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Organic Chemistry II Drill (CHEM 2220D) Practice Final Exam.

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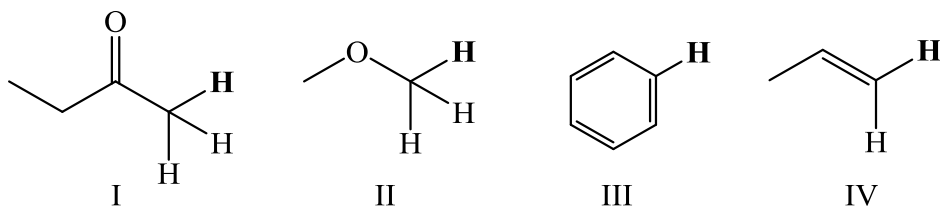
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Practice Final Exam, Chemistry 2220, Organic Chemistry II

1. Rank the designated protons by ^1H NMR chemical shift (δ), highest δ first.



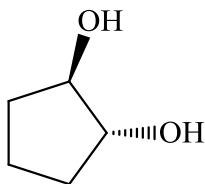
- A. $\text{IV} > \text{III} > \text{II} > \text{I}$ B. $\text{IV} > \text{II} > \text{III} > \text{I}$ C. $\text{III} > \text{IV} > \text{II} > \text{I}$ D. $\text{III} > \text{IV} > \text{I} > \text{II}$

2. What are the products, if any, expected from the following reaction?



- A. $\text{CH}_3\text{OCH}_3 + \text{NaSH}$ B. $\text{CH}_3\text{SCH}_3 + \text{NaOH}$ C. $\text{CH}_3\text{O}-\text{H} + \text{CH}_3\text{S}^-\text{Na}^+$ D. no reaction

3. What is the IUPAC name for the following compound?



- A. *cis*-1,2-cyclopentanediol B. *meso*-1,2-cyclopentanediol
 C. (1*R*,2*R*)-1,2-cyclopentanediol D. (1*R*,2*S*)-1,2-cyclopentanediol

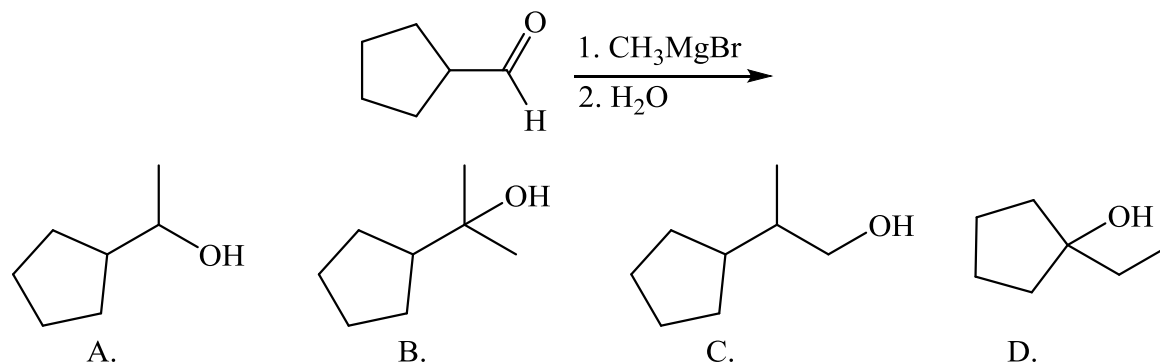
4. Which statement explains why cyclohexanol has a pK_a of 18 and phenol has a pK_a of 10?

- A. Phenolate is a stronger base than the conjugate base of cyclohexanol.
 B. The conjugate base of cyclohexanol is resonance stabilized.
 C. The conjugate base of phenol is resonance stabilized.
 D. Phenol is a weaker acid than cyclohexanol.

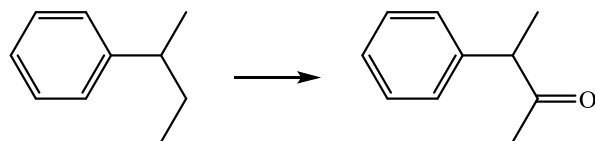
5. Which one of the following compounds is NOT a product of the reaction between 1,3-butadiene and HBr?

