

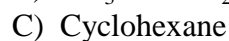
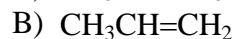
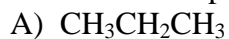
Organic Chemistry II

Sample Exam 3 **KEY**

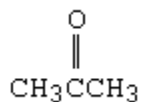
You should also be able to name compounds, draw structures from names, and complete reactions given the reactants and conditions of the reaction.

I. Multiple Choice (Circle the letter for the best answer)

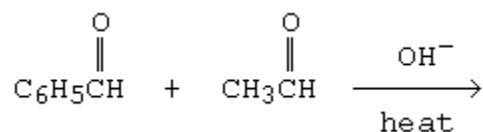
1. Which compound would be most acidic?



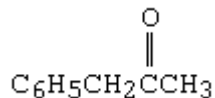
D)



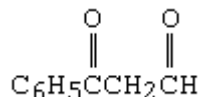
2. What would be the major product of the following reaction?



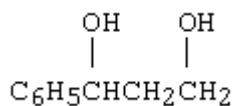
A)



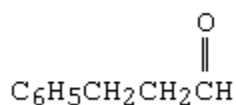
B)



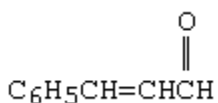
C)



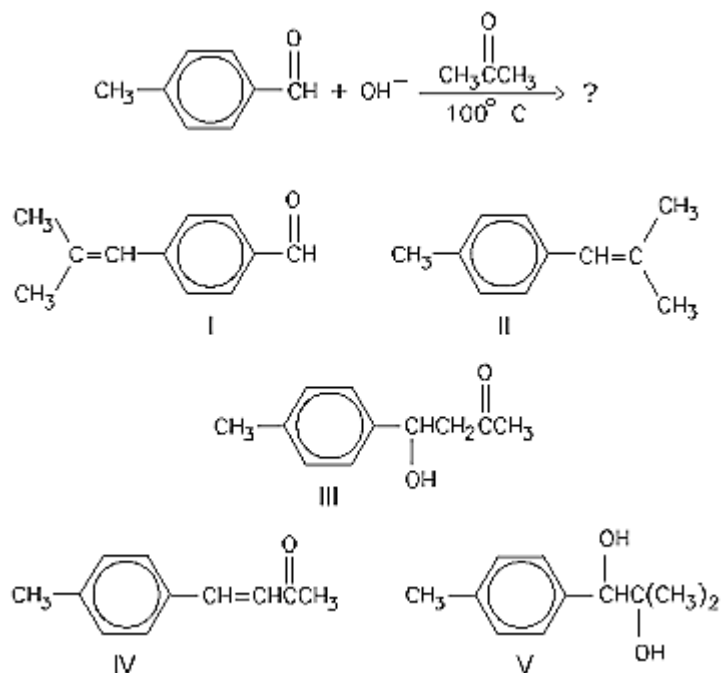
D)



E)

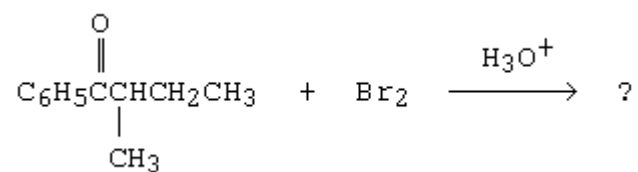


3. What would be the major product of the following reaction at 100°C?

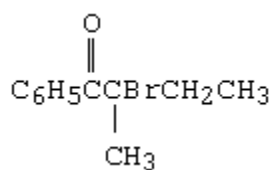


- A) I
 B) II
 C) III
 D) IV
 E) V
4. Which is the only one of these compounds which cannot self-condense in the presence of dilute aqueous alkali?
- A) Phenylethanal
 B) Propanal
 C) 2-Methylpropanal
 D) 3-Methylpentanal
 E) 2,2-Dimethylpropanal
5. Which of the following compounds would be the strongest acid?
- A) CHF₂CH₂CH₂COOH
 B) CH₂FCHFCH₂COOH
 C) CH₃CF₂CH₂COOH
 D) CH₃CH₂CF₂COOH
 E) CH₃CH₂CH₂COOH

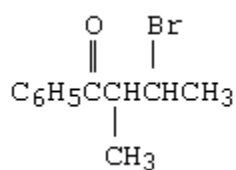
6. What would be the major product of the following reaction?



