

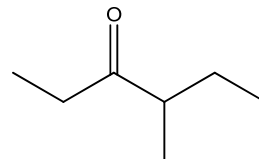
I. Circle the correct answer to the following questions: (30 points)

1. What is the purpose of the acid catalyst in an acid-catalyzed addition to a carbonyl?

- A. help the carbonyl compound dissolve in the solvent
B. make the nucleophile stronger
C. make the carbonyl more electrophilic
D. protonate the nucleophile

2. What is the IUPAC name of the following compound?

- E. ethylisobutylketone
F. isobutylethylketone
G. isobutyl-3-propanone
H. 4-methyl-3-hexanone



3. Which of the following best describes the mechanism for the formation of an imine from the reaction between an aldehyde and a 1° amine (RNH₂)?

- I. electrophilic addition followed by an S_N1 reaction
J. addition followed by an S_N2 reaction
K. an S_N1 reaction followed by a dehydration
L. nucleophilic addition followed by an elimination

4. Which of the following is the best base for forming an enolate in an **irreversible** manner?

- M. NaOH
N. LDA
O. NEt₃
P. NaOEt

5. Which of the following undergoes rapid thermal decarboxylation?

- Q. CH₃COCH₂CH₂CO₂H
R. CH₃COCH₂COCH₃
S. CH₃COCH(Ph)CO₂H
T. CH₃CH₂OCH(Ph)CH₂OH

6. When nucleophilic addition to carbonyl groups occurs, what is the change in hybridization of the carbon being attacked?

- U. sp₂ → sp₃
V. sp₃ → sp₂
W. sp₂ → sp
X. sp → sp₃

7. Which of the following acts as a nucleophile in the acid catalyzed aldol reaction of butanal??

- Y. an enolate
Z. an alkoxide
AA. an enol
BB. an aldol

8. Which of the following pairs of compounds would produce a high yield of a single compound in a Claisen condensation.?

- CC. ethyl acetate and propyl acetate
DD. ethyl acetate and ethyl propionate
EE. ethyl benzoate and ethyl formate
FF. ethyl acetate and ethyl benzoate