- A. (*S*)-3-bromo-1-butene B. (*R*)-3-bromo-1-butene
 C. (*Z*)-2-bromo-2-butene D. (*E*)-1-bromo-2-butene

6. Predict the product of the following reaction.

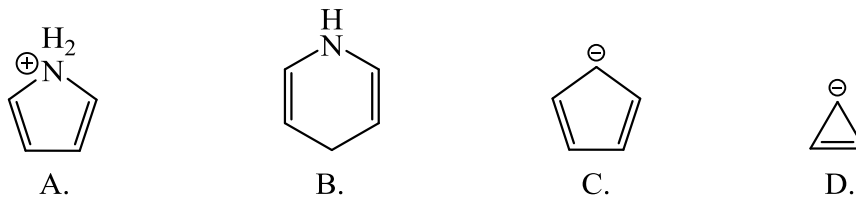


7. Choose the reagents necessary to carry out the following conversion.

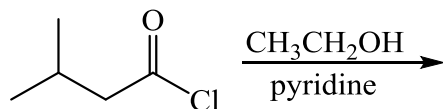


- A. 1. HBr; 2. NaOH/heat; 3. H₃O⁺; 4. PCC
B. 1. Br₂/light; 2. EtONa; 3. BH₃-THF; 4. H₂O₂/NaOH; 5. PCC
C. 1. Br₂/FeBr₃; 2. NaOH; 3. BH₃-THF; 4. H₂O₂/NaOH; 5. CrO₃/H₂SO₄
D. 1. NBS/light; 2. (CH₃)₃CONa; 3. H₃O⁺/heat; 4. PCC

8. Which one of the following compounds is aromatic?

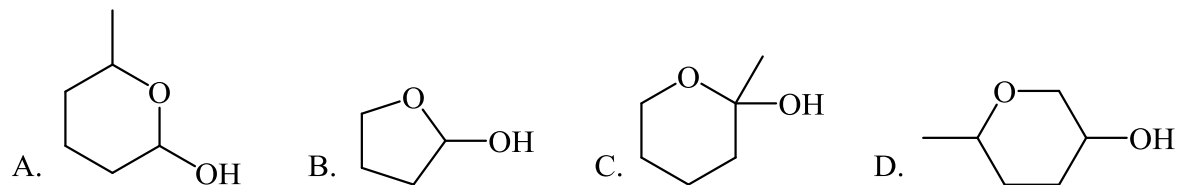
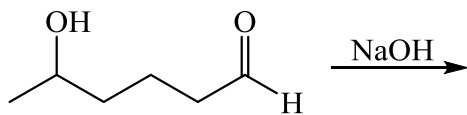


9. Predict the product for the following reaction.

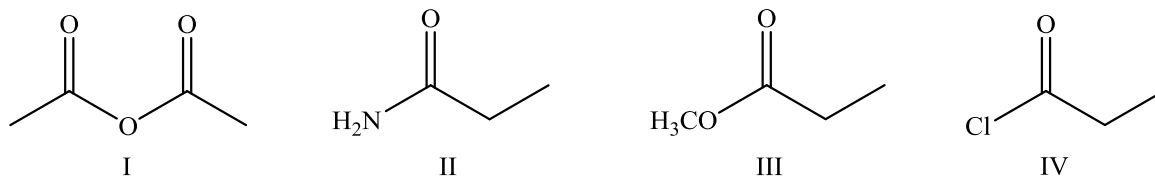


- A. ethyl-3-methylbutanoate
B. ethyl-2-methylpropanoate
C. isobutylethanoate
D. 5-methyl-3-hexanone

