5-31-2019

Organic Chemistry II Drill (CHEM2220D)
Module 6. Part A. Sample Problems

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2220D – Drill test 6 – Sample problems

1. (25 points) Predict the product or products of each reaction. If there is no reaction, write “no reaction.” If there is stereochemistry, show it with a wedge, dash or an asterisk (*).

- **1. BH\textsubscript{3}-THF**
  - \text{2. H\textsubscript{2}O\textsubscript{2}, NaOH}

- **HgSO\textsubscript{4}**
  - \text{2. H\textsubscript{2}SO\textsubscript{4}, H\textsubscript{2}O}

- **O\textsubscript{3}**
  - \text{2. DMS}

- **NH\textsubscript{2}OH**
  - \text{H\textsubscript{3}O\textsuperscript{+}}

- **1. NH\textsubscript{2}NH\textsubscript{2} / HCl**
  - \text{2. NaOH, heat}

- **dil. H\textsubscript{3}O\textsuperscript{+}**

- **dil. H\textsubscript{3}O\textsuperscript{+}**

- **dil. H\textsubscript{2}O**

- **dil. H\textsubscript{3}O\textsuperscript{+}**

- **PhNHNH\textsubscript{2}**
  - \text{dil. H\textsubscript{2}O\textsuperscript{+}}

- **HCl**
  - \text{H\textsubscript{2}O \textsubscript{OH}}
2. Propose a mechanism for the following reactions. You must include all arrows and intermediates to receive full credit.

(5 points)

\[
\text{\textbf{O}} \quad \text{\textbf{O}} \quad \text{\textbf{OH}}
\]

(9 points)

3. Provide the correct reagents and intermediate structure(s) to complete the reaction schemes.

(5.5 points)

\[
\text{?} \quad \text{\textbf{OH}}
\]

(5.5 points)

\[
\text{?} \quad \text{\textbf{OH}}
\]
4. Complete these reactions. There may be more than one important product, or it is possible that no reaction occurs. Stoichiometry is not given; if you need 2, you have 2, etc. (16 pts)

(a) 
\[
\text{HgSO}_4 \\ \text{H}_2\text{SO}_4, \text{H}_2\text{O}
\]

(b) 
\[
\text{HOCH}_2\text{CH}_3 \\ \text{H}_3\text{O}^+
\]

(c) 
\[
\text{H}_2\text{CrO}_4
\]

(d) 
\[
\text{H}_2\text{N-NH}_2 \xrightarrow{\text{dil H}^+} \text{KOH/H}_2\text{O} \xrightarrow{\text{heat}}
\]

5. Propose mechanisms for these reactions. Be sure to show all intermediates and mechanistic arrows. You can work backwards if that’s easier for you. (10 pts)

(a) 
\[
\text{O} + \text{NH}_3 \xrightarrow{\text{dil H}^+} \text{NH} + \text{H}_2\text{O}
\]

(b) 
\[
\text{HO} \xrightarrow{\text{HO}^-} \text{O} + \text{H}_2\text{O}
\]
6. Give the IUPAC names of these compounds (6 pts):

(a)

(b)

7. Propose syntheses of these compounds. (12 pts)

(a)

(b)

8. Draw the structure consistent with these data: IR band at 1750 cm\(^{-1}\); 5 signals in \(^{13}\)C NMR (1 signal is above 200 ppm; 4 signals are below 100 ppm); \(^1\)H NMR: 2.2 ppm, t, 2H; 2.1 ppm, s, 3H; 1.3 ppm, m, 2H; 0.9 ppm, t, 3H. Also, give the IUPAC name of the compound. (6 pts)

Name:
9. Name the following compounds (3 points each):

10. Draw structures of the following compounds (3 points each):

   a) 3,3- dichloropentanal  
   b) 3-cyclohexenone

11. Give the structure of the major organic product or products expected from the following reactions. "No reaction" might be an appropriate answer in some cases. Show the stereochemistry of the products if applicable. (5 points each)

   a) \[
   \begin{align*}
   &\text{KCN} \\
   &\text{HCl}
   \end{align*}
   \]

   b) \[
   \begin{align*}
   &\text{BH}_3 \text{ THF} \\
   &\text{H}_2\text{O}_2, \text{NaOH}
   \end{align*}
   \]

   c) \[
   \begin{align*}
   &\text{H}^+ \\
   &\text{H}_2\text{CrO}_4
   \end{align*}
   \]

   d) \[
   \begin{align*}
   &\text{H}_2\text{CrO}_4
   \end{align*}
   \]
12. Give a short, efficient synthesis of the target compound from the indicated starting material and any other needed reagents (6 points each).

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

b) \[
\begin{align*}
\text{from} & \\
\end{align*}
\]

13. Write a stepwise curved-arrow mechanism for the following reaction 6 points.

\[
\text{\text{CH}_3\text{O}_\text{H}} + \text{NaOCH}_3 \rightarrow \text{HO} \quad \text{OCH}_3
\]
14. Provide the IUPAC name for this compound (8 points):

15. Draw the structures of these compounds (8 points):
(a) m-nitroacetophenone
(b) 3-isopropylcyclohexanone

16. Write the reagents for the following conversions (9 pts)

17. Label the acetal and hemiacetal among the following compounds? (3 pts.)

I

II

III

IV
18. Complete these reactions. Write “no reaction” if appropriate (12 pts).
(a)

(b)

(c)

(d)

19. Propose syntheses of these molecules (6 points):
(a)

20. Provide a structure for the compound with molecular formula C₅H₁₀O and with the following spectroscopic data. (4 pts.)
IR: 1720 cm⁻¹
¹H NMR: 0.9δ (triplet, I=3H), 1.7δ (sextet, I=2H), 2.1δ (singlet, I=3H), 2.4δ (triplet, I=2H)