# Midterm II Review Packet
## UCI Department of Organic Chemistry
### Peer Tutoring Review Session Feedback Evaluation

<table>
<thead>
<tr>
<th>Quarter: Fall 2017</th>
<th>Date: 11/7/17, 6:00-7:50 PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course: Professor King</td>
<td>Midterm II</td>
</tr>
<tr>
<td>Tutors’ Names: Will Cabanela, Amanda Pinski, and Zak Valley</td>
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</tbody>
</table>

**Comments**

Will:

Amanda

Zak

What helped you the most? What was most effective?

What could be improved?

What would you like to see more of next time?

<table>
<thead>
<tr>
<th>This review was interactive and engaging.</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
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<tr>
<td>Comments:</td>
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<td>The presentation volume was acceptable.</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly Agree</td>
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<td>Comments:</td>
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<td>The presentation was visually clear and logically oriented</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
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<td>Strongly Agree</td>
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<td>Comments:</td>
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<tr>
<td>This review improved/reinforced your understanding of the material.</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
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<td>Strongly Agree</td>
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<td>Comments:</td>
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<tr>
<td>The quality of the review packet was excellent.</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly Agree</td>
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<td>Comments:</td>
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<tr>
<td>Would recommend attending review sessions.</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly Agree</td>
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<td>Comments:</td>
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<tr>
<td>Do you use our weekly worksheets available at <a href="http://sites.uci.edu/ochemtutors/">http://sites.uci.edu/ochemtutors/</a>?</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly Agree</td>
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<td>Comments:</td>
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</table>
1. Rank the following in order of increasing boiling point.

   A  \( \text{CH}_3\text{CH(CH}_3\text{)}\text{CH}_2\text{CH}_2\text{OCH}_3 \)

   B  \( \text{CH}_3\text{CH}_2\text{CH(CH}_3\text{)}\text{CH}_2\text{OH} \)

   C  \( \text{CH}_3\text{CH}_2\text{CH[CH(CH}_3\text{)}_2\text{]}\text{CH}_2\text{OH} \)

   D  \( \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OCH}_3 \)

2. a. Rank the molecules above in order of increasing solubility in hexane (1=lowest solubility).

   b. Rank the molecules in order of increasing boiling point (1=lowest boiling point).

   c. Rank the following in order of increasing solubility in methanol (\( \text{CH}_3\text{OH} \)) (1=lowest solubility).
3. In the human body, glucose is found primarily in the D-glucose form because the L-form cannot be used in human metabolism. In a random sample from a skeletal muscle tissue, the D-form is in 99% excess.
   a. What is the percent of D-glucose?
   b. If the pure D-form of glucose has a specific rotation of $+16^\circ$, what would be the specific rotation of the sample taken from the skeletal muscle tissue?
   c. What is the concentration of the sample if the 20-cm tube holding the sample had an observed rotation of $+14.95^\circ$?
   d. If an equal volume and concentration of L-form of glucose is added to the solution in part C, what is the specific rotation of the sample?

4. Observe the following molecules
   a. Provide the correct IUPAC name for the following structure.
b. Provide the names of the substituents on the cyclic alkane. Priorities/numbering are not needed.

![Cyclic Alkane Diagram](image)

c. Draw the staggered Newman projection for the first compound (part A) looking down the indicated carbons. The molecule is shown below. What type of strain does it have?

![Newman Projection Diagram](image)
5. Observe molecules A and B below.

Molecule A

Molecule B

a. Redraw the two molecules with an S-stereocenter in the corresponding boxes. Use appropriate dashes and wedges to indicate three dimensions.

<table>
<thead>
<tr>
<th>Molecule A</th>
<th>Molecule B</th>
</tr>
</thead>
</table>

b. Draw the mechanism for a SN1 reaction using the molecule above that is MOST LIKELY to react with the nucleophile, H₂O. Hint: more sterically hindered molecules undergo SN1. For midterm II, Dr. King will explicitly tell you whether the reaction is SN1 or SN2: for the final exam, you will need to decide whether the reaction is SN1 or SN2.

H₂O →
Solvent: CH₃CH₂OH
c. Draw the mechanism for a SN2 reaction using the molecule above that is MOST LIKELY to react with the nucleophile, -N3. Hint: this molecule is the least sterically hindered. For midterm II, Dr. King will explicitly tell you whether the reaction is SN1 or SN2: for the final exam, you will need to decide whether the reaction is SN1 or SN2.

\[
\begin{align*}
\Theta & \cdot \cdot \\
\text{Solvent: DMSO}
\end{align*}
\]

\[
\Theta : N_3
\]

d. Regarding parts B and C, which reaction produces products that have a nonzero optical rotation?

e. How would the reactions in C change if methanol (CH\textsubscript{3}OH) was used as the solvent?

6. Consider the following reaction.

\[
\begin{align*}
\text{D} & \cdot \cdot \\
\text{Cl} & \cdot \cdot \\
\text{H} & \cdot \cdot \\
\text{H} & \cdot \cdot \\
\text{S} & \cdot \cdot \\
\text{H} & \cdot \cdot \\
\Theta & \cdot \cdot \\
\text{SH} & \cdot \cdot \\
\end{align*}
\]

a. Draw the appropriate curvy arrows to demonstrate the mechanism of the reaction. Include all lone pairs, charges and stereochemistry.
b. Which of the following solvents would be optimal for this reaction: methanol (CH₃OH) or acetone (CH₃COCH₃)?

c. Write the rate equation for the reaction.

d. If the concentration of SH was increased by a factor of 3, how would the reaction rate change?

e. Calculate the enthalpy change for the reaction using the table of values below. [hydrogen and deuterium have indistinguishable effects on enthalpy in this problem]

<table>
<thead>
<tr>
<th>Bond</th>
<th>ΔH (kJ/mol)</th>
</tr>
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<tbody>
<tr>
<td>CH₃CH₂CH₂-Cl</td>
<td>335</td>
</tr>
<tr>
<td>CH₃CH₂CH₂-H</td>
<td>397</td>
</tr>
<tr>
<td>CH₃CH₂CH₂-SH</td>
<td>347</td>
</tr>
<tr>
<td>H-Cl</td>
<td>431</td>
</tr>
</tbody>
</table>

f. Draw the energy diagram for the reaction and draw the reactants, products and transition state(s) in the appropriate locations.
7. Shown below is the energy diagram for the solvolysis of 2,2,2-triphenylethyl chloride, a *three-step* reaction. Answer the following questions.

![Energy Diagram](image)

- **a.** How many intermediates are shown on the energy diagram?
- **b.** How many transition states are present?
- **c.** Which intermediate step will occur at a faster rate?
- **d.** Indicate the rate determining step?
- **e.** Which step(s) are exothermic? Endothermic? Indicate on the diagram.
- **f.** Is the overall reaction exothermic or endothermic?
8. Determine the relationships (enantiomers, diastereomers, constitutional isomers, neither or identical) between the pair of compounds show below.

9. For the following molecule…
   a. Draw all other possible stereoisomers
   b. Label each stereocenter as R or S
   c. Label the relationship each stereoisomer has with one another (enantiomer or diastereomer)
   d. Draw the Newman projection, from the perspective of the dotted line, of the confirmation in the highest energy level
10. For the following rings…
   a. Convert the ring into chair form
   b. Flip the chair you drew in Part A
   c. Circle the chair conformation in the *lowest energy* form

*Please remember to fill out the back-evaluation form.

Good luck on Midterm II!