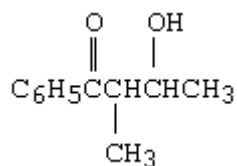
A)



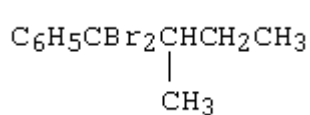
B)



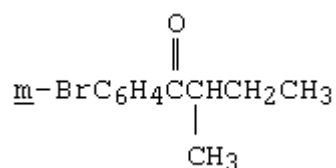
C)



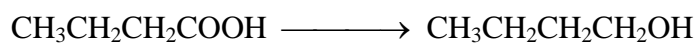
D)



E)



7. Choose the reagent(s) that would bring about the following reaction:



A) H_2/Ni

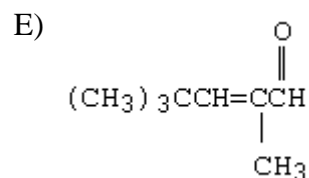
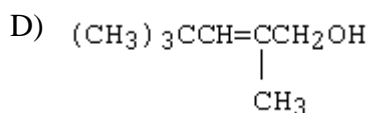
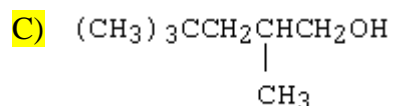
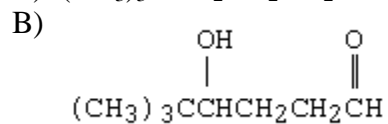
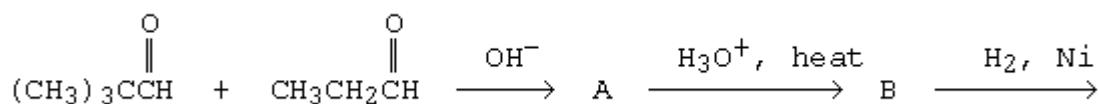
B) $\text{Li}/\text{liq NH}_3$

C) $\text{LiAlH}[\text{OC}(\text{CH}_3)_3]_3$

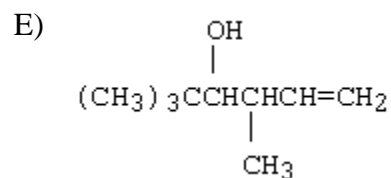
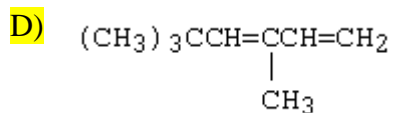
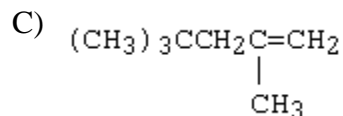
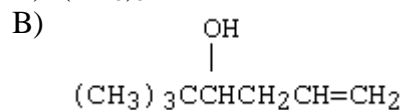
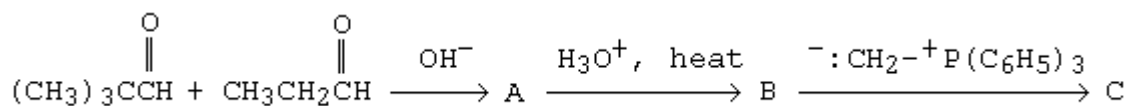
D) $\text{NaBH}_4, \text{CH}_3\text{OH}$

E) $\text{LiAlH}_4, \text{ether}$

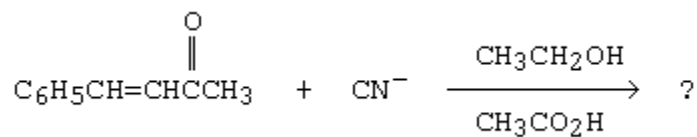
8. What would be the product, C, of the following reaction sequence?



