1. Select the possible products of the following reaction.

\[
\begin{align*}
\text{Br} & \quad \text{CH}_3\text{CH}_2\text{O}^\ominus \\
\text{CH}_3\text{CH}_2\text{OH} & \quad \downarrow \\
\end{align*}
\]

\[\text{Br} \quad \text{O} \quad \text{Br} \quad \text{Br} \quad \text{Cl} \quad \text{Cl} \quad \text{I} \quad \text{Cl} \quad \text{F} \quad \text{F} \quad \text{O} \quad \text{CO} \quad \text{OH} \]

\[\text{i} \quad \text{ii} \quad \text{iii} \quad \text{iv} \]

\[\text{a. i & iii} \quad \text{b. i & iv} \quad \text{c. ii & iii} \quad \text{d. ii & iv} \]

2. *Cis-trans* alkenes are often distinguished from each other by examining the spatial orientation of identical groups relative to the double bond. While this often also corresponds to *Z* and *E* descriptions, sometimes it does not. For which of the following alkenes does *cis* not equal *Z* OR *trans* not equal *E*?

\[\text{A} \quad \text{B} \quad \text{C} \quad \text{D} \quad \text{E} \]

3. Which of the following reactions would yield 2-butyne at the major product?

\[
\begin{align*}
\text{i} & \quad \text{CH}_3\text{C}≡\text{C}^\ominus \text{Na}^+ + \text{CH}_3\text{Br} \\
\text{ii} & \quad \text{CH}_3\text{CH}_2\text{Br} + \text{HC}≡\text{C}^\ominus \text{Na}^+ \\
\text{iii} & \quad \text{CH}_3^\ominus \text{Na}^+ + \text{HC}≡\text{CCH}_3 \\
\end{align*}
\]

\[\text{a. i} \quad \text{b. ii} \quad \text{c. iii} \quad \text{d. i + ii} \quad \text{e. All of them} \]
4. Choose the reaction(s) that would produce 1-butene at the major product.

i

\[ \text{Cl} \quad \text{OCH}_2\text{CH}_3 \]

ii

\[ \text{Cl} \quad \text{OCH}_2\text{CH}_3 \]

iii

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

a. i
b. ii
c. iii
d. i + ii
e. ii + iii

5. Choose the reaction that is most likely to undergo an E1 reaction pathway.

A

\[ \text{B} \quad \text{OCH}_2\text{CH}_3 \quad \text{CH}_3\text{OH} \]

B

\[ \text{Cl} \quad \text{CH}_2\text{CH}_2\text{OH} \quad \text{heat} \]

C

\[ \text{Cl} \quad \text{KOC(CH}_3)_3 \quad \text{HOC(CH}_3)_3 \]

D

\[ \text{Br} \quad \text{NaC≡CH} \quad \text{CH}_3\text{CN} \]

E

\[ \text{Cl} \quad \text{KOC(CH}_3)_3 \quad \text{HOC(CH}_3)_3 \]
6. Select the major product of the following reaction.

![Chemical structure](image)

7. You need to synthesize 3-methyl-1-pentene from 2-chloro-3-methylpentane. Choose the set of reagents and conditions you would use.

a. HCl, heat  
b. NH₃ (aq.), 25 °C  
c. CH₃CO₂Na, CH₃CO₂H, heat  
d. CH₃CH₂ONa, CH₃CH₂OH, heat  
e. (CH₃)₃CONa, (CH₃)₃COH, heat

8. Draw the structure of the major product of the following reaction.

![Chemical structure](image)

9. Draw the structure of the major product of the following reaction sequence.

![Chemical structure](image)

10. There are four alkenes with the molecular formula C₆H₁₂ that upon hydrogenation give 3-methylpentane. Out of those four alkenes, draw the structure of the alkene that would give off the least amount of heat upon hydrogenation.