9. Which of the following has the greatest equilibrium constant for enolization

- GG. acetone
HH. 2,4-cyclohexadienone
II. acetaldehyde
JJ. methanol

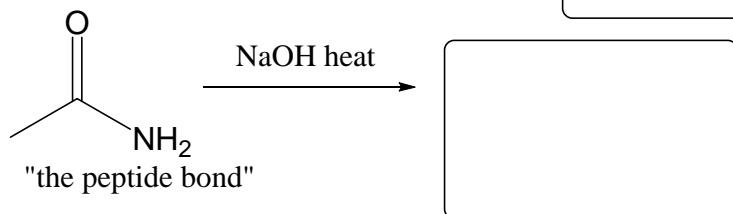
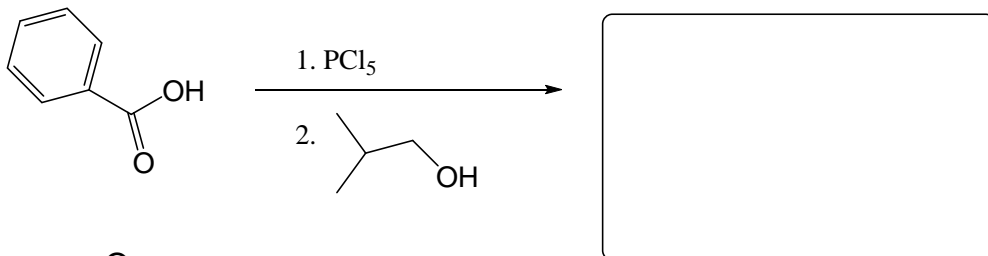
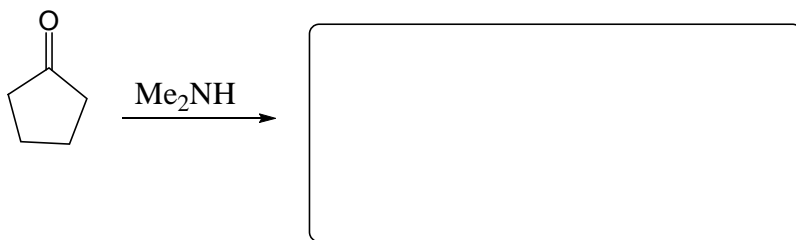
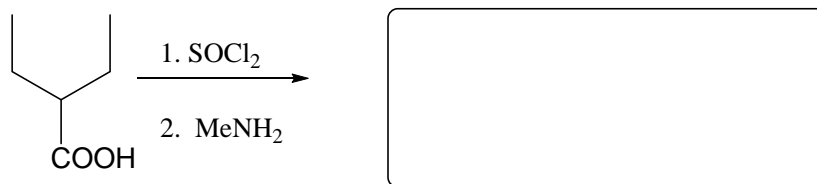
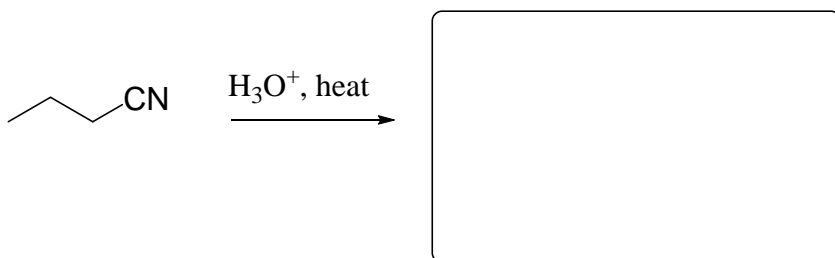
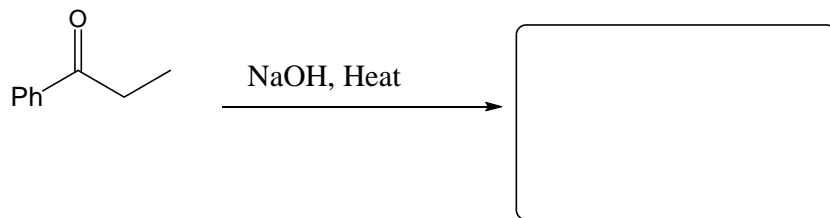
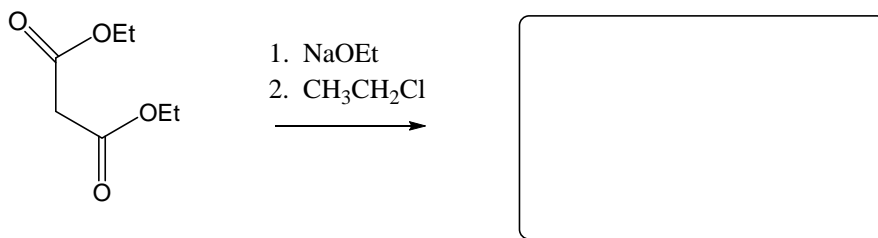
10. Hydroxide is a poor leaving group in S_N and E reactions. However, it is the leaving group in base catalyzed aldol condensations. Which of the following explains this observation?

- KK. hydroxide departs to give a very stable cation
LL. the loss of hydroxide in the aldol condensation is not an S_N or E reaction
MM. the product of the aldol condensation is a stable resonance stabilized enone
NN. the hydroxyl group is protonated prior to leaving in the aldol condensation

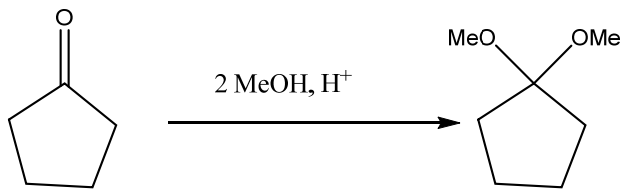
Short Answer:

II. What is saponification? How does it remove oil/dirt? (10 points)

III. Show the **Major** Product for the following reactions: (30 points)



IV. Using curved arrows, propose a mechanism for the below formation of an acetal. (10 points)



V. Describe how PET (polyethylene terephthalate) is synthesized. What reagents are required? What is the chemical structure of PET. (10 points)

VI. Synthesize following molecules. These transformations cannot be performed in a single step. Provide a sequence of reactions to perform each transformation, showing reagents and structures of isolated intermediates. **All carbon atoms in the product must be obtained from the given starting materials, methylbenzene (toluene) or other starting materials of four carbons or less. (10 points)**

