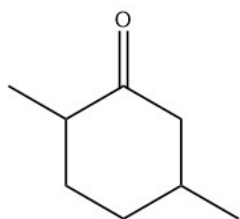
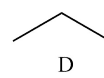
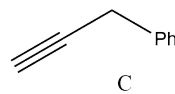
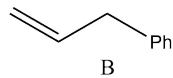
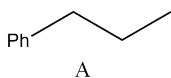


**Part I. Multiple Choice.** Circle the number that corresponds to the answer to each question. There is only **one correct answer** for each question.

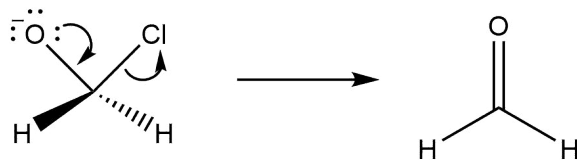
- Which of the following mechanisms involve an **iminium cation**?
  - Michael Addition
  - Robinson Annulation
  - Mannich Reaction
  - Claisen Condensation
- What is the **IUPAC name** for the following chemical?



- 2,5-dimethylcyclohexan-1-one
  - 1,4-dimethylcyclohexan-5-one
  - 2,5-dimethylphen-1-one
  - 2,5-dimethylcyclohexan-1-al
- Which of the following chemicals is **most acidic**?



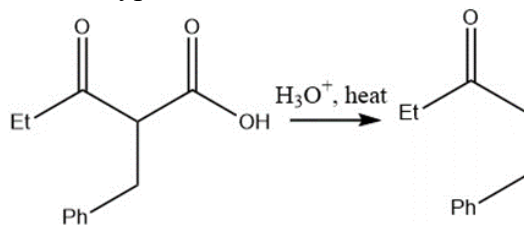
- What **localized orbital interaction** is depicted in the elementary step below?



- $n \rightarrow a$
- $\sigma \rightarrow a$

- $n \rightarrow \sigma^*$
- $\sigma \rightarrow \sigma^*$

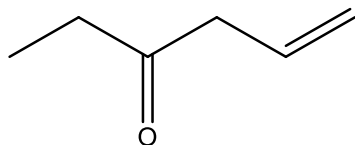
- What is the type of the **intermediate** formed during an acid-catalyzed decarboxylation?



- Enolate
- Carbocation

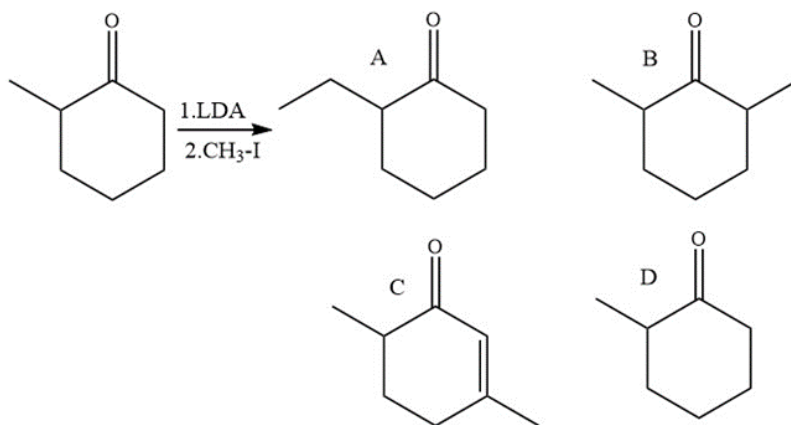
- Enol
- Alkoxide

6. What is the IUPAC name for the following chemical?



- a. 5-Hexen-3-one  
 b. 1-Hexen-4-one  
 c. 5-Hexen-3-al  
 d. (5,3)-Hexenol
7. What is the name of the alcohol obtained by hydrolysis of a glycoside?
- a. Glucose  
 b. Aglycone  
 c. Tetrose  
 d. Methanol
8. Which of the following best explains how an enzyme catalyzes reactions?
- a. it lowers  $\Delta G^\ddagger$   
 b. it raises  $\Delta G^\ddagger$   
 c. it increases  $\Delta G$   
 d. It provides an achiral environment for the reaction to occur.
9. Which of the following factors **the least** in the determination of the acidity of molecules?
- a. Electronegativity  
 b. Resonance  
 c. Hybridization  
 d. Stereochemistry
10. What type of reaction occurs **when a ketone reacts with lithium aluminum hydride** to create a secondary alcohol?
- a. Nucleophilic addition  
 b. Electrophilic addition  
 c. Nucleophilic substitution  
 d. Electrophilic substitution
11. Which of the following is **true** about the Wittig reaction (reaction of an aldehyde/ketone with a phosphorus ylide)?
- a. The product of the reaction is an alkyne  
 b. The reaction creates a cyclic intermediate called oxaphosphetane  
 c. An enol is formed to react with the phosphorus ylide  
 d. Phosphonium ylides are electrophilic
12. Which of the following can convert a primary alcohol into a carboxylic acid?
- a. Chromic Acid  
 b. Lithium Aluminum hydride  
 c. Sodium borohydride  
 d. Swern's reagent

