Organic Chemistry II Drill (CHEM2220D). Module 2. Sample Problems

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1. (4 points) Provide the IUPAC name for this compound. Use R and S where appropriate.

2. (4 points) Arrange these compounds by acidic strength, with the most acidic = 1.

   -CH₂-NH₂    -COOH    -CH₂-OH    -CH₂-SH

3. (6 points) If the acid/base reaction does not happen, write “No RXN”. If the reaction occurs, draw the products of the reaction.

   -CH₃ + -CH₂-OH

   -CH₃ + -COO⁻

4. Provide the correct reagents and intermediate structure(s) to complete the reaction schemes. There may be more than one correct scheme to complete the synthesis.

   (4 points)

   -OH

   (7 points)
5. (5 points) Draw a mechanism for this transformation. Use arrows to show the flow of electrons.

6. (20 points) Predict the product(s) of these reactions, including stereochemistry where appropriate. If nothing occurs, write “No RXN”.

- **First Reaction:**
  - **1.** Treatment with MgBr
  - **2.** Treatment with H_3O^+

- **Second Reaction:**
  - **1.** Treatment with NaBH_4
  - **2.** Treatment with H_3O^+

- **Third Reaction:**
  - **1.** Treatment with Li
  - **2.** Treatment with H_3O^+

- **Fourth Reaction:**
  - **1.** Treatment with MgBr

- **Fifth Reaction:**
  - **1.** Treatment with LiAlH_4
  - **2.** Treatment with H_3O^+

- **Sixth Reaction:**
  - **1.** Treatment with PBr_3
7. What is the IUPAC name of: (4 pts)

![Chemical Structure]

8. Which of these bases can deprotonate ethyl alcohol? Circle them. (4 pts)

NaH  NaC≡CCH₂CH(CH₃)₂  CH₃CH₂NH₂  (CH₃)₂CHCH₂SLi

9. Propose a mechanism for this transformation. Be sure to include all reactive intermediates and mechanistic arrows. (4 pts)

![Chemical Reaction]

10. Complete these reactions. (24 points)

a.  

1. Hg(OAc)₂, H₂O
2. NaBH₄

b.  

1. NaOH
2. CH₃CH₂Br

c.  

PCC  
CH₂Cl₂
11. Propose syntheses. (12 points)

a.

\[
\text{OH} \quad \text{from} \quad \text{Br}
\]

b.

\[
\text{from} \quad \text{O}
\]

12. Draw the structure of a compound having the formula C\textsubscript{5}H\textsubscript{10}O that does NOT decolorize (react with) Br\textsubscript{2}/CCl\textsubscript{4} and does not produce a blue-green ppt with H\textsubscript{2}CrO\textsubscript{4}. The compound also has this \textsuperscript{1}H NMR spectrum: 2.2 ppm, m, 1H; 2.1 ppm, s, 3H; 0.9 ppm, d, 6H. (2 pts)
13. Draw the most stable chair conformation of cis-2-isopropoxycyclohexanol (2 points).

14. Name the following compounds (4 points):

\[
\begin{align*}
\text{CH}_3\text{CH}_2\text{OH} & \quad \text{CH}_3\text{CH}_2\text{SH} \\
\text{O} & \quad (\text{CH}_3)_2\text{S} = \text{O}
\end{align*}
\]

15. Give the structure of the major organic product or products expected from the following reactions. Show the stereochemistry of the products if applicable. No reaction may be an appropriate answer in some cases. (4 points each)

a) \( \text{CH}_3\text{CH}_2\text{MgCl} + \text{O} \xrightarrow{\text{ether}} \xrightarrow{\text{water, H}^+} \)

b) \( \text{O} \xrightarrow{\text{LiAlH}_4, \text{ether}} \xrightarrow{\text{water, H}^+} \)

c) \( \text{OH} \xrightarrow{+ \text{CH}_3\text{MgBr}} \)

d) \( \text{HO} \xrightarrow{\text{Jones reagent}} \)

e) \( \text{OH} \xrightarrow{+ \text{CH}_3\text{CH}_2\text{O}^+\text{Na}^+} \)
16. Propose an efficient synthesis of each of the following compounds from the given starting material and any needed reagents and/or solvents (8 points each):

a) \[
\begin{align*}
\text{O} & \quad \text{from CH}_3\text{CH}_3 \\
\text{CH}_3\text{CH}_2\text{CH} &
\end{align*}
\]

b) *Tert*-butyl methyl ether from *tert*-butanol and methanol

17. Propose a reasonable mechanism for the following reaction (8 points):

\[
\begin{align*}
\text{CH}_3\text{CH}_2\text{MgCl} & + \quad \text{ether} \\
\text{CH}_3\text{CH}_2\text{MgCl} & \quad \text{water} \quad \text{H}^+ \\
\text{OH} &
\end{align*}
\]
18. Provide the IUPAC name for this compound. (4 pts)

2. Draw an epoxide. (2 pts)

\[ \text{Structure Image} \]

19. Predict the product(s) of these reactions. (24 points)

a. 

\[ \text{Structure Image} \]

\[ \text{Reaction: NaBH}_4, \text{MeOH} \]

b. 

\[ \text{Structure Image} \]

\[ \text{Reaction: CH}_3\text{MgBr, Ether} \rightarrow \text{H}_3\text{O}^+ \]

c. 

\[ \text{Structure Image} \]

\[ \text{Reactions: 1) H}_2\text{SO}_4, \text{H}_2\text{O}; 2) \text{PCC, CH}_2\text{Cl}_2} \]

d. 

\[ \text{Structure Image} \]

\[ \text{Reaction: SOCl}_2 \]

e. 

\[ \text{Structure Image} \]

\[ \text{Reactions: 1) Mg, Ether; 2) CH}_3\text{CH}_2\text{CHO; H}_3\text{O}^+} \]

f. 

\[ \text{Structure Image} \]

\[ \text{Reactions: 1. BH}_3, \text{THF; 2. H}_2\text{O}_2, \text{HO}^-; 3. H}_2\text{CrO}_4} \]
20. Provide a synthesis of the desired product using the starting material provided, and any other reagents you need. (12 pts)
a. 
\[
\text{Br} \quad \rightarrow \quad \text{CO} \quad \text{CH}_3 \text{CH}_2 \text{CH}_2 \text{CH}_2 \text{CH}_3
\]

b. 
\[
\text{CH}_3 \text{CH}_2 \text{OH} \quad \rightarrow \quad \text{CH}_3 \text{CH}_2 \text{CH}_2 \text{CH}_2 \text{OH}
\]

21. Arrange these compounds by acidity, with most acidic = #1. (4 points)

\[
\text{CH}_3 \text{CH}_2 \text{OH} \quad \text{H}_2 \text{N} \quad \text{PhOH} \quad \text{CH}_3 \text{CO} \quad \text{H}_2 \text{O}
\]

22. Propose a mechanism for this transformation. Be sure to include all intermediate structures and mechanistic arrows. (4 pts)

\[
\text{O} \quad \text{CH}_3 \text{CH}_2 \text{CH}_2 \text{MgBr} \quad \text{H}_2 \text{O} \quad \text{CH}_3 \text{CH}_2 \text{CH}_2 \text{CH}_2 \text{OH}
\]