

Chemistry 333

Examination #1

October 3, 2018

Professor Charonnat

Name: \_\_\_\_\_

Be certain that your examination has seven (7) 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.

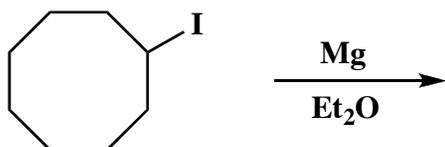
Molecular models are allowed for this examination. All electronic devices, including calculators and cell phones, are unnecessary and are not allowed.

Name: \_\_\_\_\_

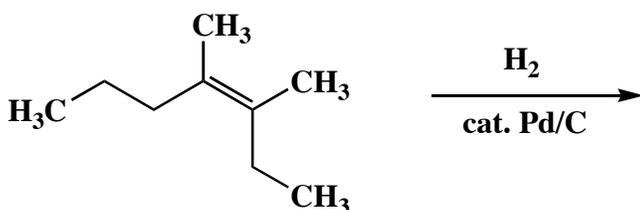
1. (25 points)

Draw the structure of the expected major organic product for each of the following five (5) questions. Specify stereochemistry clearly, if relevant.

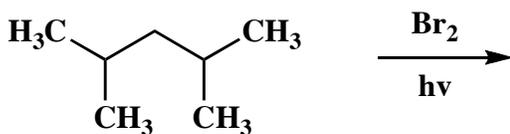
A.



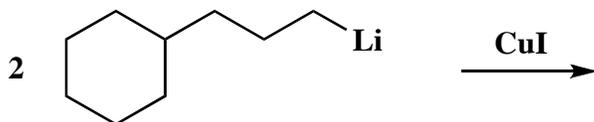
B.



C.



D.



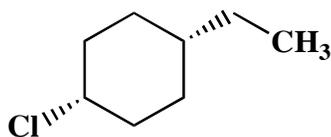
E.



Name: \_\_\_\_\_

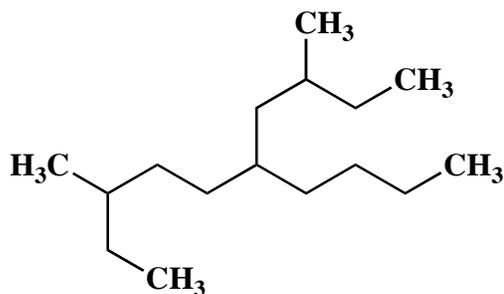
2. (20 points)

Draw the two possible chair conformations of the following disubstituted cyclohexane. Draw carefully positioned intersecting arcs to denote all sources of steric strain for both conformations. Use the first table on page 6 to calculate the total strain energy for each chair conformation. Put a star next to the more stable conformation. Then determine the energy difference between the two conformations. Finally, use the second table on page 6 to estimate the percentages of each conformation at 298 K.



3. (10 points)

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



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4. (25 points)

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

A. Which of the following compounds has a nonzero molecular dipole moment?

1.  $\text{BBr}_3$
2.  $\text{PH}_3$
3. both  $\text{BBr}_3$  and  $\text{PH}_3$

B. Identify the hybridization of the highlighted atom in  $\text{H}_3\text{CCH}\mathbf{N}\text{H}$ .

1.  $\text{sp}$
2.  $\text{sp}^2$
3.  $\text{sp}^3$

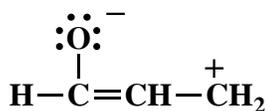
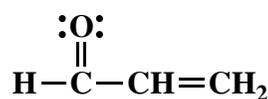
C. Consider the primary mechanistic step in which atomic chlorine reacts with propane to afford the 2-propyl radical and hydrogen chloride. The transition state for this primary mechanistic step resembles

1. the reactants
2. the 2-propyl radical and hydrogen chloride
3. both the reactants, the 2-propyl radical, and hydrogen chloride

D. Protonation of 3-iodoheptane with 0.1 M sulfuric acid fails to afford *n*-heptane due to

1. the reagent not being sufficiently acidic
2. the exceptionally strong C-I bond
3. electrostatic repulsion

E. How are the following two structures related to each other?



1. structural isomers
2. resonance structures
3. conformational isomers

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5. (10 points)

Ammonium chloride ( $\text{NH}_4\text{Cl}$ ) is a crystalline solid at room temperature. Describe in detail what must occur at the molecular level for ammonium chloride to dissolve in water. In particular, describe the specific interactions that are broken and those that are formed, both for the solute and for the solvent. Finally, state what occurs entropically when ammonium chloride dissolves in water.

6. (10 points)

Which of the following two compounds is more acidic,  $\text{H}_3\text{CCO}_2\text{H}$  or  $\text{H}_3\text{CCH}_2\text{OH}$ ? Describe your reasoning by explaining the relative stabilities of the corresponding conjugate bases. Draw chemical structures of the conjugate bases to illustrate your answer.

**Congratulations!**

1	/25
2	/20
3	/10
4	/25
5	/10
6	/10
<hr/> Total:	<hr/> /100