May 6,2002 Exam 3 Organic Chemistry NESA – Fall 2001

No collaboration, books, or notes are permitted while taking this test. Questions are worth the amount specified in parentheses.

1. Esters are very common in biomolecules. Consider the ester depicted below: (2 pts.)



What alcohol was required to synthesize this ester?

- a. Ethanol. b. Methanol.
- c. 2-Propanol. d. Butanol.
- 2. Arrange the following by increasing boiling point: (2 pts.)
 - a. CH₃CH₂COOH
 - b. CH₃CH₂CH₂CH₂CH₂CH₃
 - c. CH₃CH₂COOCH₃
 - d. $CH_3CH_2CH_2CH_2OH$
- 3. What product would result from the hydrolysis of the following compound?. (2 pts)

4. What are the products of the following reaction? (4 pts)

$$\begin{array}{c} H_{2}C-O & & \\ \hline \\ (CH_{2})_{16}CH_{3} \end{array} \xrightarrow{3 \text{ KOH}}$$

5. Complete the following reactions. Fill in the needed products or reactants where necessary. (Worth 2pts each)



6. Show the hydrogen bonds that can form between two carboxylic acids. You can use a general formula with \mathbf{R} depicting the alkyl part of the acid. (3 pts)

7. Three amide isomers, *N*,*N*-dimethylformamide, *N*-methylacetamide, and propanamide, have respective boiling points of 153 °C, 202 °C, and 213 °C. Explain these boiling points in light of their structural formulas. (3 pts)

8. **Nomenclature**. For the following: when a structure is drawn write the IPUAC or common name for the compound. If a name is shown, draw the structure of the specified compound. (2 pts. each).

- e. N-Methylacetamide
- f. Methyl butanoate

h. 3,4-Dimethylpentanoic acid

$$\begin{array}{c} H_{3}C \\ J_{1} \\ H_{3}CHCH_{2}CH_{2}C \\ -C \\ -O \\ -CH_{3} \\$$

Extra credit:

1. Explain why caprylic acid, CH₃(CH₂)₆COOH, is soluble in 5 percent aqueous NaOH but caprylaldehyde, CH₃(CH₂)₆CHO, is not. (6 pts)

2. Polyesters are examples of condensation polymers. To prepare these large molecules, each reactant must have at least two functional groups. Draw out at least one repeating unit produced in the polyester formed in the reaction shown. (4 pts)

HO - C - OH + HO OH