1. Which of the following have an enol form?
   
   A. benzaldehyde, C₆H₅CHO
   B. 2,2-dimethylpropanal, (CH₃)₃CCHO
   C. 2,2-dichloropropanal, CH₃CCl₂CHO

   1) none have enol forms  2) only A
   3) only B              4) A and C

2. How many alpha hydrogens are there on 2,4-dimethyl-3-pentanone?
   1) only one  2) two  3) three  4) four

3. What is the product of the reaction below?

   \[
   \text{(CH₃)₂CHCH₂CH} + \text{Br₂} \rightarrow \text{acetic acid}
   \]

   \[
   \begin{align*}
   1) & & 2) & & 3) & & 4) \\
   & \text{Br} & \text{O} & \text{H} & \text{Br} & \text{O} & \text{Br} & \text{H} & \text{Br} & \text{O} & \text{Br}
   \end{align*}
   \]

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

4. Identify the keto form of the following enol.

   \[
   \text{OH}
   \]

   1) 1-penten-3-one  2) (E)-3-penten-2-one
   3) 2-pentanone      4) (E)-3-pentenal

5. Which of the following has the highest percentage of enol in a keto-enol equilibrium?

   1) hexanal  2) 2-hexanone
   3) 2,4-hexanedione  4) 2,5-hexanedione
6. Identify the deuterated compound resulting from the following reaction.

\[ \text{CH}_2\text{CH}_3 \quad \overset{\text{D}_2\text{O (xs), NaOD}}{\longrightarrow} \quad \text{CD}_2\text{CH}_3 \]

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

7. How many different aldol addition products can be formed in the reaction of equal amounts of propanal and butanal with aqueous sodium hydroxide at 0°C? (consider only constitutional isomer – not stereoisomers)

1) only one 2) two 3) three 4) four

8. What is the product of the following intramolecular aldol condensation reaction?

\[ \text{H} \quad \overset{\text{KOH, CH}_3\text{OH}}{\underset{\text{heat}}{\longrightarrow}} \quad \text{KOH, CH}_3\text{OH} \]

1) 1 2) 2 3) 3 4) 4
9. Identify the starting reagents needed to make the following compound by a mixed aldol condensation.

\[ \text{CH}=\text{CCCH}_2\text{CH}_3 + \text{KOH, CH}_3\text{OH} \rightarrow \text{CH}=\text{CCCH}_2\text{CH}_3 \]

1) benzaldehyde (C₆H₅CH=O) and 3-pentanone  
2) benzaldehyde (C₆H₅CH=O) and 2-pentanone  
3) acetophenone (methyl phenyl ketone) and 2-butanol  
4) acetophenone (methyl phenyl ketone) and butanal

10. The Robinson annulation reaction is shown below. Identify the missing reagent in the first step.

\[ \text{O} \]
\[ \text{CH}_3 \]
\[ \text{+ KOH, CH}_3\text{OH Al}[\text{OC(CH}_3)_3]\text{3 benzene, heat} \rightarrow \text{O} \]
\[ \text{CH}_3 \]
\[ \text{O} \]
\[ \text{CH}_3 \]
\[ \text{1) H}_2\text{C}=\text{CHCCH}_3 \]
\[ \text{2) CH}_3\text{CH}=\text{CHCH} \]
\[ \text{3) H}_2\text{C}=\text{CHCH}_2\text{CH} \]
\[ \text{4) CH}_3\text{CCH}_2\text{CH}_3 \]

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

11. Which one of the following reagents adds a methyl group by conjugate (1,4-addition) addition to an \( \alpha,\beta \)-unsaturated ketone or aldehyde?

1) LiCu(CH₃)₂  
2) CH₃MgBr  
3) Hg(O₂CCH₃)₂  
4) CH₃Li

12. What is the product of the following reaction sequence?

\[ \text{H} \]
\[ \text{O} \]
\[ \text{NaOH, H}_2\text{O heat} \rightarrow (1) \text{LiCu(CH}_3)_2 \rightarrow (1) \text{LiAlH}_4 \]
\[ \text{H}_2\text{O} \]
\[ (2) \text{H}_2\text{O} \]

1) 3-ethyl-2-methyl-1-hexanol  
2) 2-ethyl-3-methyl-1-hexanol  
3) 2,3-dimethyl-1-pentanol  
4) 3,3-dimethyl-1-pentanol
13. Which of the following has the largest acid dissociation constant, $K_a$?

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

14. Propose a mechanism for the following reaction.