

# CHEM 310 Exam 1

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September 10, 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 \_\_\_\_\_/20

Part 3 \_\_\_\_\_/24

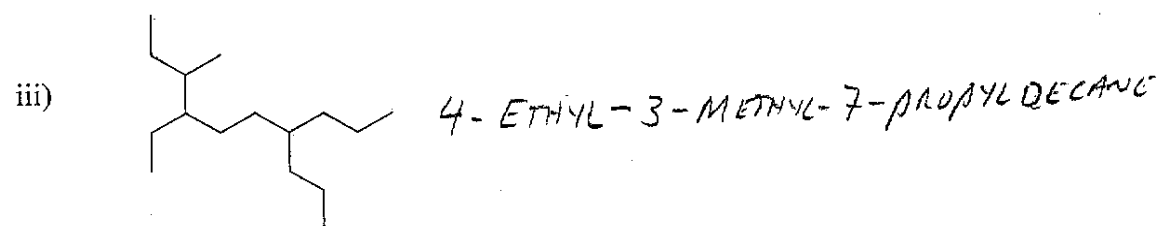
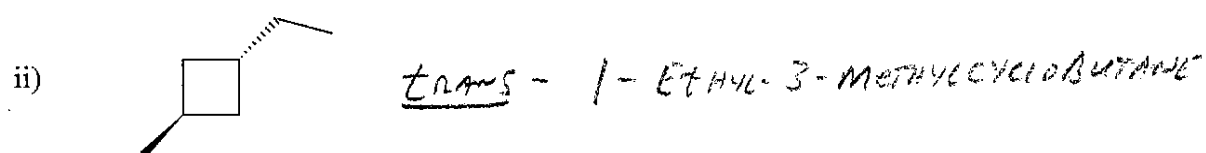
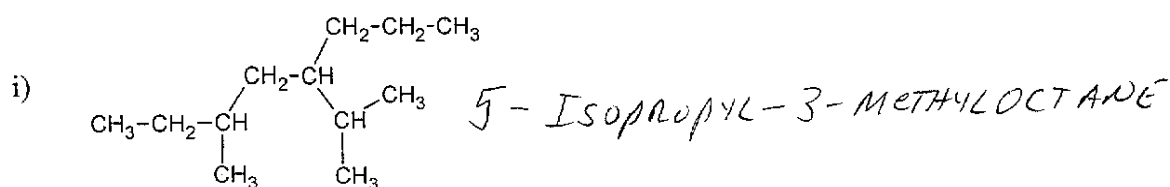
Part 4 \_\_\_\_\_/20

Part 5 \_\_\_\_\_/16

**Total** \_\_\_\_\_/100

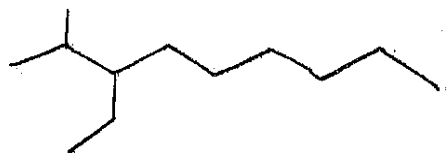
**Part 1: Nomenclature (20 pts)**

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

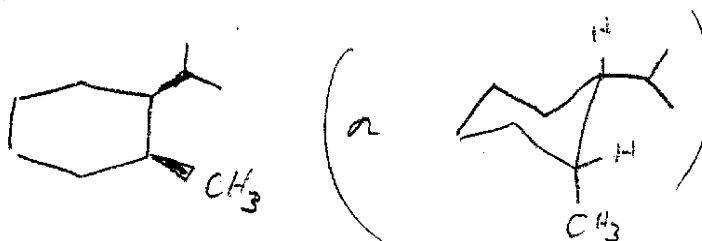


1b. Draw structures corresponding to the following IUPAC names:

i) 3-Ethyl-2-methylnonane

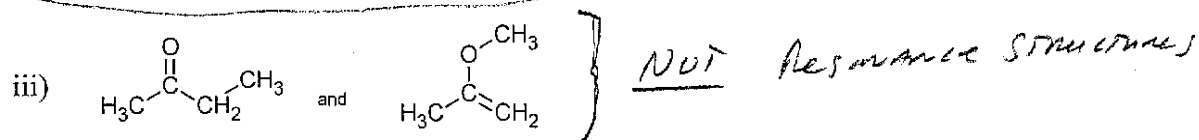
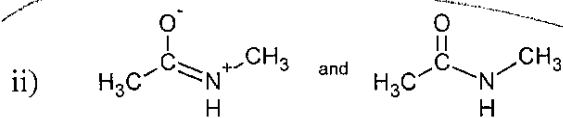
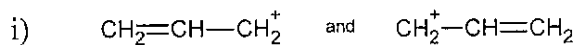