10. Predict the product for the following reaction.



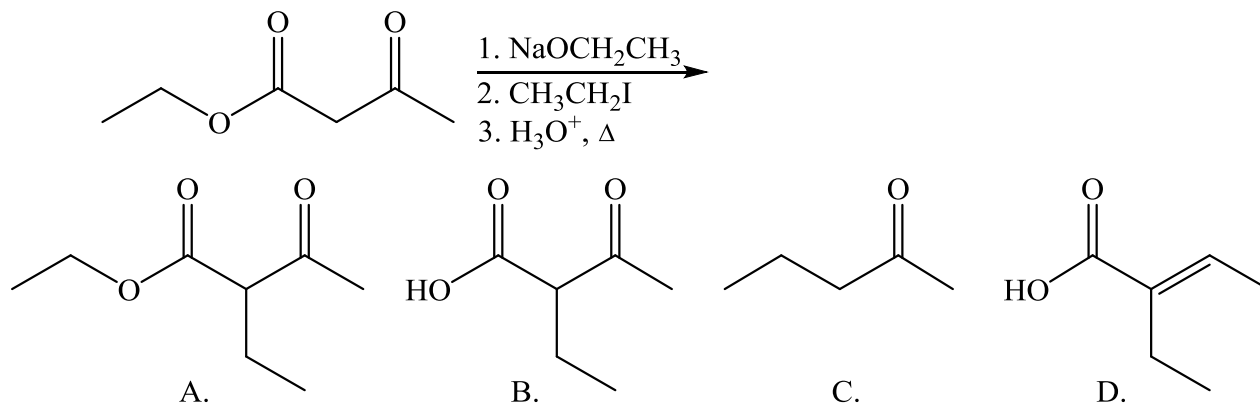
11. Rank the following carboxylic acid derivatives in decreasing order (most to least) of reactivity towards nucleophilic acyl substitution.



