CHEM 310 Exam 1

Dr. Hanna

February 7, 2007

Honor Pledge:

In Part V of the Winthrop University Student Conduct Code, it is stated that "A fundamental tenet of all institutions of higher learning is academic honesty. … Misrepresentation of someone else's work as one's own is a most serious offense in any academic setting. … Academic misconduct includes but is not limited to providing or receiving assistance in a manner not authorized by the professor in the creation of work to be submitted for academic evaluation including papers, projects, and examinations …"

By my signature below, I pledge that I did not commit academic misconduct (cheat) on this examination.

KEY
Printed Name

Signature

Part 1 _____/20

Part 2 _____/30

Part 3 _____/15

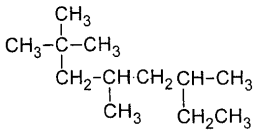
Part 4 _____/20

Part 5 _____/15

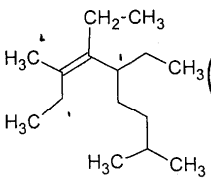
Total _____/100

Part 1: Nomenclature (20 pts)

1a. Write IUPAC names for the following compounds (indicate stereochemistry where required):

i) 

2, 2, 4, 6 - TETRAMETHYLOCTANE

ii) 

(Z)-4, 5-DIETHYL-3, 8-DIMETHYLNON-3-ENE

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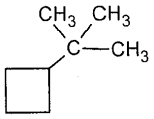
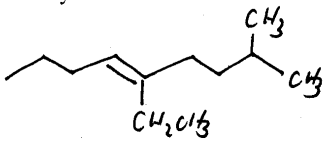
iii) 

t-BUTYLCYCLOBUTANE

1b. Draw structures corresponding to the following IUPAC names:

i) (E)-5-Ethyl-8-methylnon-4-ene



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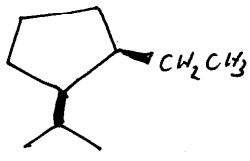
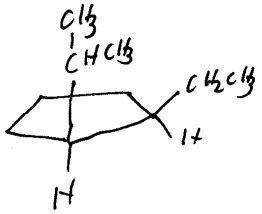
ii) *cis*-1-Ethyl-2-isopropylcyclopentane



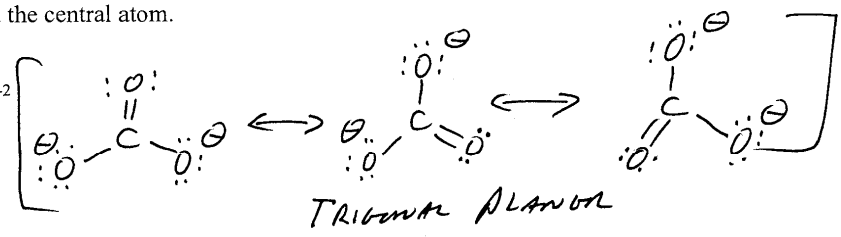
or



Part 2: Structure and Bonding (30 pts)

2a. Draw Lewis structures for the following compounds (include resonance forms if applicable). Indicate the molecular shape (e. g. linear, trigonal pyramidal, etc.) around the central atom.

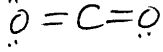
i) CO_3^{-2}



TRIGONAL PLANAR

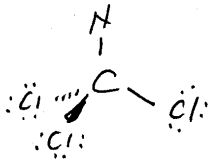
6

ii) CO_2

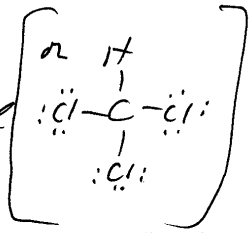


LINEAR

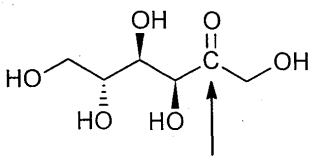
iii) $CHCl_3$



TETRAHEDRAL

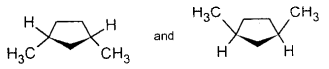


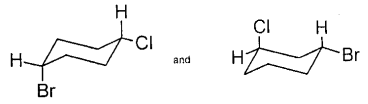
2b. Provide the hybridization of *and* the approximate bond angles around the indicated atom in the following molecules:

		Hybridization	Bond Angle
i)	$CH_3—C\equiv N$	sp	180°
6 ii)		sp^2	120°
iii)	$CH_3—CH_2—O—CH_2—CH_3$	sp^3	109.5°

