

Chemistry 333

Examination #1

February 25, 2008

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. (30 points)

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

A. An orbital can hold a maximum of

1. two electrons
2. one electron
3. three electrons

B. According to the Aufbau principle

1. highest energy orbitals are filled first
2. intermediate energy orbitals are filled first
3. lowest energy orbitals are filled first

C. Ammonia's molecular shape is

1. trigonal planar
2. trigonal pyramidal
3. tetrahedral

D. Covalent bond heterolysis affords

1. radicals
2. ions
3. both

E. Boron trifluoride is a

1. Lowry-Brønsted base
2. Lowry-Brønsted acid
3. Lewis acid

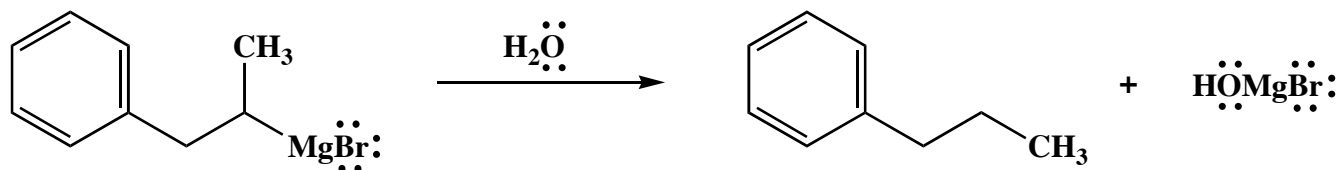
F. Which of the following reactions is entropically more favorable at elevated temperatures?

1. an elimination
2. an addition
3. a substitution

Name: _____

2. (10 points)

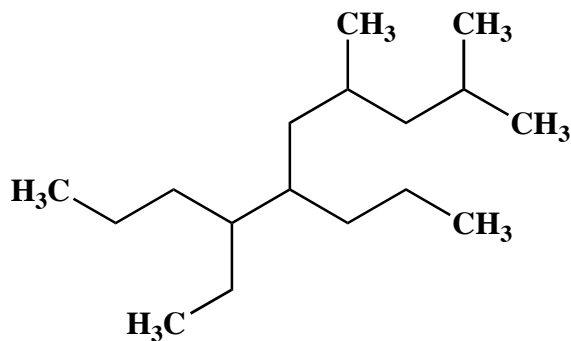
Draw the mechanism of the following reaction, using the curved-arrow notation to indicate the reorganization of electron density. Show all intermediates and denote all lone pairs, charges and countercharges.



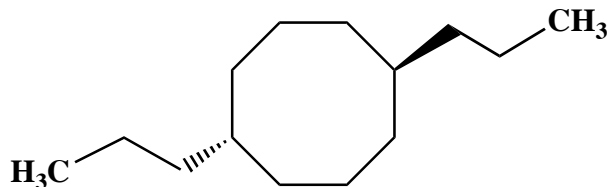
3. (20 points)

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

A.



B.

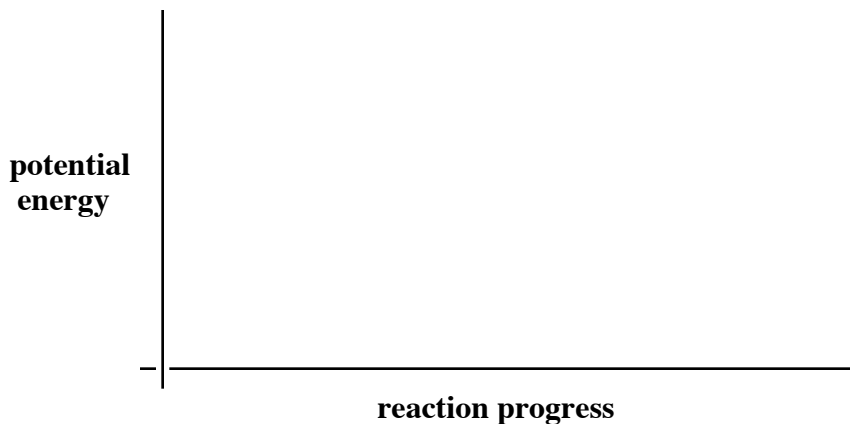


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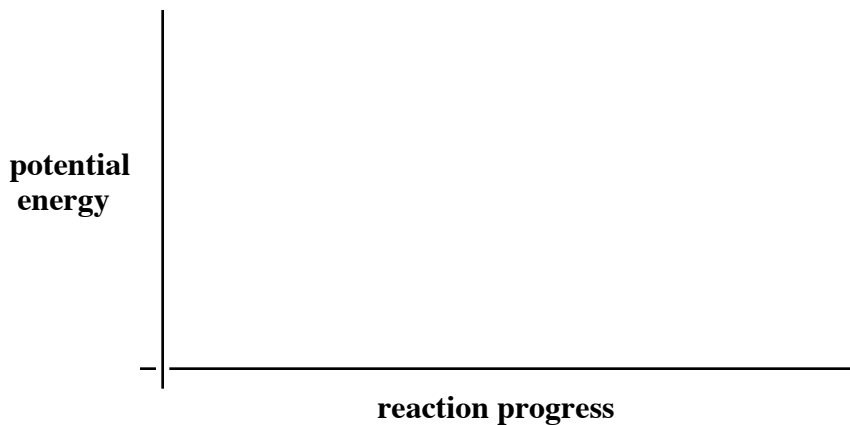
4. (20 points)

Draw reaction-energy diagrams (graphs of reaction progress versus potential energy) for both of the following two (2) reactions. Label the curves with 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°).

A. a one-step reaction with an early transition state



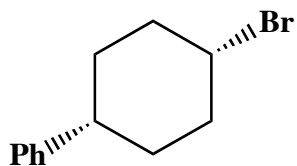
B. a two-step, overall endothermic reaction with the second step being the rate-determining step



Name: _____

5. (20 points)

Draw the two possible chair conformations of the following disubstituted cyclohexane derivative. 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, estimate the ratio of the two conformations at 298 K. (See the tables on page 6.)



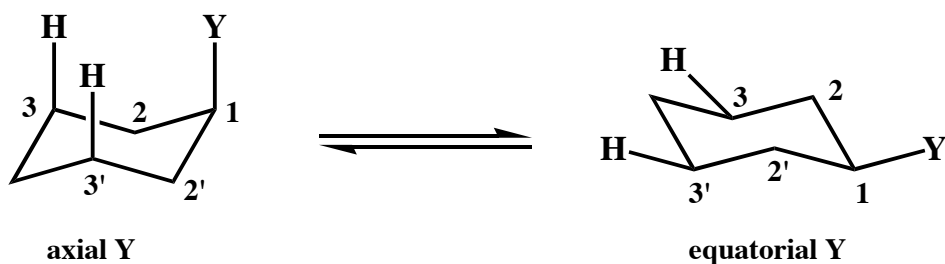
Congratulations!

1	/30
2	/10
3	/20
4	/20
5	/20
<hr/> Total:	<hr/> /100

Name: _____

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 ₃	7.3	3.7
-CH ₂ CH ₃	7.5	3.8
-CH(CH ₃) ₂	9.2	4.6
-C(CH ₃) ₃	20.	10.
-Ph	12	6.0
-CO ₂ H	5.9	3.0
-CO ₂ CH ₃	5.2	2.6
-CH=CH ₂	7.0	3.5
-C≡CH	2.0	1.0
-C≡N	0.8	0.4