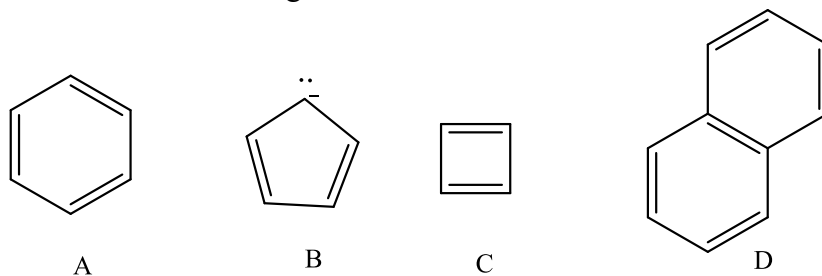
13. What is the major organic product of the following reaction?



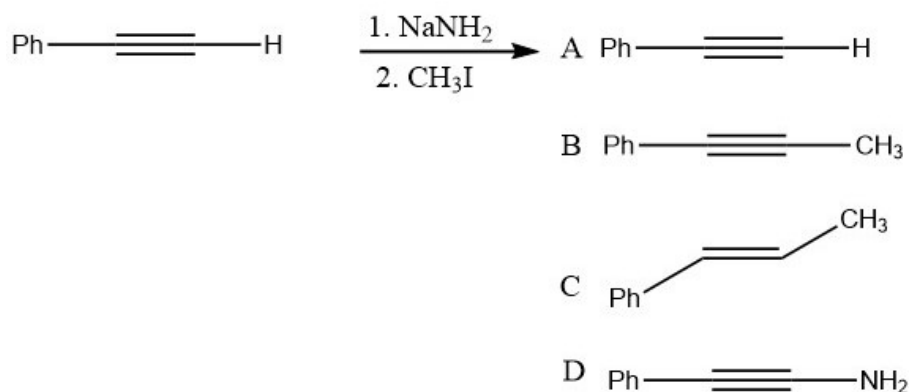
14. Which of the following best describes the key mechanistic steps during **base-catalyzed ester hydrolysis (saponification)**?

- Simultaneous proton transfer and nucleophilic addition with beta-elimination
- Proton transfer, followed by nucleophilic addition and beta-elimination
- Nucleophilic addition, proton transfer, beta elimination, and proton transfer
- Nucleophilic addition and beta elimination

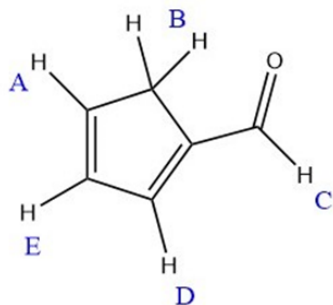
15. Which of the following is **not** aromatic?



16. What is the major product of this reaction?



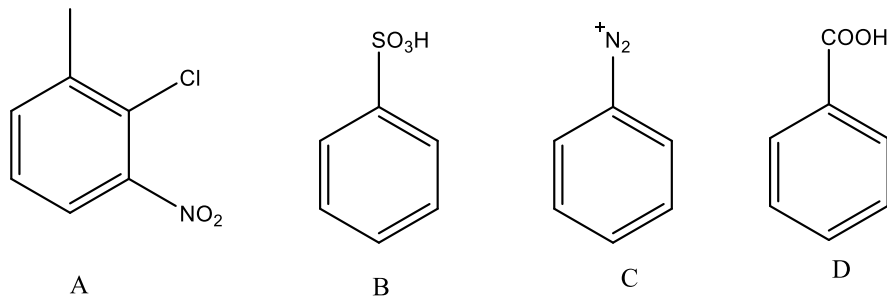
17. Which of the labeled hydrogens is the most acidic?



18. Which of the following reactions can reduce the ketone in phenyl methyl ketone to a  $-\text{CH}_2-$  group?

- a. Dieckmann condensation  
 b. DIBAL-H  
 c. Clemmenson reduction  
 d.  $\text{LiAlH}_4$

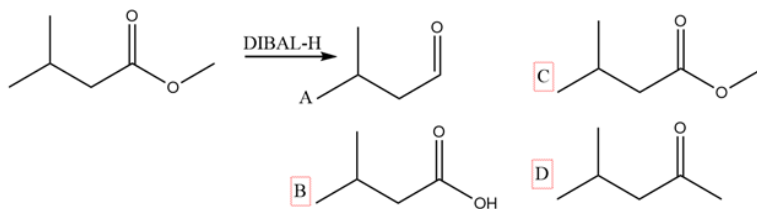
19. Which of the following structures is the product of the reaction of aniline with nitrous acid?