A. I > IV > III > II
C. IV > I > III > II

B. II > III > I > IV
D. III > I > II > IV

12. Predict the product for the following reaction sequence:

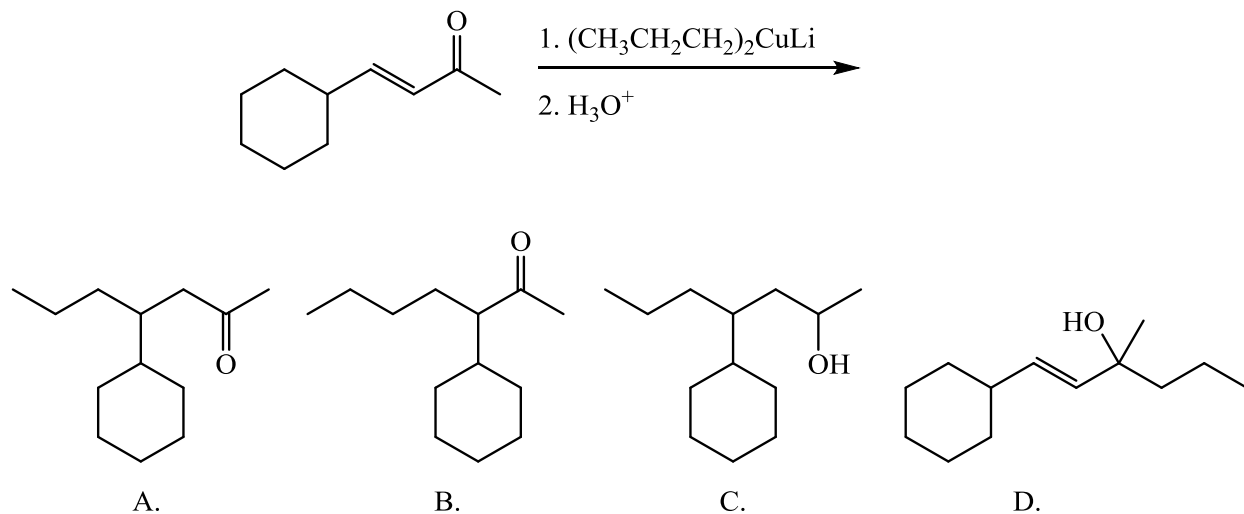


13. Amino acids are connected to each other by_____.

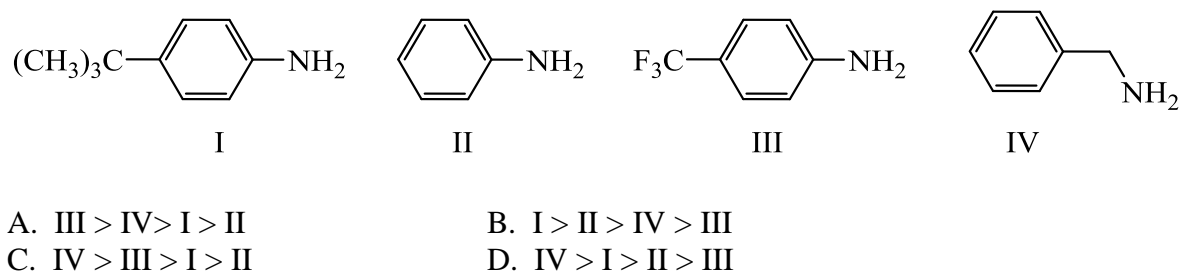
A. an ether linkage
C. an ester linkage

B. an acetal linkage
D. an amide linkage

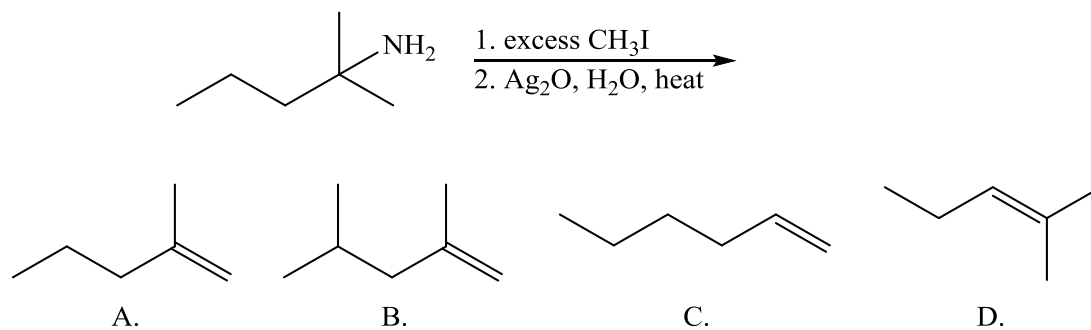
14. Predict the product for the following reaction.



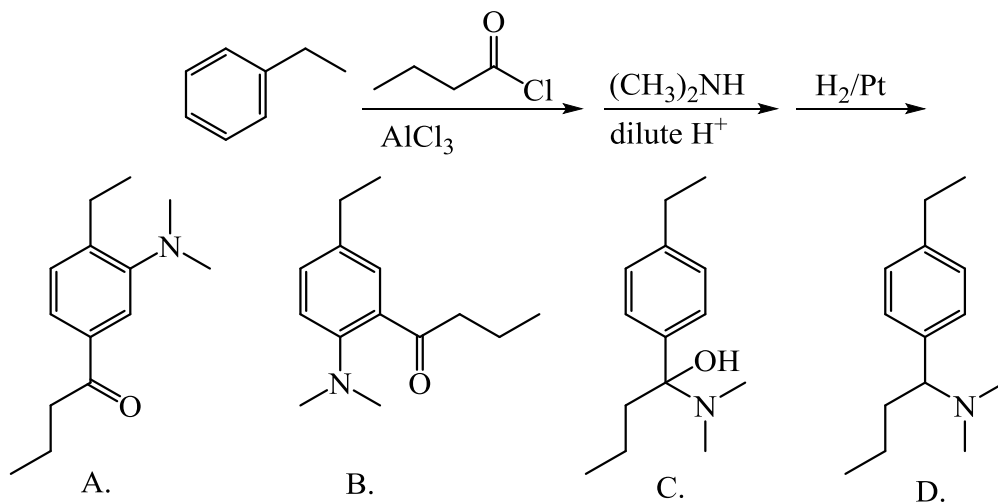
15. Rank the following compounds in decreasing order of basicity, strongest to weakest.



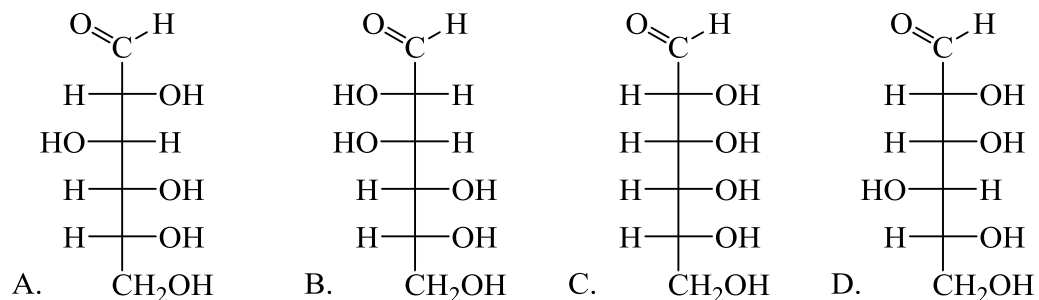
16. Predict the product for the following reaction sequence.



