MT1 Review

Topics Covered:
• Chapter 7 to 9 of Smith

1) Predict the major product(s) for each of the following reactions. (Klein 4th Ed. 7.76)
2) Determine the type of reaction, products and mechanism of the following reactions below (Smith 7th Ed. 8.52)

3) Answer the following questions:
   a) True or False: The less electronegative the atom and/or the less polarizable the atom is, the better the leaving group.
   b) True or False: SN2 reactions occur in a polar protic solvent while SN1 reactions occur in a polar aprotic solvent.
   c) True or False: The rate law of SN2 reactions is bimolecular, meaning only the alkyl halide affects the reaction rate.
4) What is the major product formed when each alcohol reacts with HCl (Hint: There may be some carbocation rearrangements) (Smith 7th Ed. 9.18)

5) Fill out the table below and determine which reaction will occur for each scenario (The Organic Chemistry Tutor)

<table>
<thead>
<tr>
<th></th>
<th>Protonic solvent</th>
<th>Aprotic solvent</th>
<th>Strong base*</th>
<th>Bulky Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Me-Br</td>
<td>( \text{S}_{\text{N}2} )</td>
<td>( \text{S}_{\text{N}2} )</td>
<td>( \text{S}_{\text{N}2} )</td>
<td>N/A</td>
</tr>
<tr>
<td>Primary alkyl bromide</td>
<td>( \text{S}_{\text{N}2} )</td>
<td>( \text{S}_{\text{N}2} )</td>
<td>( \text{S}_{\text{N}2} )</td>
<td>E2</td>
</tr>
<tr>
<td>Secondary alkyl bromide</td>
<td>( \text{S}_{\text{N}1}/\text{E}2 )</td>
<td>( \text{S}_{\text{N}2}/\text{E}2 )</td>
<td>( \text{E}<em>2/\text{S}</em>{\text{N}2} )</td>
<td>E2</td>
</tr>
<tr>
<td>Tertiary alkyl bromide</td>
<td>( \text{S}_{\text{N}1}/\text{E}1 )</td>
<td>( \text{S}_{\text{N}1}/\text{E}1 )</td>
<td>( \text{E}_2 )</td>
<td>( \text{E}_2/\text{E}1 )</td>
</tr>
</tbody>
</table>

*As long as NOT sterically hindered
6) Draw two different routes to each of the following ethers using a Williamson ether synthesis. Indicate the preferred route (if there is one) (Smith 7th Ed. 9.54)
7) Draw the products and mechanism for each reaction (Smith 7th Ed. 9.60)

8) Draw both chair conformations of the reactant and circle which is favored for this reaction. Then, draw the mechanism for the reaction.
9) Draw the mechanism for the following transformation.

![Mechanism Diagram]

10) Fill in the boxes with the appropriate starting material. In the box under the reaction arrow, write which mechanism the reaction will undergo (SN1, SN2, E1, E2).

![Fill-in-the-Blank Diagram]
11) Predict and draw the expected product. Hint: Think carefully about orbital overlap. (Klein 4th Ed. 7.14) (IGNORE FOR THIS MIDTERM)

![Chemical reaction diagram]

12) Using the same reactions as stated in question 2, explain the result of the following changes on rate of reaction. (IGNORE FOR THIS MIDTERM)

- For reaction a, doubling the concentration of reactant and tripling the concentration of NaSH.

- For reaction b, quadrupling the concentration of reactant and halving the concentration of NaOH.

- For reaction c, doubling the concentration of reactant and halving the concentration of MeOH.

- For reaction d, quartering the concentration of reactant.

- **BONUS (no material reward, just pride)**: For reaction d, increasing the temperature of the reaction by 20 °C (no need for numeric answer).
13) Consider the following transformations. For both reactions, an alcohol is converted into a chloride with thionyl chloride and pyridine. *(IGNORE FOR THIS MIDTERM)*

![Diagram showing two reactions involving thionyl chloride and pyridine to convert alcohols into chlorides.]

a) Draw the mechanism for the first reaction (N.B. Please search up the mechanism; this is a conceptual and arrow-pushing question. The mechanism is beyond the scope of the class). Why is there inversion of stereochemistry?

b) The second reaction is a bit strange. The stereochemistry is retained in the product. Based on your mechanism and answer from part a, explain why the second reaction CANNOT have the same mechanism.