20. Which of the following amino acid residues is **achiral**?

- a. Alanine  
 b. Methionine  
 c. Glutamine  
 d. Glycine

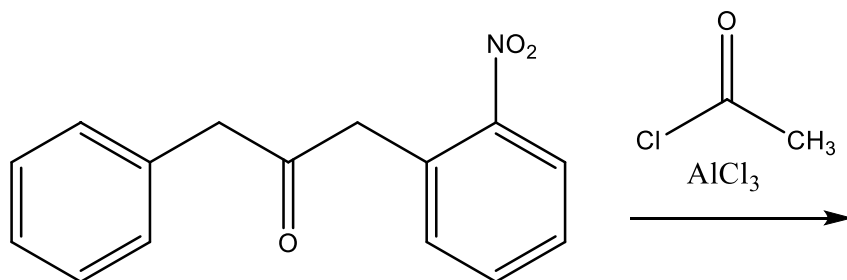
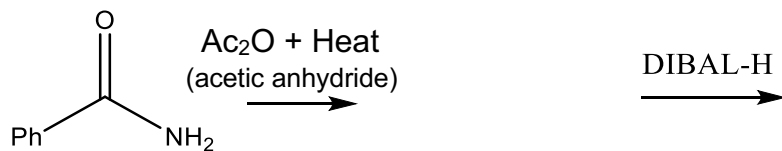
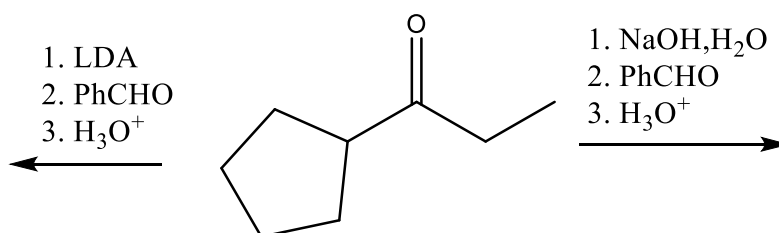
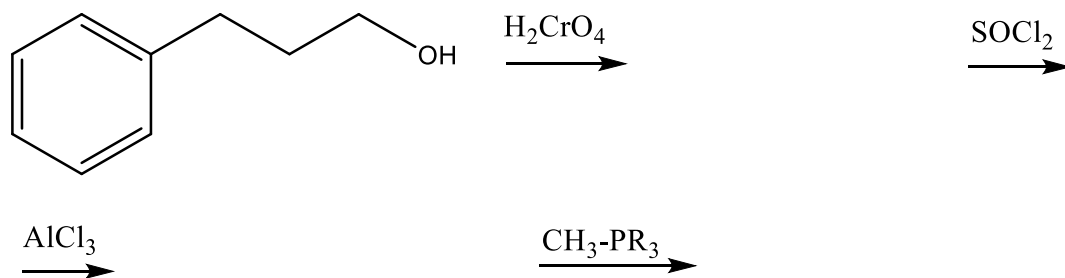
21. What is the major organic product from the following reaction?

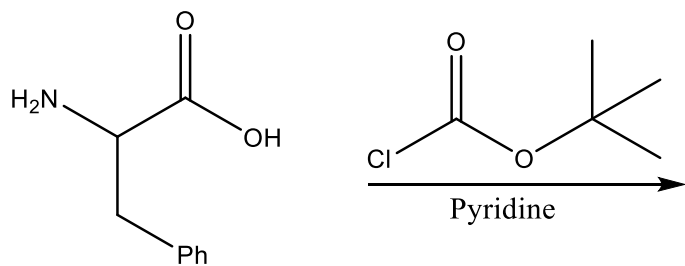


22. Which of the following best describes the key mechanistic steps in the reaction between **an ester and a Grignard reagent**?

- a. Addition followed by protonation  
 b. Substitution followed by decarboxylation  
 c. Addition followed by elimination  
 d. Elimination followed by addition

**Part II. Provide the Answers.** Give the answers for each part of the questions.





## Multiple Choice Answers

- |      |       |       |
|------|-------|-------|
| 1. C | 9. D  | 17. B |
| 2. A | 10. A | 18. C |
| 3. C | 11. B | 19. C |
| 4. C | 12. A | 20. D |
| 5. C | 13. B | 21. A |
| 6. A | 14. D | 22. C |
| 7. B | 15. C |       |
| 8. A | 16. B |       |