Chemistry 333

Examination #1

February 26, 2007 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.

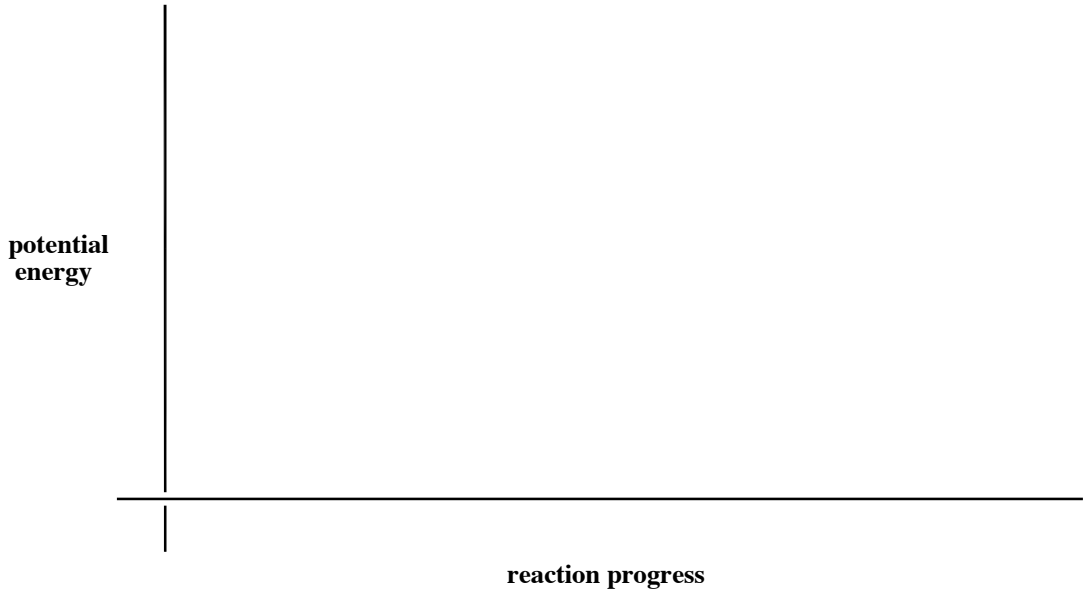
Molecular models are allowed for this examination. All electronic devices, including calculators, are unnecessary and are not allowed.

Name: _____

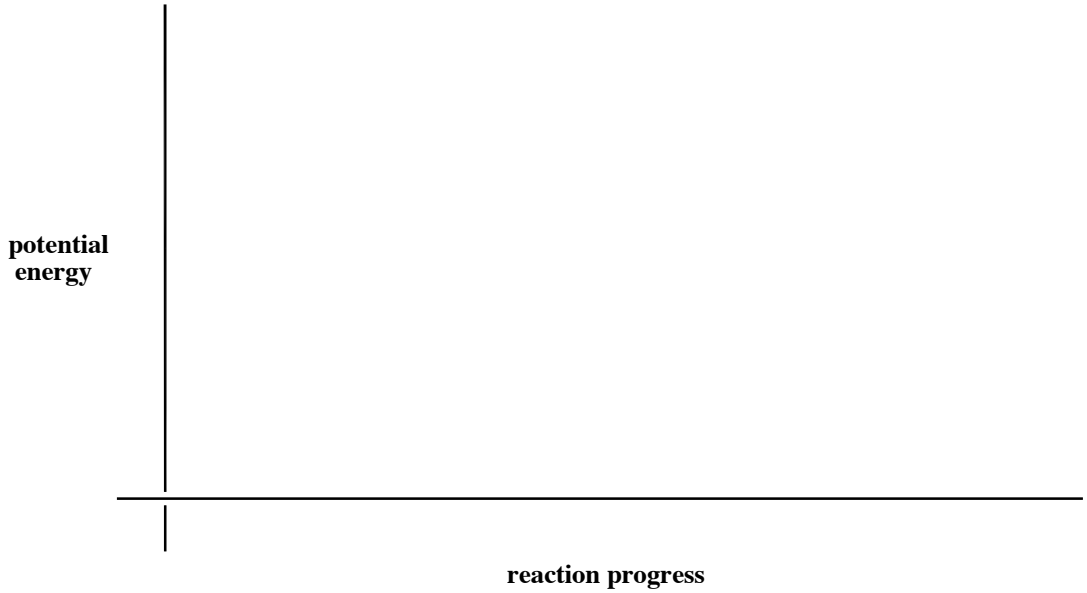
1. (20 points)

Draw reaction-energy diagrams (graphs of reaction progress versus potential energy) for the following two (2) reactions. Label both graphs with the following: starting material (sm), transition states (ts_X), intermediates (int_X), product (p), activation energies (Ea_X) and overall standard heat of reaction (ΔH^o).