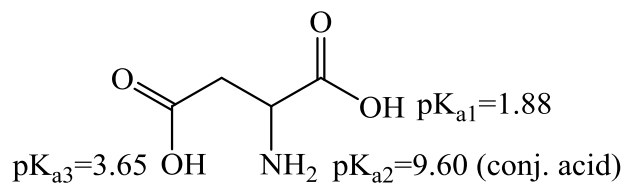
17. Predict the product for the following reaction sequence.



18. Which of the following D-aldoses will produce an optically inactive product when treated with $\text{NaBH}_4/\text{H}_2\text{O}$?

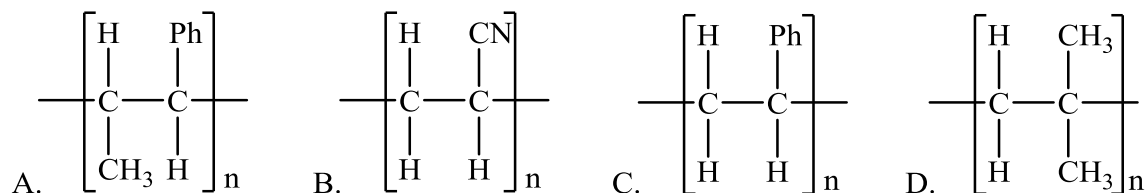


19. What is the pI of the following amino acid?

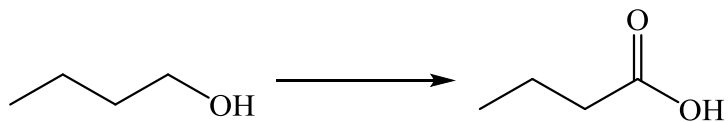


A. 2.76 B. 5.74 C. 6.62 D. 7.5

20. Which one of the following is the correct structure for polyisobutylene?



21. Please choose an appropriate oxidizing reagent for the following reaction.

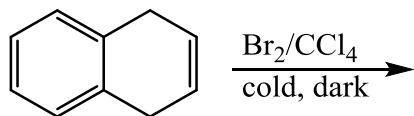


- A. LiAlH₄ B. H₂/Pt C. PCC D. H₂CrO₄

22. Which of these compounds best fits these data? It is soluble in water, and turns red litmus blue. It has only one major IR band, at 2950 cm⁻¹, and has the following ¹H NMR spectrum: 2.7 ppm, 2H; 2.2 ppm, 6H; 1.0 ppm, 3H.

- A. *N,N*-dimethylethanamine
B. propanoic acid
C. 2-propanol
D. 2-methylpropane

23. What is the major product for the following reaction?



- A.
B.
C.
D.

24. Which position is most likely to undergo an EAS reaction?

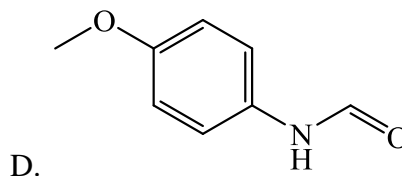
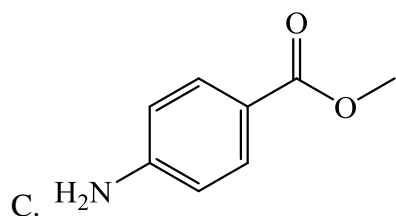
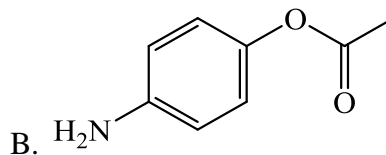
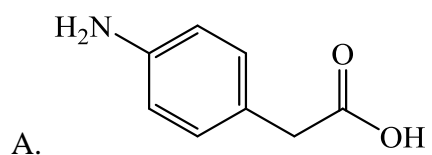
- A.
B.
C.
D.

