WORKSHEET: ALCOHOLS - SOLUTIONS

1. a) 2-chloro-4-methyl-3-hexanol  
   b) 2,7-dimethyl-3,6-octanediol

2. The alcohol (b) will have the highest boiling point because the molecules can H-bond to each other. The boiling points of these compounds are: propanol (H-bond), 97°C; butane (a) (LDF), 0°C; ethyl methyl ether (c) (dipole/dipole), 35°C.

3. a)

   \[
   \text{H}_3\text{C} - \text{C} - \text{C} - \text{H} + \text{H}^+ \rightarrow \text{H}_3\text{C} - \text{C} - \text{C} - \text{CH}_3
   \]

   \[
   \text{H}_3\text{C} - \text{C} - \text{C} - \text{H} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{C} - \text{C} - \text{C} - \text{CH}_3
   \]

   \[
   \text{H}_2\text{C} - \text{C} - \text{C} - \text{CH}_3 \rightarrow \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_3 + \text{H}^+
   \]

b)

   \[
   \text{CH}_3 - \text{C} - \text{C} - \text{CH}_3 + \text{H}^+ \rightarrow \text{CH}_3 - \text{C} - \text{C} - \text{CH}_3
   \]

   \[
   \text{CH}_3 - \text{C} - \text{C} - \text{CH}_3 + \text{H}_2\text{O} \rightarrow \text{CH}_3 - \text{C} - \text{C} - \text{CH}_3 + \text{H}^+
   \]
c) yes

\[
\begin{array}{c}
\text{H} \quad \text{H} \\
\text{CH}_3-\text{C}-\text{C}-\text{C}-\text{H} \quad \rightarrow \quad \text{CH}_3-\text{C}==\text{C}-\text{H} \\
\text{H} \quad \text{H} \\
\end{array}
\]

minor product

d) The major product of the dehydration of an alcohol is the **most** substituted (fewest H on C=C) alkene.

In this case, the **major** product was 2 butene (2 H on C=C)

\[
\begin{array}{c}
\text{CH}_3-\text{C}==\text{C}-\text{CH}_3 \\
\end{array}
\]

The **minor** product was 1 butene (3 H on C=C)

\[
\begin{array}{c}
\text{CH}_3-\text{C}-\text{C}==\text{C} \quad \text{H} \\
\text{H} \\
\end{array}
\]

e) \[
\begin{array}{c}
\text{OH} \\
\rightarrow \quad \text{H}^+ / \text{dry} \quad \rightarrow \quad + \text{H}_2\text{O} \\
\text{H} \\
\end{array}
\]

There is only 1 product, 4,4-dimethyl-2-pentene.

4. a)

\[
\begin{array}{c}
\text{O} \quad \text{H} \\
\text{H} \quad \text{H} \\
\rightarrow \quad \text{H}^+ \quad \rightarrow \quad + \text{H}_2\text{O} \\
\text{H} \\
\end{array}
\]

b) The organic product is an ether. Its common name is butyl propyl ether.

c) This is a **condensation** reaction. Two molecules combine to form one larger organic molecule plus water. It is also a **substitution** reaction. An –OR group is substituted for an –OH group.