Name:__________________

Final Exam - Chemistry 211

Thursday, December 14, 2006 – 3:00 to 6:00 PM

Show all your work to receive partial credit. Try to use pencil! Browse over the whole exam and work on the questions that you feel more comfortable with first!

1) (20 points) a) Provide IUPAC names for the compounds drawn below, and draw the structures for those whose names are provided using bond-line representation. Make sure to draw the right enantiomer when the stereochemistry is specified, and provide the stereochemistry for all chiral centers on the compounds you name.

(1) (1S,3R)-1,3-dicyclohexylcyclohexane

(2)

(3) (2R,4S)-2,3,4-tribromo-3-pentanol

(4)

b) Draw the Fischer projections of compounds 2 and 3.

c) Are there any meso compounds? If so, mark them clearly.
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2) (20 points) Solvolysis of chloride 1 with H$_2$O in acidic conditions yields compounds 2, which was expected, and 3, which was not:

![Chemical structures](image)

Propose mechanisms for the formation of both compounds under these conditions (i.e., push electrons), paying particular attention to the formation of compound 3.

*Hint*: In one case, atoms will have to reorganize somehow to get what you want, and you should think of synonyms of the word *reorganize*…
3) (20 points) You decided to brominate the following compound using Br₂ / hν:

![Chemical structure image]

a) What will be the propensity to bromination of the three carbons indicated by the arrows? Explain your answer clearly in terms of the stability of the radicals formed in each case.

b) Draw all the possible products from bromination at the carbon you determined in part (a).

*Hint: Remember the hybridization and geometry of the radical intermediate, and that there's more than meets the eye when you can have resonant forms...*
4) (20 points) For the following transformations, and considering only substitution-type (SN₁ or SN₂) reactions:

1) \[
\begin{array}{c}
\text{Br} \\
\text{Cl}
\end{array}
\xrightarrow{\Delta} \text{C₇H₁₃ClO}
\]

2) \[
\text{OH}
\xrightarrow{\text{H₂SO₄}} \text{C₁₄H₁₄O}
\]

3) \[
\text{KCN}
\xrightarrow{\text{DMSO}} \text{C₈H₁₀N₂}
\]

a) Predict the products and write detailed mechanisms for their formation (i.e., push electrons...).

b) For the product formed in reaction (3) make sure that you draw the most stable conformer in the appropriate representation (i.e., chairs...). Is the compound formed optically active?
5) (20 points) a) Draw a three-dimensional (3D) representation for the following fused ring system (i.e., draw it as chairs…). Pay attention to cis/trans fusions.

[3D structure image]

b) For the following fused ring system presented as a 3D structure, draw it in its 2D bond-line representation. Again, pay attention to the cis/trans fusions.

[2D bond-line representation image]

*Hint:* Don’t look for similarities between parts (a) and (b)…
6) (20 points) For the following reaction schemes:

1) \( \text{Br} \quad \text{NaOH} \quad \text{H}_2\text{O} \quad \text{Intermediate 1} \quad \text{PCC} \quad \text{CH}_2\text{Cl}_2 \quad \text{Intermediate 2} \quad \text{i) THF} \quad \text{ii) H}_2\text{O} \quad \text{3-hexanol} \)

2) \( \text{OH} \quad \text{Intermediate 1} \quad \text{PBr}_3 \quad \text{CH}_2\text{Cl}_2 \quad \text{Intermediate 2} \quad \text{i) THF} \quad \text{ii) H}_2\text{O} \quad \text{iiii) Conditions 2} \quad \text{1-hexene} \)

a) Provide the structure of all the missing intermediates and reactions conditions (reagents and/or solvents). No reaction mechanisms, just the structures and conditions. Use additional space to draw the structures if the space in the boxes is not enough.

b) To what type of reaction do the conditions that you provided above correspond?