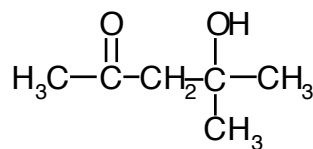


Reading Passage:

Following an experimental workup procedure, a Chem 227 student treated a carbonyl containing starting material with NaOH using acetone $[(\text{CH}_3)_2\text{C}=\text{O}]$ as a solvent. The starting material was recovered unreacted. And, the student isolated a small amount of Product A (shown below).



Product A

She determined that Product A resulted from the aldol self-condensation of acetone. Product A was identified based on the following observations.

Observations about Product A

1. Elemental analysis of Product A indicated that it consisted only of carbon, hydrogen, and oxygen.
2. Product A had a molecular weight of 116 g/mole.
3. Characteristic signals in the infrared spectrum of Product A included a broad band at 3400 cm^{-1} and an intense signal at 1720 cm^{-1} .
4. Product A was a methyl ketone because it gave a positive iodoform test.
5. When Product A was treated with Br_2 in CCl_4 , the red bromine color persisted, because no carbon-carbon double bonds were present to react with the bromine

The structure of Product A was further confirmed when treatment with hot sulfuric acid resulted in the corresponding dehydration product, Product B.

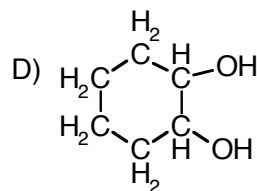
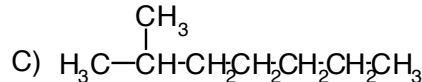
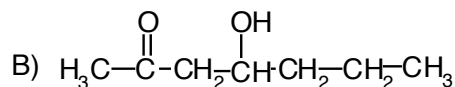
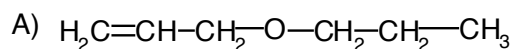
1. What is the molecular weight of a compound that undergoes an aldol self-condensation reaction to result in a (3-hydroxy ketone with a molecular weight of 144?

- A) 70 g/mole
B) 72 g/mole
C) 74 g/mole
D) 76 g/mole

2. The aldol self-condensation of acetone is an equilibrium that favors acetone over its condensation product. Which of the following experimental modifications is most likely to shift the position of equilibrium toward Product A?

- A) Using only a catalytic amount of NaOH
B) Using only a catalytic amount of acetone
C) Removing Product A as it is formed
D) Increasing the reaction temperature to the boiling point of acetone

3. If *only* Observations 1 and 2 are considered, which of the following compounds could have been Product A?



4. When a drop of Br_2 in CCl_4 is added to Product B, the resulting solution will be:

- A) colorless, because Product B does not contain a carbon-carbon double bond.
B) colorless, because Product B contains a carbon-carbon double bond.
C) red, because Product B does not contain a carbon-carbon double bond.
D) red, because Product B contains a carbon-carbon double bond.

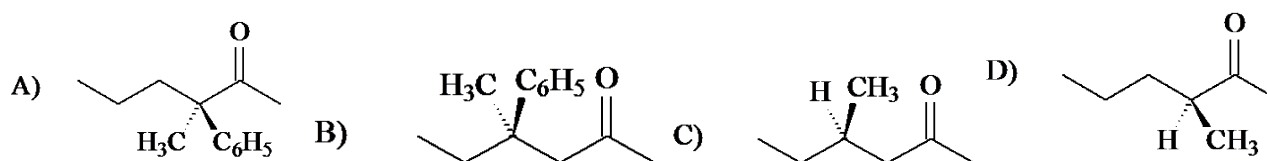
5. The student obtained a proton NMR spectrum of a sample of the isolated Product A. If the sample were contaminated with acetone, how many extra signals corresponding to the acetone would be present in the spectrum?

- A) 1
B) 2
C) 3
D) 6

6. Which of the following compounds from the passage will give a positive iodoform test?

- A) Product A only
B) Product A and Product B only
C) Product A and acetone only
D) Product A, Product B, and acetone

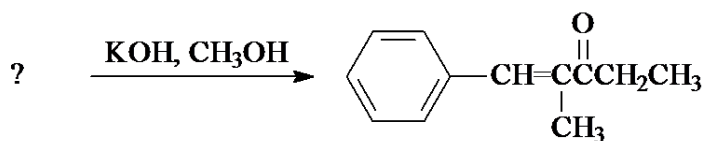
7. Which one of the following optically active compounds racemizes in dilute KOH/CH₃OH solution?



8. 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 isomers - not stereoisomers.)

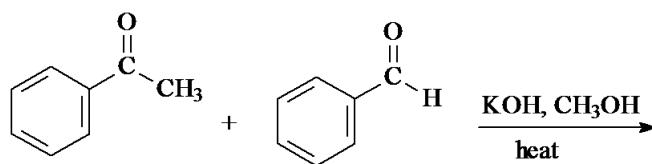
- A. only one B. two C. three D. four


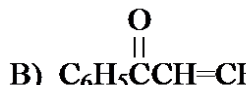
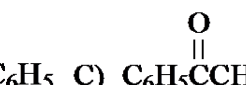
9. Identify the starting reagents needed to make the following compound by a mixed aldol condensation.



- A. benzaldehyde (C₆H₅CH=O) and 3-pentanone
B. benzaldehyde (C₆H₅CH=O) and 2-pentanone
C. acetophenone (methyl phenyl ketone) and 2-butanone
D. acetophenone (methyl phenyl ketone) and butanal

10. Which of the following is the mixed aldol condensation product of the reaction shown below



- A)  B)  C)  D) 