1. The name of the following ether is:

\[(\text{CH}_3)_2\text{CH-O-CH}_2\text{CH}_2\text{CH}_3\]

1) butyl isopropyl ether.  
2) isobutyl propyl ether.  
3) sec-butyl isopropyl ether.  
4) butyl propyl ether.

2. The C-O-C bond angle in dimethyl ether is closest to:

1) 90°  
2) 109°  
3) 120°  
4) 180°

3. Match the boiling points with the following three isomers of C₄H₁₀O₂.

<table>
<thead>
<tr>
<th>CH₃OCH₂CH₂OCH₃</th>
<th>CH₃CH₂OCH₂CH₂OH</th>
<th>HOCH₂CH₂CH₂CH₂OH</th>
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</thead>
<tbody>
<tr>
<td>1) 85°C</td>
<td>230°C</td>
<td>135°C</td>
</tr>
<tr>
<td>2) 230°C</td>
<td>85°C</td>
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<tr>
<td>3) 85°C</td>
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<td>230°C</td>
</tr>
<tr>
<td>4) 135°C</td>
<td>230°C</td>
<td>85°C</td>
</tr>
</tbody>
</table>

4. Of the following, which yields isopropyl methyl ether as the major product with little or no byproducts?

1) \((\text{CH}_3)_2\text{CHO}^- \text{Na}^+ + \text{CH}_3\text{I}\)  
2) \(\text{CH}_3\text{O}^- \text{Na}^+ + (\text{CH}_3)_2\text{CHI}\)  
3) \((\text{CH}_3)_2\text{CHOH} + \text{CH}_3\text{OH}\) \(\text{H}_2\text{SO}_4\)  
4) all three give isopropyl methyl ether as the major product

1) 1  
2) 2  
3) 3  
4) 4

5. Which of the following is not a good method to make tert-butyl methyl ether?

1) \((\text{CH}_3)_3\text{CO}^- \text{Na}^+ + \text{CH}_3\text{Br}\)  
2) \((\text{CH}_3)_3\text{CBr} + \text{CH}_3\text{O}^- \text{Na}^+\)  
3) \(\text{H}_2\text{C}=\text{C}(\text{CH}_3)_2 + \text{CH}_3\text{OH}\) \(\text{H}^+\)  
4) \((\text{CH}_3)_3\text{CBr} + \text{CH}_3\text{OH}\) \(\text{heat}\)

1) 1  
2) 2  
3) 3  
4) 4
6. Which of the following is not an intermediate in the reaction below?

\[
2 \text{CH}_3\text{OH} \xrightarrow{\text{H}_2\text{SO}_4, \text{heat}} \text{CH}_3\text{OCH}_3 + \text{H}_2\text{O}
\]

1) \text{H}_3\text{C}--\text{O}--\text{H}  
2) \text{H}_3\text{C}--\text{O}--\text{CH}_3  
3) \text{H}--\text{C}--\text{H}  
4) they are all intermediates

1) 1  
2) 2  
3) 3  
4) 4

7. What are the products of the reaction below?

\[
\text{HI (xs), heat}
\]

\[
\begin{align*}
\text{OH} & \quad \text{CH}_2\text{OCH}_3 \\
\text{I} & \quad + \text{CH}_3\text{OH} \\
\text{OH} & \quad + \text{CH}_3\text{I} \\
\text{I} & \quad \text{CH}_2\text{I}
\end{align*}
\]

1) 1  
2) 2  
3) 3  
4) 4
8. What is the product of the following reaction?

\[ \text{H}_3\text{C} = \text{CH}_2\text{CH}_3 + \text{CH}_3\text{COOH} \rightarrow \]

1) \[ \text{H}_3\text{C} \quad \text{CH}_2\text{CH}_3 \quad + \text{enantiomer} \]

2) \[ \text{H}_3\text{C} \quad \text{O} \quad \text{CH}_2\text{CH}_3 \quad + \text{enantiomer} \]

3) \[ \text{H}_3\text{C} \quad \text{CH}_2\text{CH}_3 \quad \text{O} \quad + \text{enantiomer} \]

4) \[ \text{H}_3\text{C} \quad \text{CH}_2\text{CH}_3 \quad \text{O} \quad + \text{enantiomer} \]

9. The reaction shown below can be described as an:

\[ \text{H}_3\text{C} = \text{CH} - \text{CH}_2\text{Br} \quad \text{NaOH, H}_2\text{O} \quad \rightarrow \quad \text{H}_3\text{C} - \text{CH} - \text{CH}_2 \]

1) acid-base reaction followed by an intramolecular Williamson ether synthesis.
2) acid-base reaction followed by an intramolecular S_N1 reaction.
3) E2 reaction followed by an addition reaction to a double bond.
4) S_N2 reaction followed by an intramolecular Williamson ether synthesis.

10. What is the product of the following reaction?

\[ \text{O} \quad \text{NaOH, H}_2\text{O} \quad \rightarrow \quad \text{CH}_3 \]

1) (S)-1,2-propanediol
2) (R)-1,2-propanediol
3) racemic mixture of 1,2-propanediol
4) 1,3-propanediol

11. Which of the following reacts the fastest with NaOH, H_2O?

1) ethylene oxide (oxirane)
2) cis-2,3-dimethyloxirane
3) trans-2,3-dimethyloxirane
4) 2,2,3,3-tetramethyloxirane
12. What reagents and/or reaction sequence below would convert trans-3-hexene to meso-3,4-hexanediol?

1) OsO₄, (CH₃)₃COOH, (CH₃)₃COH, NaOH
2) B₂H₆/diglyme followed by H₂O₂/NaOH
3) O₃ followed by Zn/H₂O
4) CH₃CO₃H followed by NaOH/H₂O

13. Which of the following yields an epoxide on treatment with NaOH?

1) cis-2-bromocyclohexanol
2) trans-2-bromocyclohexanol
3) cis-1,2-cyclohexanediol
4) 3-bromocyclohexene

14. Which of the following epoxides is formed when KOH is added to the optically active halohydrin shown below?

\[ \text{OH} \]
\[ \text{CH₃} \]
\[ \text{Br} \]
\[ \text{H} \]
\[ \text{CH₃} \]

1) trans-(2S,3S)-2,3-dimethyloxirane
2) trans-(2R,3R)-2,3-dimethyloxirane
3) 2,2-dimethyloxirane
4) meso-2,3-dimethyloxirane

15. Benzene reacts with 2-methyloxirane in the presence of AlCl₃ to give a product with a formula of C₉H₁₂O. Identify the product.

\[ \text{C₉H₁₂O} \]

1) 1 2) 2 3) 3 4) 4
16. Propose a mechanism for the reaction shown below. (Hint: CF$_3$CO$_2$H is a strong acid.)

Propose a synthesis of the bicycloalkene starting material above. (Hint: Furan can be used as a diene in Diels-Alder reactions. What dieneophile would work best?)
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<th>No. on Test</th>
<th>Correct Answer</th>
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