Chemistry 333

Examination #1

March 8, 2004 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. (20 points)

Circle the number that corresponds to the correct answer for each of the following four (4) questions.

A. Rank the following *n*-butane conformational isomers from least to most stable.

1. gauche, eclipsed, anti
2. eclipsed, gauche, anti
3. anti, gauche, eclipsed
4. anti, eclipsed, gauche

B. How many electrons can exist in a specific orbital?

1. zero or one, only
2. one or two, only
3. one, two or three
4. zero, one or two

C. A Lewis acid is:

1. an electron pair acceptor
2. an electron pair donor
3. a proton acceptor
4. a proton donor

D. According to the VSEPR rules, the C-N-C bond angle of $(H_3C)_2C{=}NCH_2CH_3$ is:

1. 180^o
2. 120^o
3. 109^o
4. 90^o

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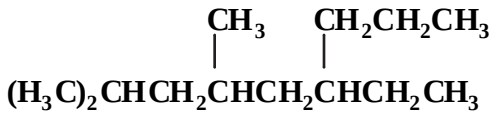
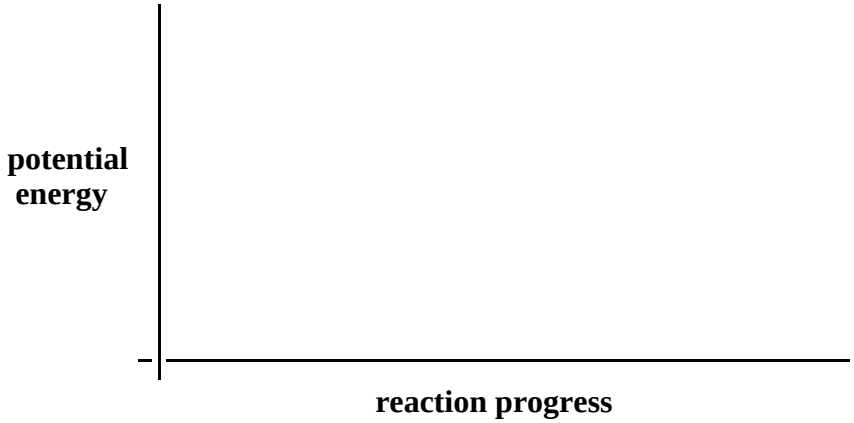
2. (10 points)

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



3. (10 points)

Draw a reaction-energy diagram (graph of reaction progress versus potential energy) for an overall exothermic, three-step process with a rate-determining first step. Label the curve with each of 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). Finally, state whether the rate-determining step has an early or a late transition state.



4. (10 points)

Draw a Lewis structure for $H_3CCHOHC(CH_3)_2CH_2COCH_3$. Show all covalent bonds and unshared electrons clearly. Draw a second picture, using the line-angle convention.

Name:_____

5. (20 points)

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

A. Why is NaCl ionic, whereas Cl_2 is covalent?

B. Why don't all collisions of two potentially reactive species result in an observed reaction?

6. (10 points)

Draw the most stable chair conformation of *trans*-1-*t*-butyl-3-methylcyclohexane Clearly denote all 1,3-diaxial interactions. Calculate the total strain energy for this conformation. (See the data tables on page 6.)

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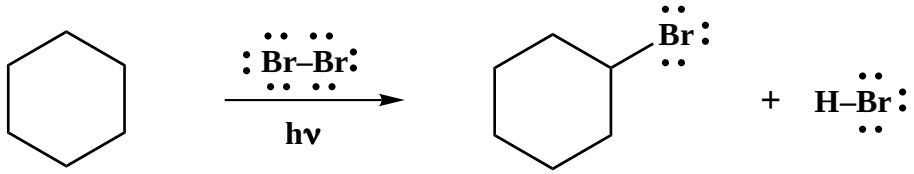
7. (20 points)

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 and unpaired electrons. Write at least one termination step.

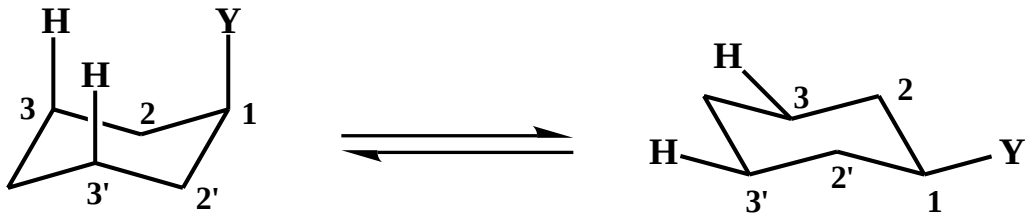


Congratulations!

1	/20
2	/10
3	/10
4	/10
5	/20
6	/10
7	/20
Total:	/100

Calculated Equilibrium Values at T = 298 K

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



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