ii) *cis*-1-isopropyl-2-methylcyclohexane

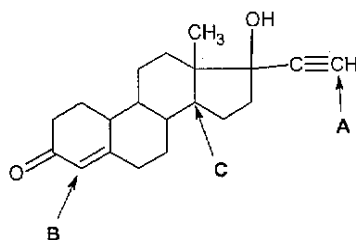


## Part 2: Structure and Bonding (20 pts)

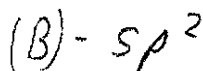
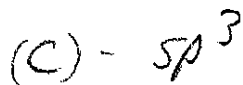
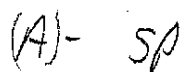
2a. Which of the following pairs are resonance structures of each other?



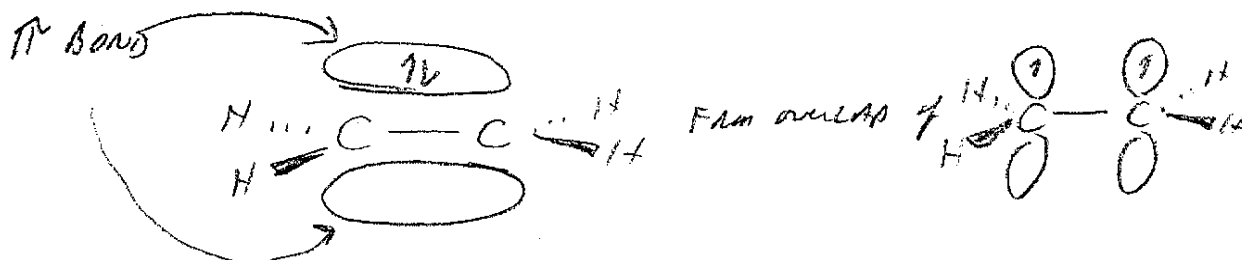
2b. What are the hybridizations of the indicated carbon atoms in the following molecule?



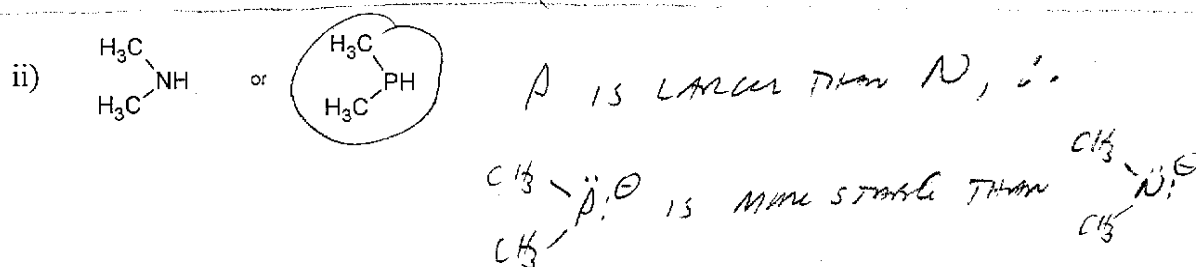
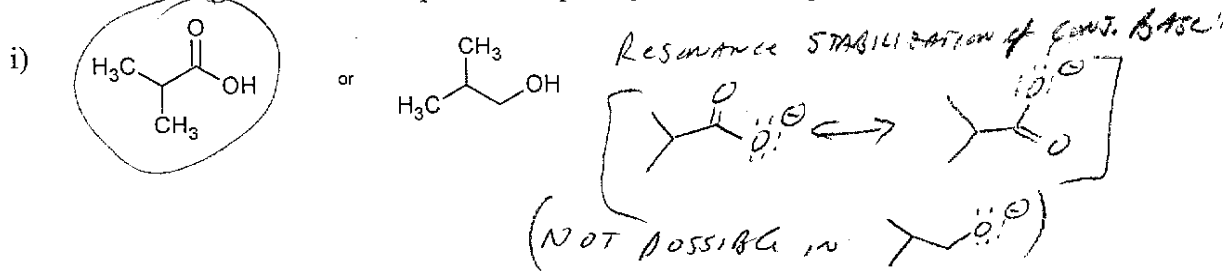
Norethindrone

2c. Define a  $\pi$ -bond and draw an orbital picture showing the  $\pi$ -bonding in ethylene ( $\text{CH}_2=\text{CH}_2$ ).