25. How would you convert an unsaturated fatty acid into a saturated fatty acid?

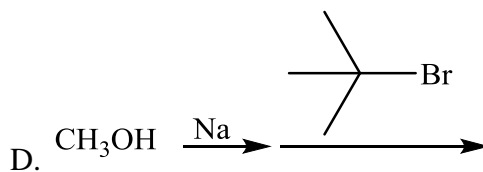
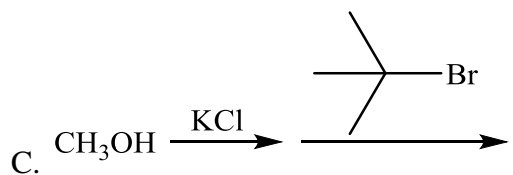
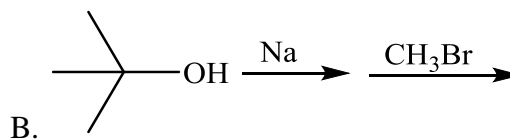
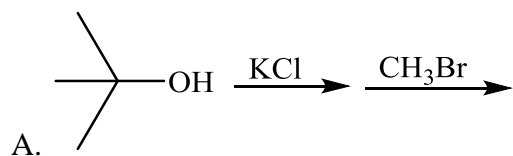
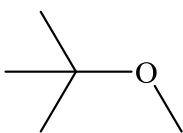
- A. KMnO_4 , OH^- , heat
- B. OH^- , H_2O , heat; then H_3O^+
- C. H_2 , Ni, pressure
- D. H_3O^+ , H_2O , heat

26. What structure has the following proton NMR spectrum?

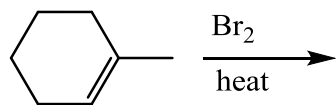
^1H NMR: doublet, 6.6 ppm, 2H
 doublet, 7.8 ppm, 2H
 broad singlet, 4.2 ppm, 2H
 singlet, 2.1 ppm, 3H



27. Which of the following is the correct synthesis of the compound shown?



28. Which is the correct intermediate for the **major product** of following reaction?

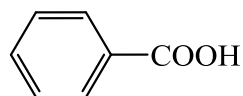


- A. B. C. D.

29. Which of the following molecules has the lowest boiling point?

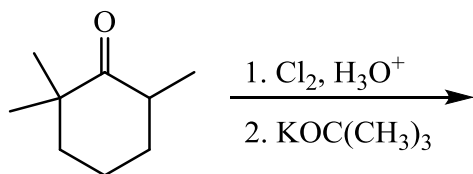
- A. $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$ B. $\text{CH}_3\text{CH}_2\text{NHCH}_3$
 C. $(\text{CH}_3)_3\text{N}$ D. $(\text{CH}_3)_3\text{NHCl}$

30. Starting from benzene, what is the correct synthesis of the compound below?



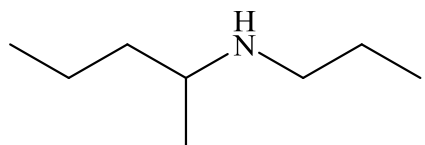
- A. $\xrightarrow{\text{Br}_2/\text{FeBr}_3} \xrightarrow{\text{Mg/ether}} \xrightarrow{\text{H}_2\text{C=O}} \xrightarrow{\text{H}_3\text{O}^{\oplus}}$
 B. $\xrightarrow{\text{Br}_2/\text{FeBr}_3} \xrightarrow{\text{NaCN}} \xrightarrow{\text{H}_3\text{O}^{\oplus}}$
 C. $\xrightarrow{\text{CH}_3\text{CH}_2\text{Cl, AlCl}_3} \xrightarrow{\text{Na}_2\text{Cr}_2\text{O}_7} \xrightarrow{\text{H}_3\text{O}^{\oplus}}$
 D. $\xrightarrow{\text{CH}_3\text{Cl, AlCl}_3} \xrightarrow{\text{Br}_2/\text{heat}} \xrightarrow{\text{NaCN}} \xrightarrow{\text{H}_3\text{O}^{\oplus}}$

31. What is the major product for the following reaction?



- A. B. C. D.

32. What is the IUPAC name for the following compound?

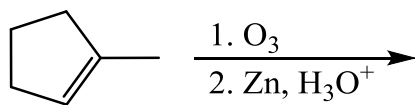


- A. 1-methyl-*N*-butyl-1-butanamine
 B. 4-methyl-5-octanamine
 C. 1-ethyl-*N*-propyl-1-pentanamine
 D. *N*-propyl-2-pentanamine

33. A pentapeptide has the molecular composition: Arg, Glu, Ile, Phe, Leu. After partial hydrolysis, the fragments are: Glu-Ile, Leu-Arg, Phe-Leu, Arg-Glu. What is the sequence?

