Multiple Choice Questions. 60 points

1. Choose the reaction scheme that could not be used to prepare the following alcohol. D

2. Choose the species that is not an intermediate in the palladium catalyzed Heck reaction. B

3. Chose the major product of the following reaction. E
4. Choose the major product of the following reaction.

\[
\text{BrCH}_2 + \text{CH}_2=\text{CHO} \quad \text{Pd(OAc)}_2 \quad \text{Na}_2\text{CO}_3 \xrightarrow{} \begin{array}{c}
\text{(A)} \\
\text{(B)} \\
\text{(C)} \\
\text{(D)} \\
\text{(E)}
\end{array}
\]

5. Choose the species that is not an intermediate in the following acid catalyzed reaction.

\[
\text{CH}_3\text{CHO} + \text{HOCH}_3 \xrightarrow{\text{H}^+} \begin{array}{c}
\text{CH}_3\text{OCH}_3 \\
\text{H}_2\text{O}
\end{array}
\]

6. Choose the answer that has correctly selected the major species of the following two acids to be present in blood naturally buffered at pH = 7.2.

\[
\begin{array}{c}
\text{(A)} \\
\text{(B)} \\
\text{(C)} \\
\text{(D)} \\
\text{(E)}
\end{array}
\]

possible species in blood buffered at pH = 7.2
7. Choose the following compound that will cyclize to give the pheromone frontalin.

(A)  \[ \text{HO-CH-CH}_2-\text{OH} \]
(B)  \[ \text{HO-CH}_2-\text{CH}_2-\text{OH} \]
(C)  \[ \text{HO-CH-CH}_2-\text{OH} \]
(D)  \[ \text{HO-CH}_2-\text{CH}_2-\text{OH} \]
(E)  \[ \text{HO-CH-CH}_2-\text{OH} \]

8. The following acids have pKₐ values of 1.25, 2.9 and 4.75. Choose the answer that has these correctly assigned.

(A)  \[ \text{C}_2\text{H}_4\text{COOH} \quad \text{pK}_a = 1.25 \]
(B)  \[ \text{C}_2\text{H}_4\text{COOH} \quad \text{pK}_a = 2.9 \]
(C)  \[ \text{C}_2\text{H}_4\text{COOH} \quad \text{pK}_a = 4.75 \]
(D)  \[ \text{C}_2\text{H}_4\text{COOH} \quad \text{pK}_a = 1.25 \]
(E)  \[ \text{C}_2\text{H}_4\text{COOH} \quad \text{pK}_a = 2.9 \]

9. Choose the reaction that is not correctly shown.

(A)  \[ \text{C}_6\text{H}_5-\text{CO}_2\text{H} + \text{SOCl}_2 \rightarrow \text{C}_6\text{H}_5-\text{COCl} + \text{SO}_2 + \text{HCl} \]
(B)  \[ \text{C}_6\text{H}_5-\text{CO}_2\text{H} \rightarrow 1. \text{LiAlH}_4 \rightarrow 2. \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_5-\text{CH}_2\text{OH} \]
(C)  \[ \text{C}_6\text{H}_5-\text{CO}_2\text{H} \rightarrow 1. \text{NaBH}_4 \rightarrow 2. \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_5-\text{CH}_2\text{OH} \]
(D)  \[ \text{C}_6\text{H}_5-\text{MgBr} \rightarrow 1. \text{CO}_2 \rightarrow 2. \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_5-\text{CO}_2\text{H} \]
(E)  \[ \text{CH}_3-\text{CO}_2\text{H} + \text{H}_2\text{O} \rightarrow \text{CH}_3-\text{CO}_2\text{H} + \text{H}_2\text{O} \quad \text{pK}_a = -1.74 \]

Answer:

7. (A)
8. (E)
9. (C)
10. Choose order that has the following compounds correctly arranged with respect to increasing rate of reaction with LiAlH₄. (most reactive compound on the right)

(A) \( \text{H}_2\text{C} = \text{CH} \text{CH}_2\text{O} \) \( \text{H}_2\text{C} = \text{CH} \text{CH}_2\text{O} \) \( \text{H}_2\text{C} = \text{CH} \text{CH}_2\text{O} \)

(B) \( \text{H}_2\text{C} \text{CH}_2\text{O} \) \( \text{H}_2\text{C} \text{CH}_2\text{O} \) \( \text{H}_2\text{C} \text{CH}_2\text{O} \)

(C) \( \text{H}_2\text{C} = \text{CH} \text{CH}_2\text{O} \) \( \text{H}_2\text{C} = \text{CH} \text{CH}_2\text{O} \) \( \text{H}_2\text{C} = \text{CH} \text{CH}_2\text{O} \)

11. Choose order that has the following compounds correctly arranged with respect to increasing solubility in water. (most soluble compound on the right)

(A) \( \text{O}_\text{Na}^+ \text{O}_\text{Na}^+ \text{O}_\text{Na}^+ \) \( \text{O}_\text{Na}^+ \text{O}_\text{Na}^+ \) \( \text{O}_\text{Na}^+ \)

(B) \( \text{O}_\text{Na}^+ \text{O}_\text{Na}^+ \text{O}_\text{Na}^+ \) \( \text{O}_\text{Na}^+ \text{O}_\text{Na}^+ \) \( \text{O}_\text{Na}^+ \)

(C) \( \text{O}_\text{Na}^+ \text{O}_\text{Na}^+ \) \( \text{O}_\text{Na}^+ \text{O}_\text{Na}^+ \) \( \text{O}_\text{Na}^+ \)

12. Choose the reaction that is not correctly shown.

(A) \( \text{O} \text{CH}_2 = \text{CH}_2 \) \( \text{O} \text{CH}_2 = \text{CH}_2 \) \( \text{O} \text{CH}_2 = \text{CH}_2 \)

(B) \( \text{O} \text{CH}_2 = \text{CH}_2 \) \( \text{O} \text{CH}_2 = \text{CH}_2 \) \( \text{O} \text{CH}_2 = \text{CH}_2 \)
Short Answer Questions. 40 points.

13. Predict the products of the following reactions.

(a) \[ \text{CH}_3\text{Li} \rightarrow \text{C}_6\text{H}_6\text{O}_2 \]
(b) \[ \text{H}-\text{Cl} \rightarrow \text{Cl} \]

14a. Give an acceptable name for the following structure.
14b. Give the correct structure for the following name.

2-hexanone
14a

(Z)-3-hexenoic acid
14b

15. Using the curved arrow formalism, show the bond making and bond breaking that occurs in the following transformation.
16. Propose a synthesis of the following compound from bromobenzene, compounds containing 4 carbon atoms or less, and any other necessary reagents.