A. A three-step, overall endothermic reaction with a rate-determining third step



B. A three-step, overall exothermic reaction with a late transition state in the first step and an early transition state in the second step



Name: _____

2. (30 points)

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

A. Which of the following species is the strongest Lowry-Brønsted base?

1. HF
2. H_2O
3. NH_3

B. Degenerate orbitals always have the same

1. energy
2. occupancy
3. directionality

C. Catalytic hydrogenation of alkenes usually affords

1. anti addition of hydrogen
2. syn addition of hydrogen
3. a mixture of anti and syn addition of hydrogen

D. Resonance structures that contribute to a resonance hybrid vary due to the delocalization of

1. electrons
2. nuclei
3. electrons and nuclei

E. Which of the following species is ionic?

1. CBr_4
2. PCl_3
3. MgI_2

F. Alkanes contain carbon atoms that are

1. sp hybridized
2. sp^2 hybridized
3. sp^3 hybridized

Name: _____

3. (20 points)

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

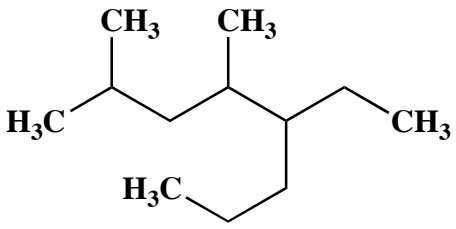
A. Explain the term, "structural isomers." Draw a pair of compounds as a specific example.

B. Why is 2-bromobutane formed preferentially to 1-bromobutane in the photochemical bromination of *n*-butane?

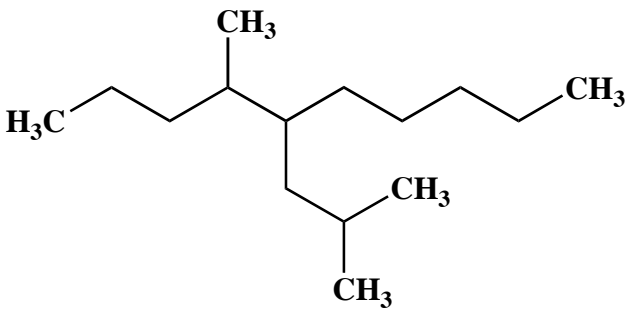
4. (10 points)

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

A.



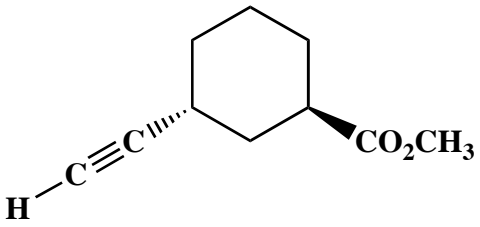
B.



Name: _____

5. (20 points)

Draw the two possible chair conformations of the following disubstituted cyclohexane. Clearly denote all 1,3-diaxial interactions for both conformations. Then calculate the total strain energy for each conformation. Put a star next to the more stable conformation. Finally, determine the approximate ratio of the two conformations at 298 K. (See the tables on page 6 for reference.)



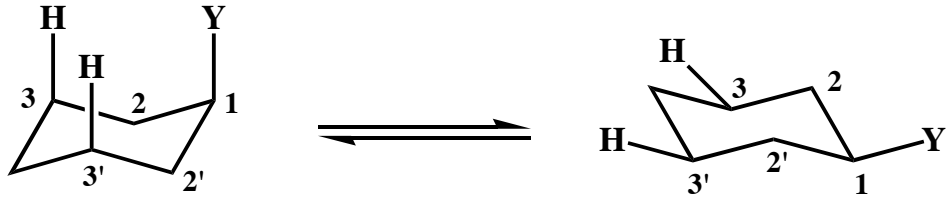
Congratulations!

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

Name: _____

Calculated Equilibrium Values at T = 298 K

energy difference (kJ/mol)	% more stable isomer	% less stable isomer	K
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



axial Y **equatorial Y**

substituent Y	total strain due to two H-Y 1,3-diaxial interactions (kJ/mol)	strain due to one H-Y 1,3-diaxial interaction (kJ/mol)
-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
$-CH_2CH_3$	7.5	3.8
$-CH(CH_3)_2$	9.2	4.6
$-C(CH_3)_3$	20.	10.
-Ph	12	6.0
$-CO_2H$	5.9	3.0
$-CO_2CH_3$	5.2	2.6
$-CH=CH_2$	7.0	3.5
-C≡CH	2.0	1.0
-C≡N	0.8	0.4