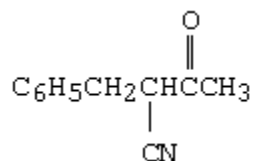
9. What would be the product, C, of the following reaction sequence?



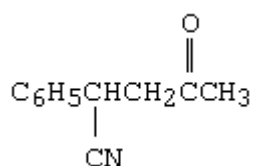
10. What would be the major product of the following reaction?



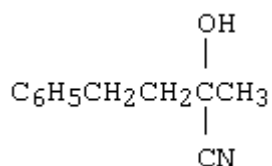
A)



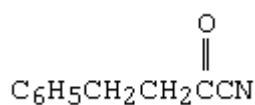
B)



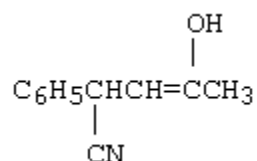
C)



D)



E)



11. The IR spectrum of a compound exhibits a broad absorption band at 2500-3000 cm^{-1} and a sharp band at 1710 cm^{-1} . Which of these compounds could it be?

A) 1-Butanol

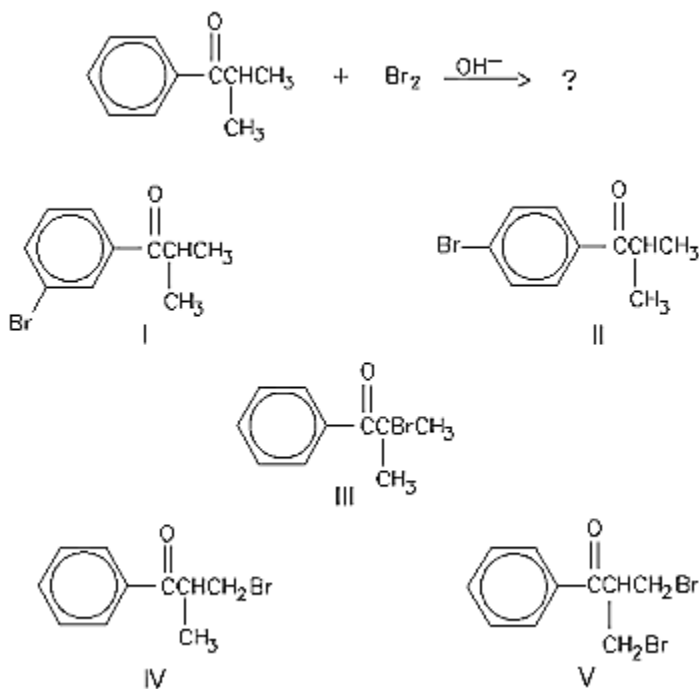
B) Propyl acetate

C) **Butanoic acid**

D) Acetyl chloride

E) Acetic anhydride

12. What would be the major product of the following reaction?



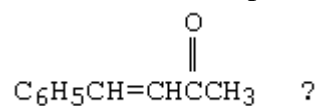
- A) I
- B) II
- C) III**
- D) IV
- E) V

13. In which of the following sequences are the compounds listed in order of decreasing acidity?

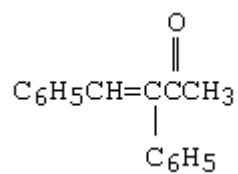
- A) $\text{CH}_3\text{COOH} > \text{H}_2\text{O} > \text{CH}_3\text{CH}_2\text{OH} > \text{HC}\equiv\text{CH} > \text{NH}_3$**
- B) $\text{CH}_3\text{CH}_2\text{OH} > \text{CH}_3\text{COOH} > \text{H}_2\text{O} > \text{HC}\equiv\text{CH} > \text{NH}_3$
- C) $\text{CH}_3\text{COOH} > \text{CH}_3\text{CH}_2\text{OH} > \text{H}_2\text{O} > \text{NH}_3 > \text{HC}\equiv\text{CH}$
- D) $\text{H}_2\text{O} > \text{CH}_3\text{COOH} > \text{CH}_3\text{CH}_2\text{OH} > \text{HC}\equiv\text{CH} > \text{NH}_3$
- E) $\text{CH}_3\text{CH}_2\text{OH} > \text{H}_2\text{O} > \text{CH}_3\text{COOH} > \text{HC}\equiv\text{CH} > \text{NH}_3$

