

Chemistry 333

Examination #1

June 19, 2006

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)

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

A. Molecular oxygen causes the rate of free-radical chlorination of *n*-pentane to

1. increase
2. remain constant
3. decrease

B. Cyclopropane has 115 kJ/mol of strain energy. The largest contribution is due to

1. angle strain
2. torsional strain
3. steric strain

C. Which of the following compounds has the largest molecular dipole moment?

1. H_3COCH_3
2. H_3CCH_3
3. CBr_4

D. If the equilibrium composition of a reaction is to contain at least 99% of the products and less than 1% of the reactants, ΔG° for the reaction must be

1. 12 kJ/mol or more positive
2. zero kJ/mol
3. -12 kJ/mol or more negative

E. Homolytic bond dissociation enthalpy is

1. the same as heterolytic bond dissociation enthalpy
2. not the same as heterolytic bond dissociation enthalpy
3. the same as heterolytic bond heat of formation

2. (20 points)

What is the hybridization of the bold atom in each of the following four (4) compounds?

A. $\text{H}_3\text{C}\mathbf{N}\text{HCH}_2\text{CH}_3$ _____

B. $\text{H}_3\text{C}\mathbf{C}\text{CCH}_3$ _____

C. $\text{H}_3\text{C}\mathbf{C}\text{HCHCH}_3$ _____

D. $\text{H}_3\text{C}\mathbf{C}\text{H}_2\text{CH}_2\text{CH}_3$ _____

Name: _____

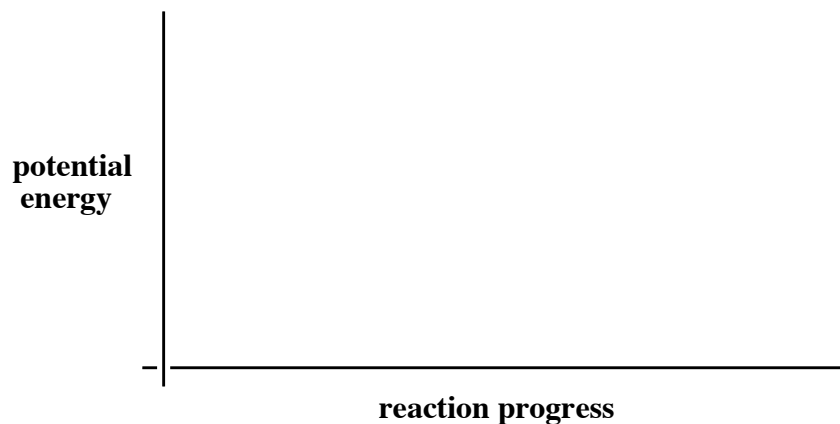
3. (40 points)

Answer the following three (3) questions precisely, succinctly and with correct grammar.

A. Why is hydrogen bromide a stronger acid than hydrogen chloride?

B. The eclipsed conformation of propane is less stable than the staggered conformation. What is the physical basis for this fact? Draw three-dimensional structures to illustrate your answer.

C. Explain qualitatively why free-radical bromination of propane affords 2-bromopropane with good regioselectivity. Draw a labeled reaction-energy diagram (graph of potential energy versus reaction progress) to illustrate your answer.

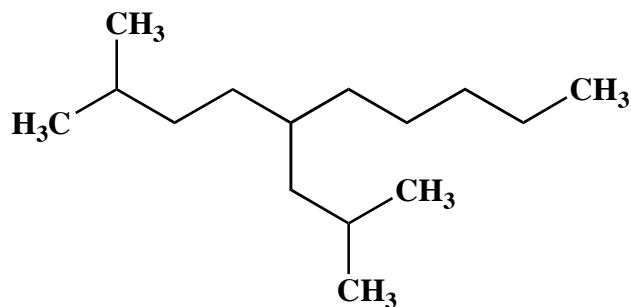


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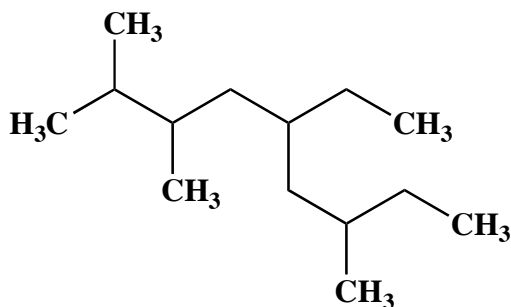
4. (20 points)

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

A.



B.



5. (20 points)

Draw all the important resonance structures for the following two (2) ions. Show all nonbonding electron pairs and nonzero formal charges for each resonance structure.

A.



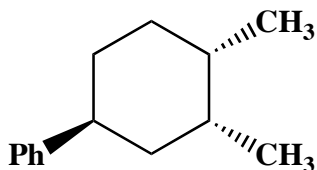
B.



Name: _____

6. (25 points)

Draw the two possible chair conformations of the following trisubstituted cyclohexane (Ph = phenyl). Clearly denote all 1,3-diaxial and gauche 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.)

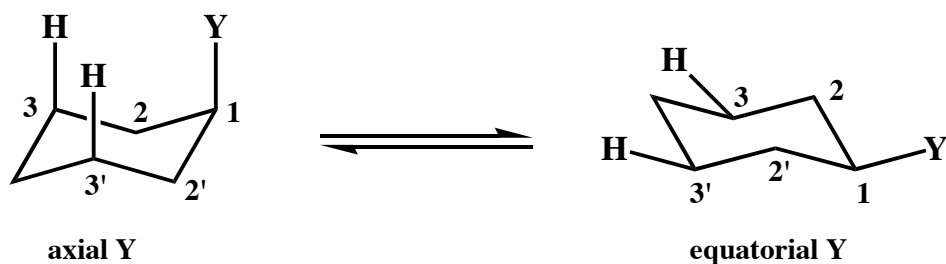


Congratulations!

1	/25
2	/20
3	/40
4	/20
5	/20
6	/25
Total:	/150

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</u>	<u>strain due to one H-Y</u>
	<u>1,3-diaxial interactions (kJ/mol)</u>	<u>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