**YOU ARE NOT ALLOWED TO TAKE SPARE COPIES OF THIS EXAM FROM THE TESTING ROOM**

- PRINT YOUR NAME ON EACH PAGE!
- READ THE DIRECTIONS CAREFULLY!
- USE BLANK PAGES AS SCRATCH PAPER
- MOLECULAR MODELS ARE ALLOWED
- DON'T USE RED INK

Interaction Energies, kcal/mol

<table>
<thead>
<tr>
<th></th>
<th>Eclipsing</th>
<th>Gauche</th>
</tr>
</thead>
<tbody>
<tr>
<td>H/H</td>
<td>-1.0</td>
<td></td>
</tr>
<tr>
<td>H/Me</td>
<td>-1.4</td>
<td></td>
</tr>
<tr>
<td>Me/Me</td>
<td>-2.6</td>
<td>-0.9</td>
</tr>
<tr>
<td>Et/Me</td>
<td>-0.95</td>
<td></td>
</tr>
<tr>
<td>i-Pr/Me</td>
<td>-1.1</td>
<td></td>
</tr>
<tr>
<td>t-Bu/Me</td>
<td>-2.7</td>
<td></td>
</tr>
</tbody>
</table>

Infrared Correlation Chart

-1710 (cm\(^{-1}\))

-2720–2820

broad ~3300

broad peak

broad with spikes ~3300

2 peaks

1680

1600–1660

1735

1710

1650

1600

2200

2200

2850–2960

2720–2820
YOU MUST COMPLETE THIS PAGE WITH YOUR NAME
(EVEN THOUGH YOU ALREADY DID THIS ON THE COVER PAGE)
AND ALSO GIVE YOUR ASU OR POSTING ID NUMBER
WE NEED THIS NUMBER BECAUSE YOU WOULDN’T BELIEVE THE NUMBER OF
STUDENTS Whose NAMES WE CAN’T READ!

Points by question

1_____________/12
2_____________/22
3_____________/36
4_____________/20
5_____________/20
6_____________/14
7_____________/18
8_____________/33

Points Removed for cover errors ____/2

Extra Credit_____/5

Total (incl Extra)_________/175+5

**YOU ARE NOT ALLOWED TO TAKE SPARE COPIES OF THIS EXAM FROM THE TESTING ROOM**
Question 1 (12 pts.) Give the IUPAC name for the following compound. Be sure to use cis/trans, E/Z or R/S where appropriate.

![Chemical structure](image)

Question 2 (22 pts.) Which is the stronger Brønsted acid, A or B? Give a BRIEF explanation that includes drawings of ALL IMPORTANT resonance contributors of the conjugate base anions. Your explanation MUST include the following terms: "electron donating", "electron withdrawing", "resonance" "inductive effect", and also mentions BASE STRENGTH.

![Resonance structures](image)
Question 3 (part one, 18 pts.) For each reaction
1) Provide the missing major organic product or reagents/conditions as appropriate, be sure to indicate any racemic mixtures
2) State whether each reaction is an Addition, Elimination, Substitution or Rearrangement
3) State whether each reaction is Reduction, Oxidation or Neither

a) \[
\begin{align*}
\text{O} & \quad \text{O} \\
\text{OCH}_3 & \\
\text{NaBH}_4 & \\
\text{EtOH} & \\
\end{align*}
\]

b) 

Question 3 (part two, 18 pts.) For each reaction:
Provide the missing major organic product or reagents/conditions as appropriate
DO NOT state whether each reaction is an Addition, Elimination, Substitution or Rearrangement
DO NOT state whether each reaction is Reduction, Oxidation or Neither

c) 

d) 

5 pts Extra Credit. Which functional group can be polymerized to form an organic metal?
- alcohol
- alkene
- alkyne
- epoxide
Question 4 (20 pts) For (3R)-bromo-(4S)-methylhexane:
  a) Draw a line-angle OR 3-D/sawhorse structure for this molecule
  b) Draw a Newman projection for the conformation that can undergo E2 elimination, looking FROM carbon 3 TO carbon 4.
  c) Give the E2 elimination product

Question 5 (20 pts.) For EACH of the two indicated bonds A and B, perform retrosynthetic analysis and draw the best synthons. Only one of these bond can actually be made, indicate which one, give the actual reactants/synthetic equivalents you would use to make that bond, give the curved arrow pushing showing bond formation and BRIEFLY explain why the other bond can not be made

Question 6 (14 pts). Perform retrosynthetic analysis for the bond indicated by the dashed line in the target structure below, generate the best sythons and also the synthetic equivalents. Give the curved arrow pushing for the synthetic equivalents that give the target structure and label the synthetic equivalents as Lewis acid (LA) and Lewis base (LB) as appropriate.
Question 7 (18 pts.) Show how you would synthesize the target structure on the right from the starting structure on the left. Show reagents and conditions, and the structures of important intermediate compounds. Do not show any (arrow pushing) mechanisms.

HC≡CH

\[ \text{OH} \]
Question 8 (33 pts). Give a curved arrow pushing mechanisms for the following two reactions.
1) Add non-bonding electrons and C-H bonds to the line-angle structures as required.
2) Indicate the Lewis acid/Lewis base (LA, LB) at each INTERMOLECULAR step as appropriate, and whether they are also Brønsted acids/bases (LA/BA, LB,BB)
3) Include ALL IMPORTANT RESONANCE CONTRIBUTORS for intermediates
4) GIVE THE NUMBER OF STEPS IN YOUR MECHANISMS

a) 

\[ \begin{array}{c}
\text{H}_2\text{SO}_4 \text{ (cat.)} \\
\text{H}_2\text{O}
\end{array} \]

\[ \begin{array}{c}
\text{H}_2\text{O}
\end{array} \]

number of steps = _____

b) 

\[ \begin{array}{c}
\text{HCl} \text{ (cat.)} \\
\text{H}_2\text{O}
\end{array} \]

\[ \begin{array}{c}
\text{H}_2\text{O}
\end{array} \]

number of steps = _____