14. While the IUPAC name for HCO_2H is methanoic acid, it is commonly known as formic acid.

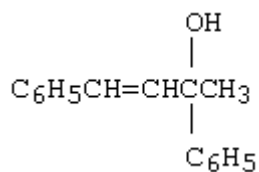
15. Which of these is a product of the reaction of $\text{C}_6\text{H}_5\text{MgBr}$ with



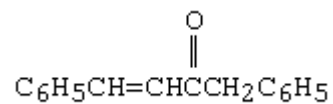
A)



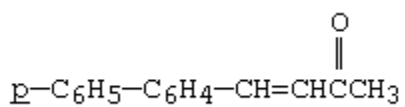
B)



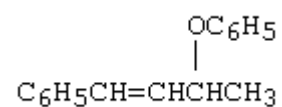
C)



D)

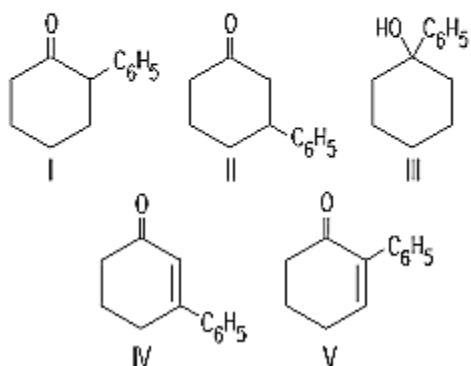
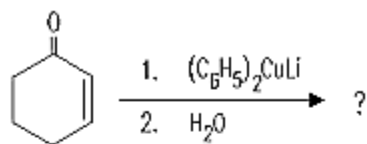


E)



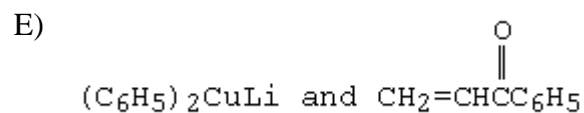
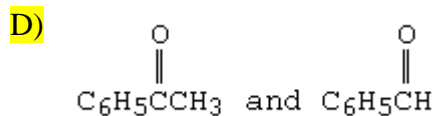
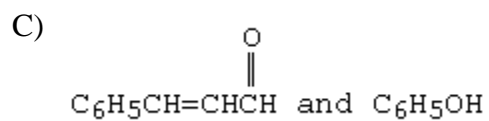
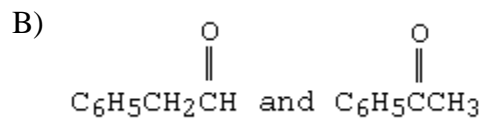
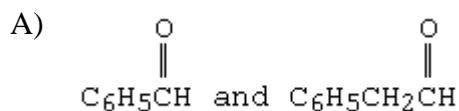
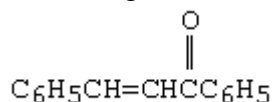
17. Ethanoic acid ($\text{CH}_3\text{CO}_2\text{H}$) is usually called **acetic acid**, from the Latin for “vinegar”.