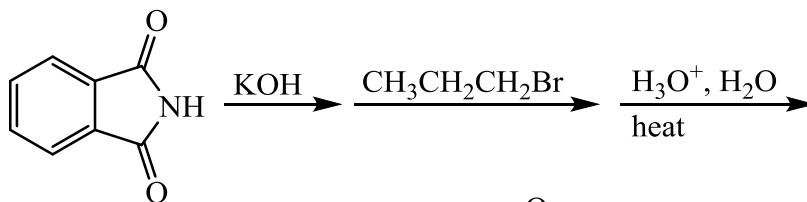
- A. Phe-Leu-Arg-Glu-Ile
 B. Ile-Glu-Arg-Leu-Phe
 C. Arg-Glu-Ile-Phe-Leu
 D. Phe-Leu-Glu-Ile-Arg

34. Predict the product for the following reaction.



- A. B. C. D.

35. What is the product of the following reaction?



- A. B. C. D.

36. Which of the following compounds is able to undergo a self-aldol condensation?

- A. phenylethanal
- B. formaldehyde
- C. benzaldehyde
- D. 2,2-dimethylpropanal

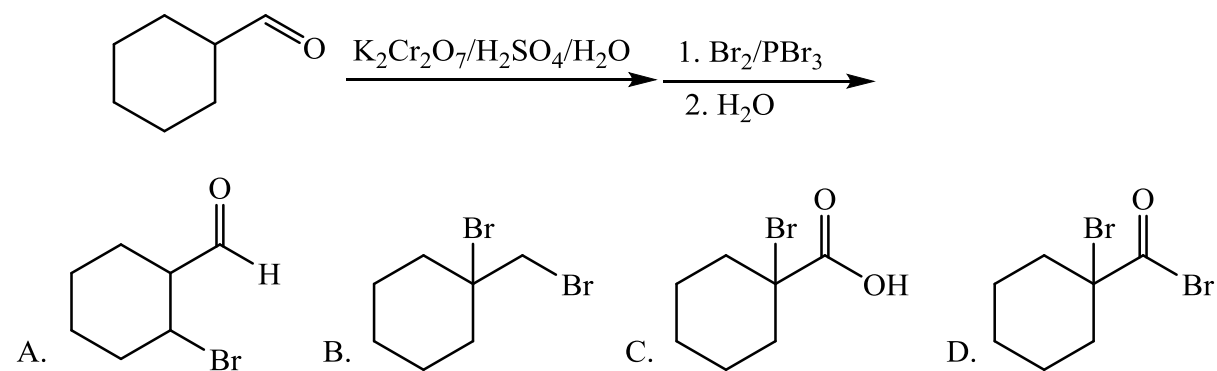
37. The best synthesis of 1,4-dimethyl-2-nitrobenzene is:

- A. Benzene $\xrightarrow[2. 2 \text{ CH}_3\text{Cl}, 2 \text{ AlCl}_3]{1. \text{ HNO}_3, \text{ H}_2\text{SO}_4}$
- B. toluene $\xrightarrow[2. \text{ CH}_3\text{Cl}, \text{ AlCl}_3]{1. \text{ HNO}_3, \text{ H}_2\text{SO}_4}$
- C. *p*-xylene $\xrightarrow{\text{ HNO}_3, \text{ H}_2\text{SO}_4}$
- D. *m*-nitrotoluene $\xrightarrow{\text{ CH}_3\text{Cl}, \text{ AlCl}_3}$

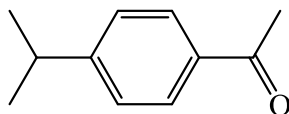
38. Which of these is the most reliable way to make 3-heptene?

- A. $\text{CH}_3\text{CH}_2\text{CHBrCH}_2\text{CH}_2\text{CH}_2\text{CH}_3 + \text{NaOCH}_3, \text{ heat}$
- B. $\text{CH}_3\text{CH}_2\text{CH}=\text{O} + \text{Ph}_3\text{P}=\text{CHCH}_2\text{CH}_2\text{CH}_3$
- C. $\text{CH}_3\text{CH}_2\text{CHOHCH}_2\text{CH}_2\text{CH}_2\text{CH}_3 + \text{H}_2\text{SO}_4, \text{ heat}$
- D. $\text{CH}_3\text{CH}_2\text{C}\equiv\text{CCH}_2\text{CH}_2\text{CH}_3 + \text{H}_2/\text{Pt}$

