51B Midterm I Review Session Packet

1. The following alkyl halide is expected to give only one product in the E2 elimination. **Put this alkyl halide into a Newman projection, show rotation to the proper configuration, and show how E2 elimination gives a single alkene product.**

   ![Newman Projection Diagram]

   (Adapted from Prof. King’s ‘Week 3 POW’)

2. Rank the stability of the following carbocations (1 = most stable).

   ![Carbocation Diagrams]
3. Consider the following E2 reaction.

a. Draw the arrow pushing to get from reactant to product, making sure to include all curvy arrows, lone pairs, and formal charges.

b. What happens to the reaction rate with each of the following changes?
   i. The solvent is changed to DMF
   ii. The concentration of \( \text{OC(CH}_3)_3 \) is decreased
   iii. The base is changed to \( \text{OH} \)
   iv. The halide is changed to \( \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}(\text{Br})\text{CH}_3 \)
   v. The leaving group is changed to I⁻

(Smith 6th Ed., Ch. 8, #35)
4. Draw all constitutional isomers formed in each elimination reaction. Label the mechanism as E1 or E2.

A. \[
\begin{align*}
\text{Br} & \quad \stackrel{\text{OCH}_3}{\longrightarrow} \\
\end{align*}
\]

B. \[
\begin{align*}
\text{Br} & \quad \stackrel{\text{CH}_3\text{OH}}{\longrightarrow} \\
\end{align*}
\]

C. \[
\begin{align*}
\text{I} & \quad \stackrel{\text{OC(CH}_3)_3}{\longrightarrow} \\
\end{align*}
\]

D. \[
\begin{align*}
\text{Cl} & \quad \stackrel{\text{H}_2\text{O}}{\longrightarrow} \\
\end{align*}
\]

E. \[
\begin{align*}
\text{Cl} & \quad \stackrel{\text{OH}}{\longrightarrow} \\
\end{align*}
\]

F. \[
\begin{align*}
\text{Cl} & \quad \stackrel{\text{OH}}{\longrightarrow} \\
\end{align*}
\]

5. Devise a synthesis of each compound from an alkyl halide using any other organic or inorganic reagents.
6. Use the four molecules labeled A-C below to answer the following questions:

   a. Which molecule most favors SN2?
   b. Which molecule(s) can undergo SN1, E1, SN2, & E2
   c. Which compound will have a major product alkene that is NOT the most stable when tert-butoxide is added?
   d. Which molecule can undergo E1 but NOT E2?

(Adapted from Prof. King’s Lecture Notes/POW)
7. For which reaction mechanisms - SN1, SN2, E1, E2 - are each of the following statements true?
   a. The mechanism involves carbocation intermediates.
   b. The mechanism has two steps.
   c. The mechanism has 3 steps.
   d. The reaction rate increases with better leaving groups.
   e. The reaction rate increases when the solvent is changed from CH₃OH to (CH₃)₂SO.
   f. The reaction rate depends on the concentration of only the alkyl halide.
   g. The mechanism is concerted.
   h. The reaction of CH₃CH₂Br with NaOH occurs by this mechanism.
   i. Racemization at a stereogenic center occurs.
   j. Tertiary (3°) alkyl halides react faster than 2° or 1° alkyl halides.
   k. The reaction follows a second-order rate equation.

(Smith 6th Ed., Ch. 8, #74)