18. What is the product of the reaction below?

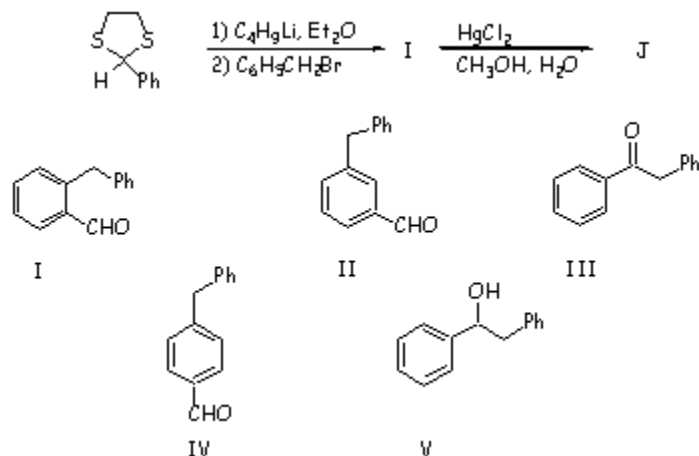


- A) I
- B) II**
- C) III
- D) IV
- E) V

20. Which reagents would you use to synthesize this compound by an aldol condensation?

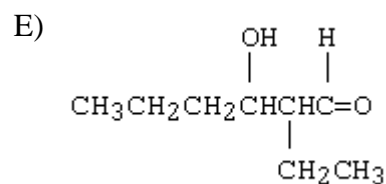
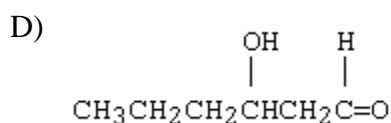
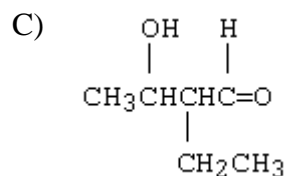
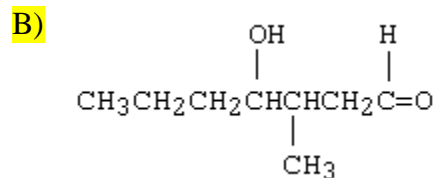
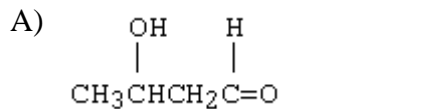


21. What is the structure for J?

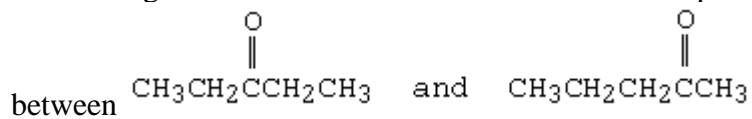


- A) I
 B) II
C) III
 D) IV
 E) V

22. Which of these is not among the reaction products when a crossed aldol addition occurs between ethanal and butanal?



23. Which reagent would best serve as the basis for a simple chemical test to distinguish



A) NaOI (I₂ in NaOH)

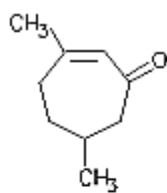
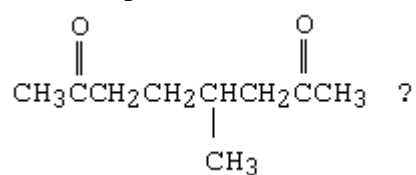
B) Br₂/CCl₄

C) CrO₃/H₂SO₄

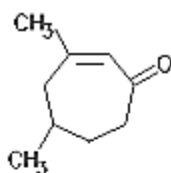
D) NaHCO₃/H₂O

E) Ag(NH₃)₂⁺

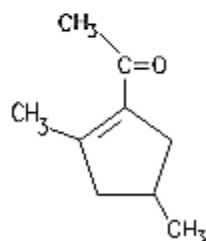
24. What compound results from the aldol cyclization of



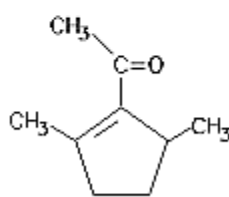
I



II



III

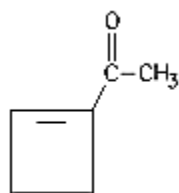


IV

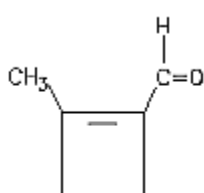
- A) I
- B) II
- C) III
- D) IV
- E) Both III and IV

25.

