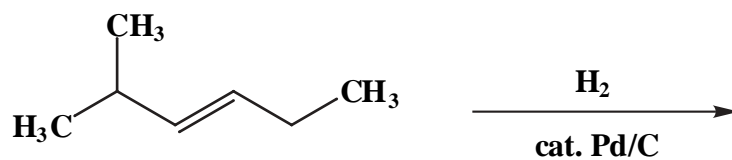
Molecular models are allowed for this examination. Calculators are unnecessary and are not allowed.

Name: _____

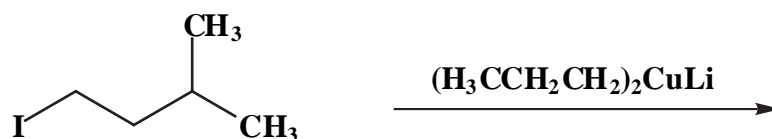
1. (15 points)

Draw the major organic product for each of the following three (3) questions.

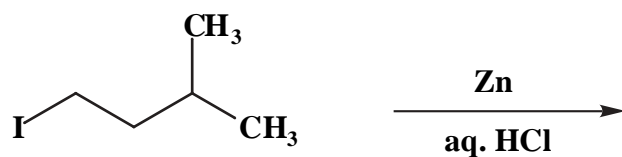
A.



B.

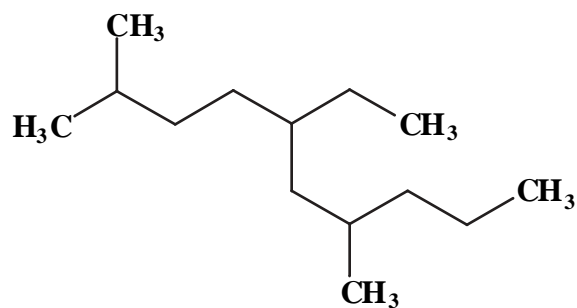


C.



2. (10 points)

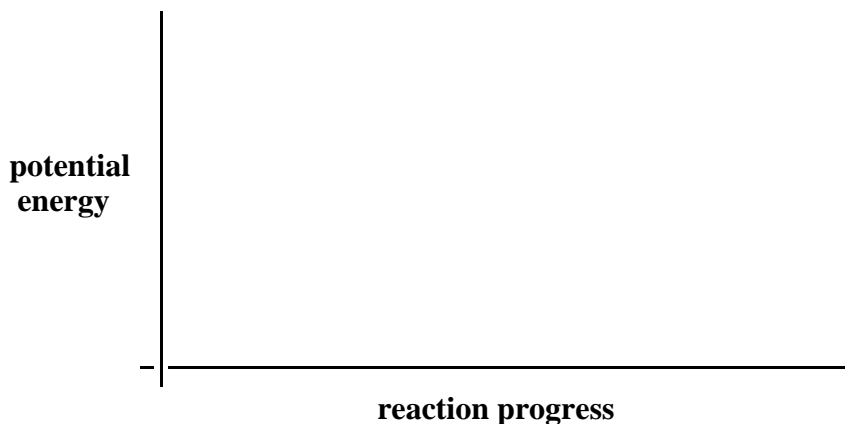
Use IUPAC nomenclature to write the systematic name of the following alkane.



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3. (10 points)

Draw a reaction profile (graph of potential energy versus reaction progress) for an overall endothermic, four-step process with a rate-determining third step. Label the curve with each of the following: starting material (sm), transition states (ts_x), intermediates (int_x), product (p), activation energies (E_{a_x}) and overall standard heat of reaction (ΔH^0).



4. (20 points)

Draw the two possible chair conformations of *trans*-1-ethyl-3-methylcyclohexane. 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 on page 6.)

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5. (20 points)

Draw the structures of specific examples for each of the following eight (8) categories.

A. a polar, covalent bond

B. a nonpolar, covalent bond

C. an ionic bond

D. a resonance-stabilized anion

E. a Lewis acid

F. a Lowry-Brønsted base

G. two alkanes that are structural isomers of each other

H. two conformational isomers of propane (use sawhorse structures)

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6. (25 points)

Circle the number that corresponds to the correct answer for each of the following five (5) questions.

A. An early transition state is structurally similar to:

1. the product
2. the starting material
3. the reagent

B. A 2p orbital:

1. is more stable than a 2s orbital
2. is less stable than a 2s orbital
3. has the same stability as a 2s orbital

C. An sp^3 hybrid orbital has:

1. linear geometry
2. trigonal geometry
3. tetrahedral geometry

D. CBr_4 is a:

1. very polar molecule
2. moderately polar molecule
3. nonpolar molecule

E. Which of the following is the least stable conformation of cyclohexane?

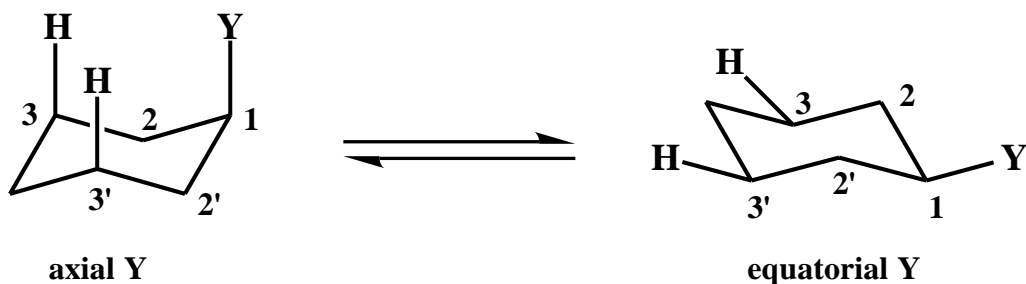
1. half-chair
2. twist-boat
3. boat

Congratulations!

1	/15
2	/10
3	/10
4	/20
5	/20
6	/25
Total:	/100

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>1,3-diaxial interaction (kcal/mol)</u>	<u>total steric strain due to two H-Y</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