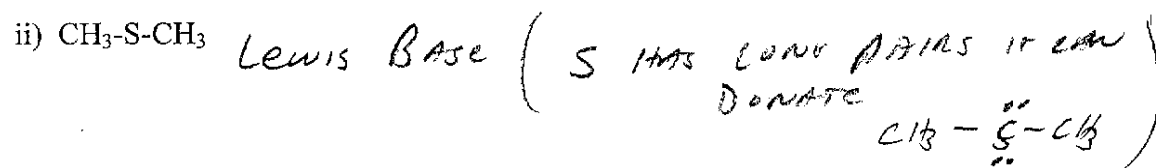
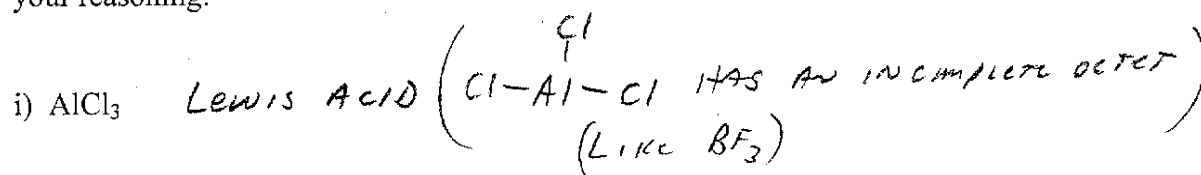
$\pi$  Bond results from side to side overlap of singly occupied p atomic orbitals,



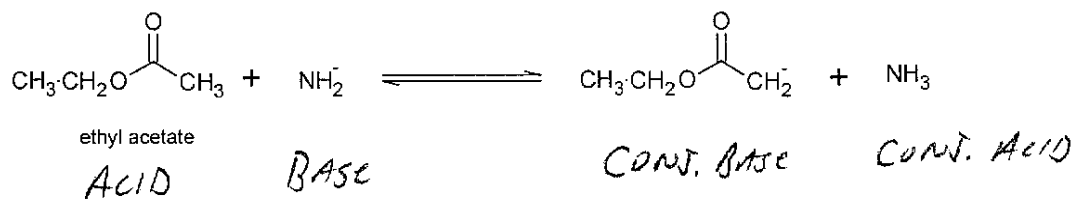
## Part 3: Acids and Bases (24 pts)

3a. Circle the **stronger** acid in each pair and explain your reasoning:

3b. Label the following compounds as either a Lewis acid or a Lewis base and explain your reasoning:

3c. The  $\text{pK}_a$  of ethyl acetate is about 25, while the  $\text{pK}_a$  of ammonia is about 36.

i) Label the conjugate acid-base pairs in the following reaction:



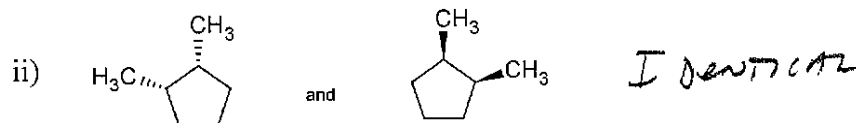
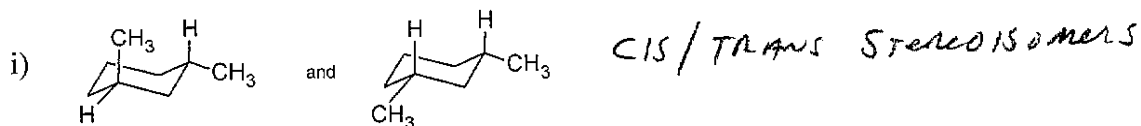
ii) Will the equilibrium for the above reaction favor the reactants or the products?

Explain.

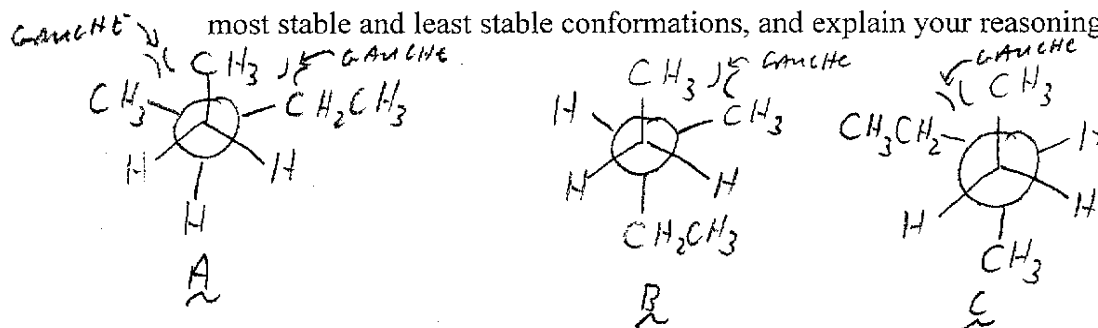
*E.g. FAVORS PRODUCTS B/C AMMONIA ( $\text{NH}_3$ )  
 IS A WEAKER ACID (HIGHER  $\text{pK}_a$ ) THAN  
 ETHYL ACETATE*