($R-\ddot{O}-R \Rightarrow$ 4 e⁻ pairs = Tetrahedral; Tetrahedral = sp^3)

2c. Indicate whether the compounds in each pair are *cis-trans* diastereomers, constitutional isomers, or identical:

i)  IDENTICAL

ii)  CONSTITUTIONAL ISOMERS (1,3- vs 1,4-)

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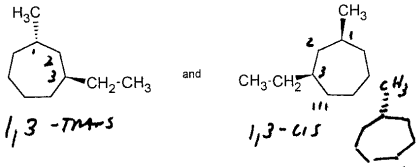
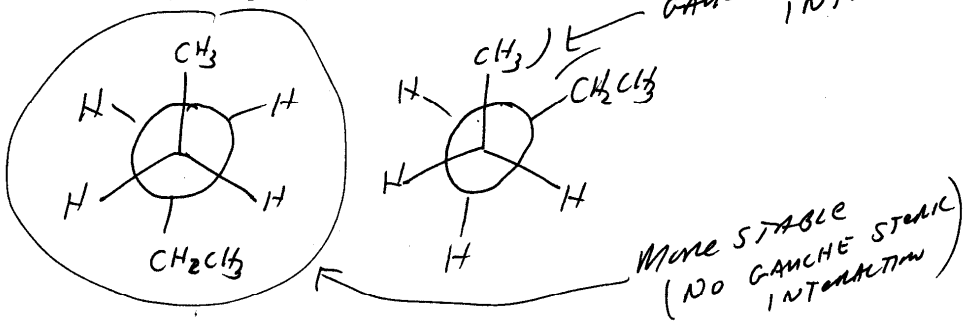
iii)  CIS-TRANS DIASTEREOMERS

1,3-TRANS 1,3-CIS

2d. Sighting down the C2-C3 bond of *n*-pentane, there are 2 types of staggered conformations. Draw Newman projections for both, indicate the most stable conformation, and explain your choice.



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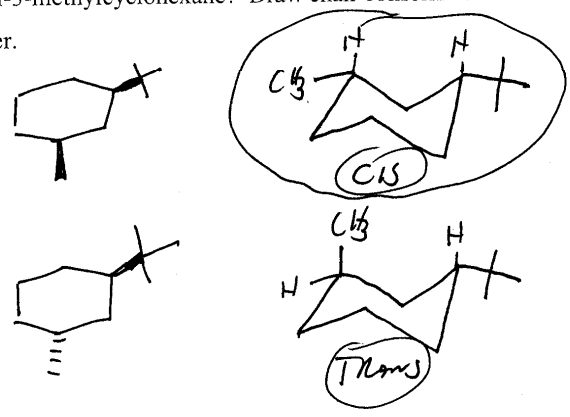
2e. Which is a more stable compound – *cis*-1-*tert*-butyl-3-methylcyclohexane or *trans*-1-*tert*-butyl-3-methylcyclohexane? Draw chair conformations of both, and explain your answer.



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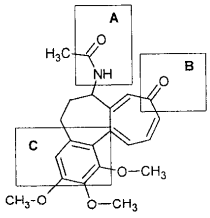
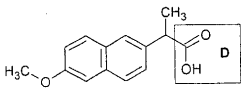
Part 3: Functional Groups (15 pts)

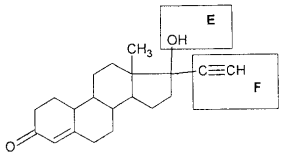
Identify the functional groups present in the following compounds:



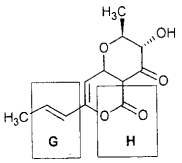
Colchicine



Naproxen



Norethindrone



Radicinin

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A = AMIDE

B = KETONE

C = ARENE

D = CARBOXYLIC ACID

E = ALCOHOL (HYDROXYL)

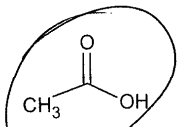
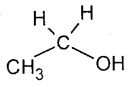
F = ALKYNE

G = ALKENE

H = ESTER

Part 4: Acids and Bases (20 pts)

4a. Circle the **stronger** acid in each pair and state the major factor that accounts for the acidity difference:

				Major Factor
i)	CH_3OH	or	CH_3SH	SIZE
ii)	NH_3	or	HF	ELECTRONEGATIVITY
iii)		or		Resonance
iv)	HCl	or	PH_3	ELECTRONEGATIVITY

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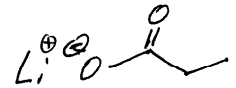
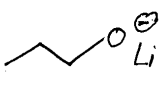
4b. The pK_a of propanoic acid is about 5, while the pK_a of 1-propanol is about 16. Will the following reaction take place? Explain.