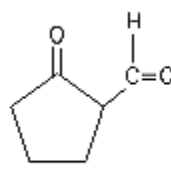
The aldol cyclization of $\text{CH}_3\overset{\text{O}}{\parallel}{\text{C}}\text{CH}_2\text{CH}_2\text{CH}_2\overset{\text{H}}{\text{C}}=\text{O}$ produces which of these?



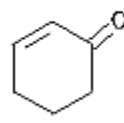
I



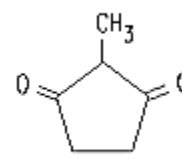
II



III



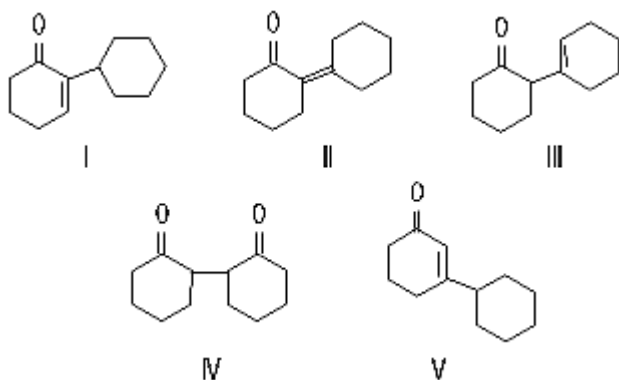
IV



V

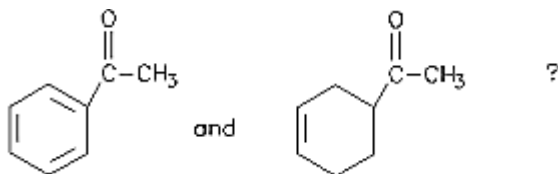
- A) I
- B) II
- C) III
- D) IV
- E) V

26. The aldol reaction of cyclohexanone produces which of these self-condensation products?



- A) I
B) II
 C) III
 D) IV
 E) V

27. Which reagent would best serve as the basis for a simple chemical test to distinguish between

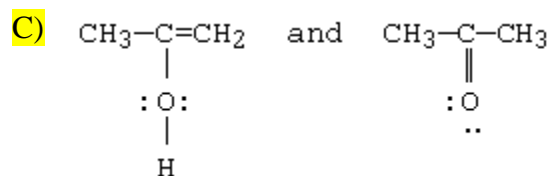
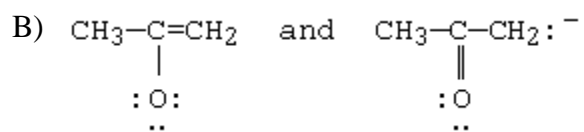
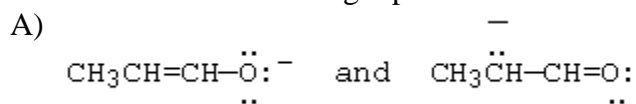


- A) NaOI (I_2 in NaOH)
B) Br_2/CCL_4
 C) CrO_3/H_2SO_4
 D) $NaHCO_3/H_2O$
 E) $Ag(NH_3)_2^+$

28. In a solution of acetic acid ($pK_a=4.74$) adjusted to a pH of 2.74,

- A) the ratio of acetate to acetic acid is 10 to 1.
 B) the ratio of acetate to acetic acid is 100 to 1.
 C) the ratio of acetate to acetic acid is 1000 to 1.
 D) the ratio of acetate to acetic acid is 1 to 10.
E) the ratio of acetate to acetic acid is 1 to 100.