**Part 4: Isomerism and Conformational Analysis (20 pts)**

4a. Indicate whether the compounds in each pair are *cis-trans* stereoisomers, constitutional isomers, or identical:

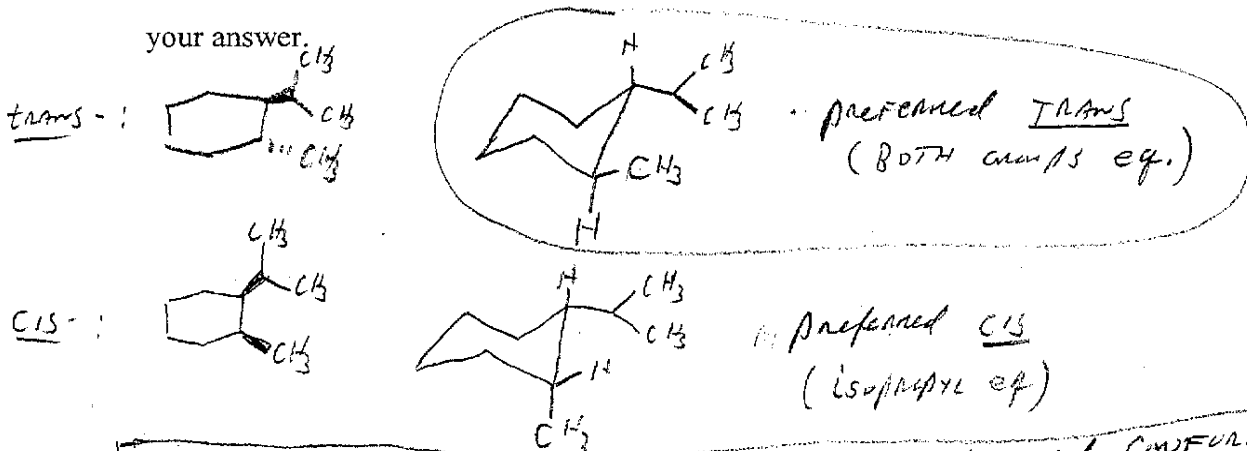


4b. Sighting down the C2-C3 bond of 3-methylpentane, there are 3 types of staggered conformations possible. Draw Newman projections for all three, indicate both the most stable and least stable conformations, and explain your reasoning.



**A IS LEAST STABLE** DUE TO 2 GAUCHE C-C INTERACTIONS  
**B + C HAVE 1 GAUCHE C-C INTERACTION EACH, BUT SINCE CH<sub>3</sub> IS SMALLER THAN CH<sub>2</sub>CH<sub>3</sub>, THE GAUCHE INTERACTION IN B IS LOWER E. ∴ B IS MOST STABLE**

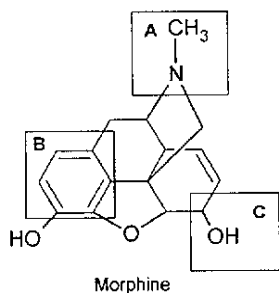
4c. Which is a more stable compound – *cis*-1-isopropyl-2-methylcyclohexane or *trans*-1-isopropyl-2-methylcyclohexane? Draw chair conformations of both, and explain your answer.



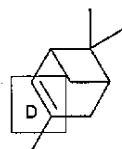
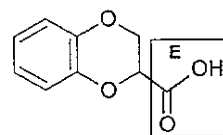
**TRANS IS MORE STABLE BECAUSE IN ITS PREFERRED CONFORMATION, BOTH GROUPS ARE EQ.**

**Part 5: Functional Groups (16 pts)**

5a. Identify the indicated functional groups in the following compounds:



Morphine

 $\alpha$ -Pinene  
(major component of turpentine)Cardura®  
(a hypertension drug)

A = AMINE

B = ARENE (OR AROMATIC RING)

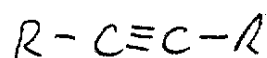
C = ALCOHOL (OR HYDROXY)

D = ALKENE

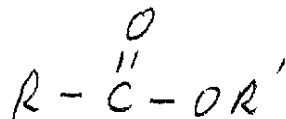
E = CARBOXYLIC ACID

5b. Draw an example of a compound containing the following functional groups:

i) An alkyne



ii) An ester



iii) A thiol