1-Propanol

Propanoic acid

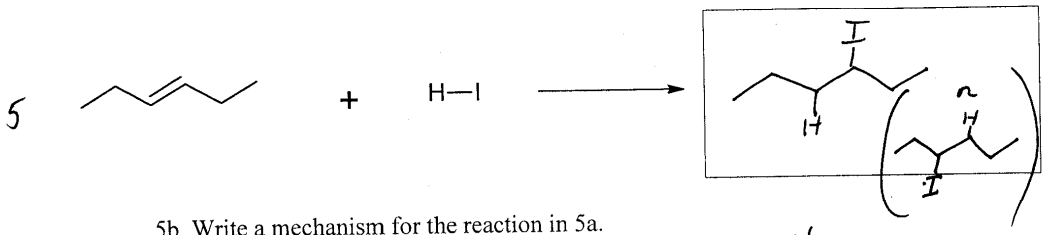
4

No. Propanoic acid is a stronger acid so eqm. will lie ~~to~~ toward reactants

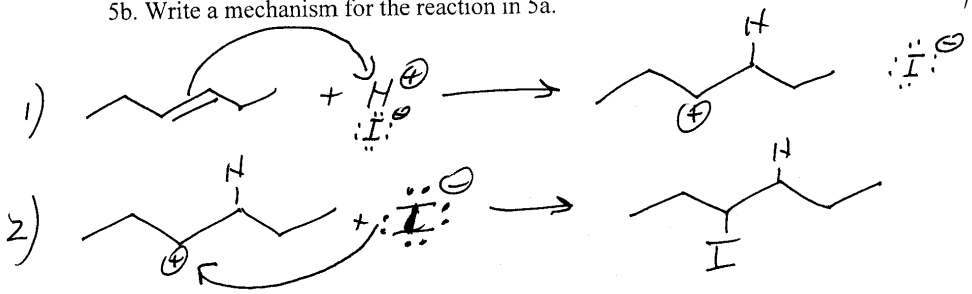
or  is the weaker base (vs ) so it will not accept the H^+ from propanol

Part 5: Reaction Mechanisms and Energy Diagrams (15 pts)

5a. Predict the product of the following reaction:



5b. Write a mechanism for the reaction in 5a.



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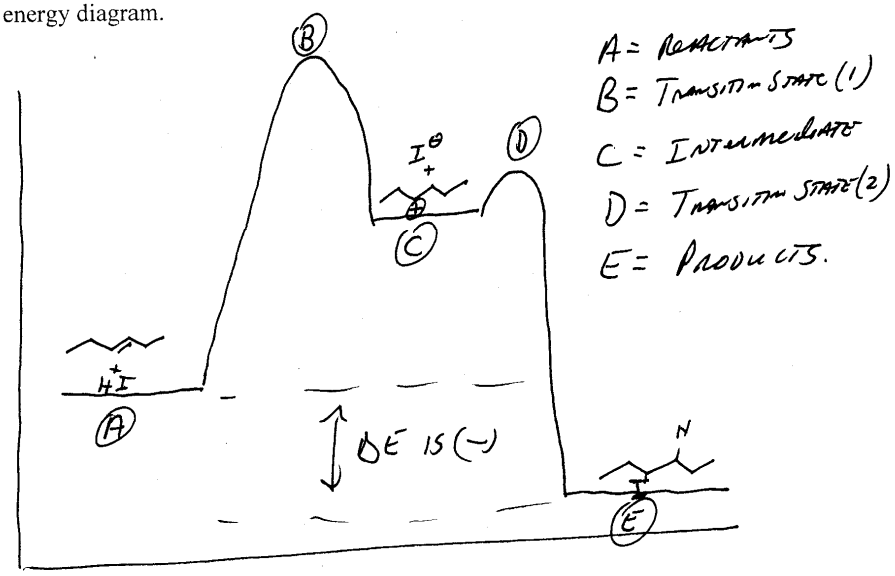
5c. Sketch a reaction energy diagram for the reaction above. Assume that the product is of lower energy than the reactants, and the first step is the rate limiting step (the slowest step). Label the reactants, products, intermediate, and transition states on your energy diagram.



A

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