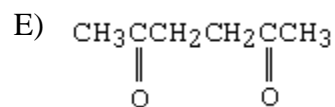
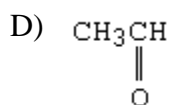
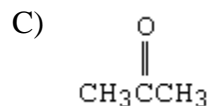
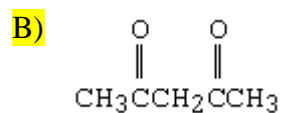
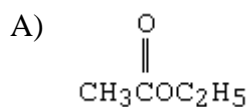
29. Which of the following represent tautomers?



D) All of these

E) None of these

30. Which of these compounds would exist in an enol form to the greatest extent?



31. If acetone is reacted with LDA followed by methyl bromide, the product is

A) isopropyl alcohol.

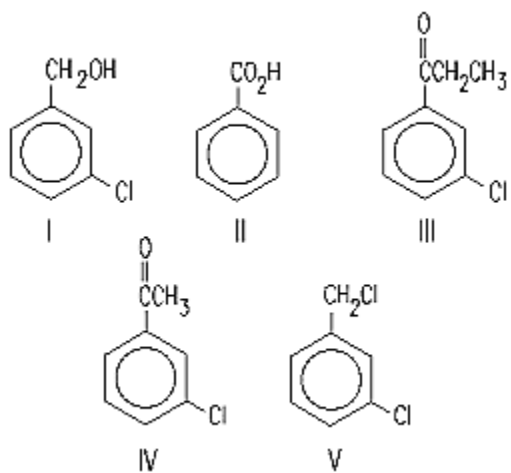
B) 2-butanol.

C) 2-butanone.

D) 3-methyl-2-butanol.

E) acetone.

32. Which compound could be subjected to a haloform reaction to produce m-chlorobenzoic acid?



- A) I
- B) II
- C) III
- D) IV**
- E) V

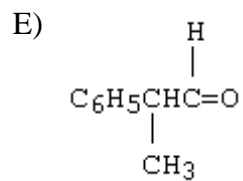
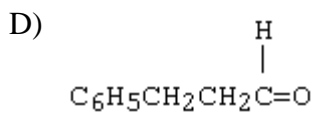
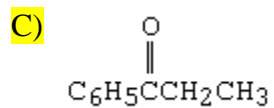
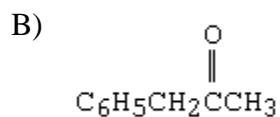
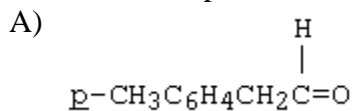
35. A compound, X, $C_9H_{10}O$, gives a strong IR absorption peak at 1690 cm^{-1} and gives the following 1H NMR spectrum.

Triplet, δ 1.2

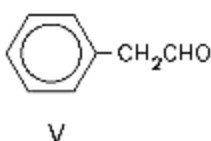
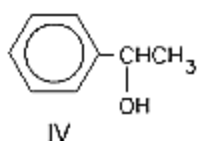
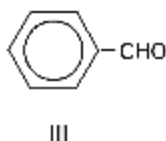
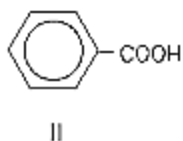
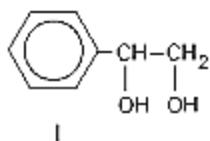
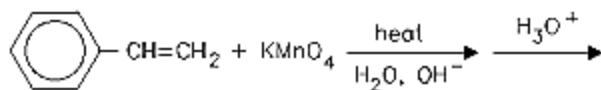
Quartet, δ 3.0

Multiplet, δ 7.7

Which is a possible structure for X?



36. Predict the major organic product of the reaction sequence below



- A) I
- B) II**
- C) III
- D) IV
- E) V

II. Mechanism (8 points)

Using the curved arrow notation and showing all charges on ions and atoms, show the mechanism of the aldol condensation reaction of propanal with itself. Show the steps for the formation of the enolate ion, the attack of the enolate ion, and any protonation or deprotonation reactions that may occur. If acid and heat are added after the reaction has occurred, what product would be produced?