PRACTICE EXAM #3 (Ch. 6-8)

Chem21, Introduction to Organic and Biochemistry

Instructions: Don't panic. There are three (3) total pages for this exam. For every question, read all given directions and follow them completely. Clearly and logically show <u>all</u> your work and reasoning where applicable. Box all final answers.

1.) Consider decanoic acid, also known as capric acid found in coconuts and palms. (18 pts)

a.) Draw the line-angle structure of the above-named compound.



- b.) Label the part of the structure that is a hydrogen bond **donor**, and the part that is a hydrogen bond **acceptor**.
- c.) Given that hexanoic acid is insoluble in water, would you expect decanoic acid to be soluble or insoluble in aqueous solution? Explain.

Insoluble. Decanoic acid has **four more carbons** than hexanoic acid in its alkyl chain, thus extending its nonpolar portion. The **more nonpolar** the carboxylic acid becomes, the less likely it is to dissolve in aqueous (polar) solution.

d.) As a fatty acid, is decanoic acid more likely to be solid or liquid at room temperature? Explain.

Solid. **Saturated** acids are able to stack better due to their linear structures, and thus are more attracted to one another. This increases the amount of energy needed to break their intermolecular attractions, and thereby increases their boiling point.



- 3.) Consider dibutylamine (b.p. = 160°C) and butyldiethylamine (b.p. = 136°C). (26 pts)
 - a.) Draw the line-angle structure of **dibutylamine**.



b.) Draw the line-angle structure of **butyldiethylamine**.



c.) Explain why dibutylamine has a *higher* boiling point than butyldiethylamine, despite being constitutional isomers.

Dibutylamine is a **secondary** amine, so **still has an H-N** bond that is capable of behaving as a hydrogen bond donor and forming **hydrogen bonds** with itself. Butyldiethylamine is a **tertiary** amine and **does not have an H-N bond**, so can only behave as a hydrogen bond acceptor and **cannot hydrogen bond** with itself.

4.) For each set of reactants, predict the products. If there are multiple products, be sure to include <u>all</u> of them. (40 pts, 8 pts ea)



5.) Identify the following saccharides. Include α/β designations and circle and identify the hemiacetal or hemiketal group in each. (21 pts, 7 pts ea)



g.) Draw the structure that results from *complete* hydrogenation of linoleic acid.

