Part I: Ketones and Aldehydes

1. Show all the steps needed to complete the synthesis below. Draw all the intermediate products and all necessary reagents.

```
CHO
\n\nCHO
\n\n
CH₃
```

2. We discussed the Aldol reaction in lecture. Below is an example of a synthesis that involves a crossed Aldol condensation. Provide structures for all the compounds in the synthesis.

```
p-Tert-Butylbenzyl alcohol → \text{C}_{11}\text{H}_{14}\text{O} → \text{C}_{14}\text{H}_{18}\text{O} → \text{C}_{14}\text{H}_{20}\text{O}
```

3. Shown are the mass spectra for 2-pentanone, 3-pentanone, and 3-methyl-2-butanone. Match the correct structure to the correct mass spectrum.
Part II: Carboxylic acids

1. The Ka for dichloroacetic acid is $5.5 \times 10^{-2}$. What percentage of the acid is dissociated in a 0.1 M aqueous solution of this acid?
2. Identify the more acidic compound in each pair and explain your choice.
   a) CF₃CH₂COOH or CF₃CH₂CH₂COOH
   
   b) CH₃CH₂CH₂COOH or CH₃C≡CCOOH

   c) ![Cyclohexane COOH](image)
      or ![Phenyl COOH](image)

   d) ![Fluorinated aromatic COOH](image)
      or ![Benzoic acid](image)

   e) ![Fluorinated aromatic COOH](image)
      or ![Fluorinated aromatic COOH](image)

3. Which method, hydrolysis of a nitrile or reaction of a Grignard with CO₂, would be better to carry out each of the following syntheses? Note: Some may require the use of protecting groups.
   a) (CH₃)₃CCl → (CH₃)₃CCOOH

   b) BrCH₂CH₂Br → HOOCCH₂CH₂COOH

   c) CH₃CCH₂CH₂CH₂Br → CH₃CCH₂CH₂CH₂COOH

   d) (CH₃)₃CCH₂Br → (CH₃)₃CCH₂COOH

   e) CH₃CH₂CH₂CH₂Br → CH₃CH₂CH₂CH₂COOH