1. Give the IUPAC name for the following compound

\[ \text{CH}_2\text{CHCHCHCH}_2\text{CH}_2\text{C}\text{C(CH}_3\text{)}_2\text{CH}_2\text{CH}_2\text{CH}_3 \]

2. Develop a synthesis of 1-hexyne from 1-hexene.

\[ \text{\equiv} \quad \text{\equiv} \quad \text{\equiv} \]

3. Draw a stepwise mechanism for the following reaction:

\[ \text{H} \quad \text{\equiv} \quad \text{\equiv} \quad \text{HCl} \quad (2 \text{ equiv}) \quad \text{Cl} \quad \text{Cl} \]
4. Draw a keto tautomer of the following enol.

5. Draw the other enol tautomer of 2-methylcycloexanone.

6. Enamines and imines are tautomers that contain N atoms. Draw the stepwise mechanism for the acid-catalyzed conversion of enamine X to imine Y.
7. Draw the products formed when following alkyne is treated with each set of reagents. Be sure to answer all parts.

![Alkyne structure]

[1] $\text{H}_2\text{O}, \text{H}_2\text{SO}_4, \text{HgSO}_4$

[2] $\text{BH}_3$ followed by $\text{H}_2\text{O}_2, \cdot \text{OH}$
8. What acetylide anion and alkyl chloride can be used to prepare the following alkyne?

\[
\begin{align*}
\text{Acetylide Anion} & \quad \text{Alkyl Chloride} \\
\end{align*}
\]

9. Draw the product of the following reaction.
10. Draw the organic product formed when 1-hexyne is treated with H₂O, H₂SO₄, AND HgSO₄.


12. Draw the product formed when 3-hexyne is treated with HBr (2 equiv).
13. Draw the product formed in the following reaction and indicate stereochemistry.

\[
\begin{align*}
\text{O} & \quad \text{[1] } \text{HC≡C}^- \\
\text{H} & \quad \text{[2] } \text{H}_2\text{O} \\
\text{H}_3\text{C} & \quad \text{CH}_3
\end{align*}
\]

14. Devise a synthesis of CH\textsubscript{3}CH\textsubscript{2}CH\textsubscript{2}CHO from two-carbon starting materials. Be sure to answer all parts.

\[
\text{\longrightarrow} \quad 2 \text{ carbon starting materials}
\]

Hints:

Step 1: (circle the reagents to form intermediate 1)

A. HC≡CH  
B. CH≡CH

C. CH≡CH  
D. CH≡CH

[1] BH\textsubscript{3}  
[2] H\textsubscript{2}O\textsubscript{2}, HO\textsuperscript{-}

Intermediate 1: (draw the intermediate)
Step 2: (circle the reagents to convert intermediate 1 to intermediate 2)

A. \[ \text{CH}_3\text{CH}_2\text{Br} \]

B. \[ \text{NaNH}_2 \]
   \[ \text{2 equiv} \]

C. \[ \text{H}_2\text{O} \]
   \[ \text{H}_2\text{SO}_4 \]
   \[ \text{HgSO}_4 \]

D. \[ \text{BrCH}_2\text{CH}_2\text{OH} \]

Intermediate 2: (draw the intermediate)

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Step 3: (circle the reagents to convert the intermediate into the final product)

A. \[ \begin{array}{l} [1] \text{BH}_3 \\ [2] \text{H}_2\text{O}_2, \text{HO}^- \end{array} \]

B. \[ \text{BrCH}_2\text{CHO} \]

C. \[ \text{Na, NH}_3 \]

D. \[ \begin{array}{l} \text{H}_2\text{O} \\ \text{H}_2\text{SO}_4 \\ \text{HgSO}_4 \end{array} \]
15. Devise a synthesis of \( \text{CH}_3\text{CH}_2\text{C}==\text{CCH}_2\text{CH}_2\text{OH} \) using \( \text{CH}_3\text{CH}_2\text{CH}==\text{CH}_2 \) as the starting material. You may use any other organic compounds or inorganic reagents. Be sure to answer all parts.

Hints:
Step 1: (circle the reagents to form intermediate 1)

A. \( \text{Cl}_2 \)
B. \( \text{SOCl}_2 \)
C. \( \text{HCl} \)
D. \( \text{KO(\text{CH}_3)_3} \), 2 equiv

Intermediate 1:

Step 2: (circle the reagents to form intermediate 2)

A. \( \text{PBr}_3 \)
B. [1] \( \text{NaH} \), [2] \( \text{CH}_3\text{I} \)
C. 2 \( \cdot \text{NH}_2 \)
D. \( \text{SOCl}_2 \)
Intermediate 2:

Step 3: (circle the reagents to form intermediate 3)

A.  

[1]  

O

B.  

NH₃

C.  

NaH

D.  

CH₃CH₂CH₂Br

Intermediate 3:
Step 4: (circle the reagents to form the final product)

A. \( \text{CH}_3\text{CH}_2\text{OH} \)
B. \( \text{H}_2\text{O} \)
C. \( \text{[1]} \text{O} \text{[2]} \text{H}_2\text{O} \)
D. \( \text{CH}_3\text{CH}_2\text{CH}_2\text{Br} \)

16. Devise a synthesis of the following compound. You may use \( \text{CH}==\text{CH} \), ethylene oxide, and alkyl halides as organic starting materials and any inorganic reagents.

\( \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{C}==\text{CCH}_2\text{CH}_2\text{OH} \)
17. Devise a stepwise mechanism for the following reaction.