39. Predict the major product for the following reaction.

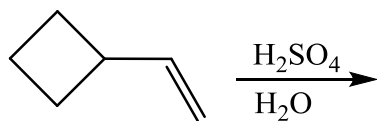


40. Please indicate the # of signals in the ^{13}C NMR and ^1H NMR spectra for the following compound:



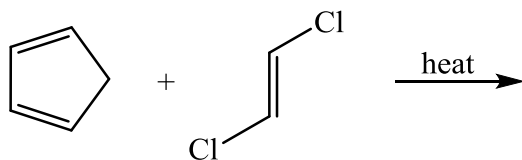
- A. 4 ^{13}C NMR and 4 ^1H NMR B. 10 ^{13}C NMR and 7 ^1H NMR
 C. 6 ^{13}C NMR and 4 ^1H NMR D. 8 ^{13}C NMR and 5 ^1H NMR

41. What is the major product of this reaction?



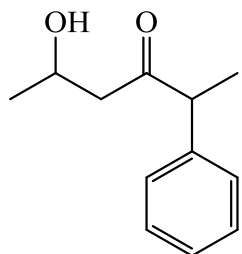
- A.
- B.
- C.
- D.

42. Predict the product of the following reaction.



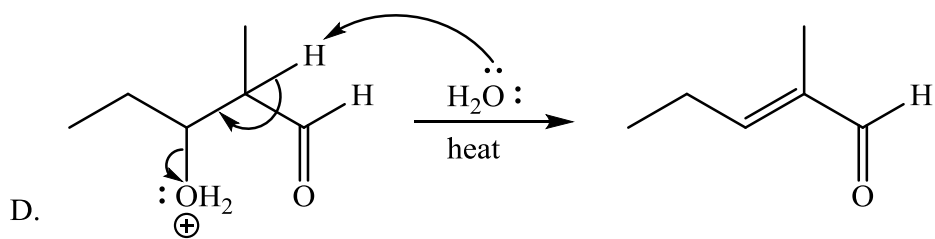
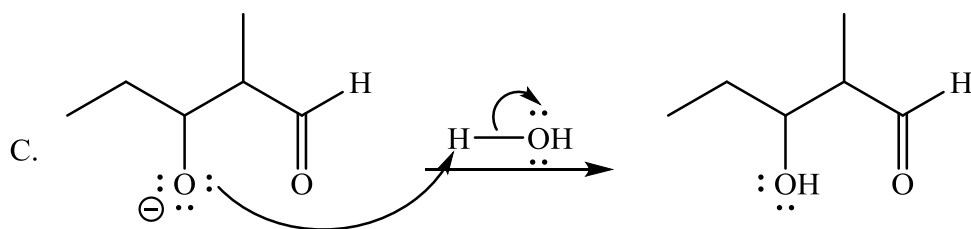
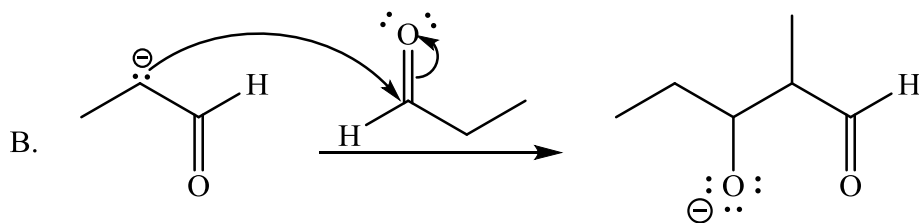
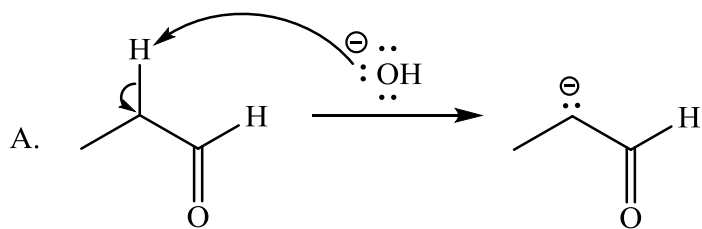
- A.
- B.
- C.
- D.

43. What is the IUPAC name for:



- A. 5-hydroxy-2-phenyl-3-hexanone B. 2-hydroxy-5-phenyl-4-hexanone
 C. 2-hydroxypropyl-1-phenylethylketone D. 5-hydroxy-3-keto-2-phenylhexane

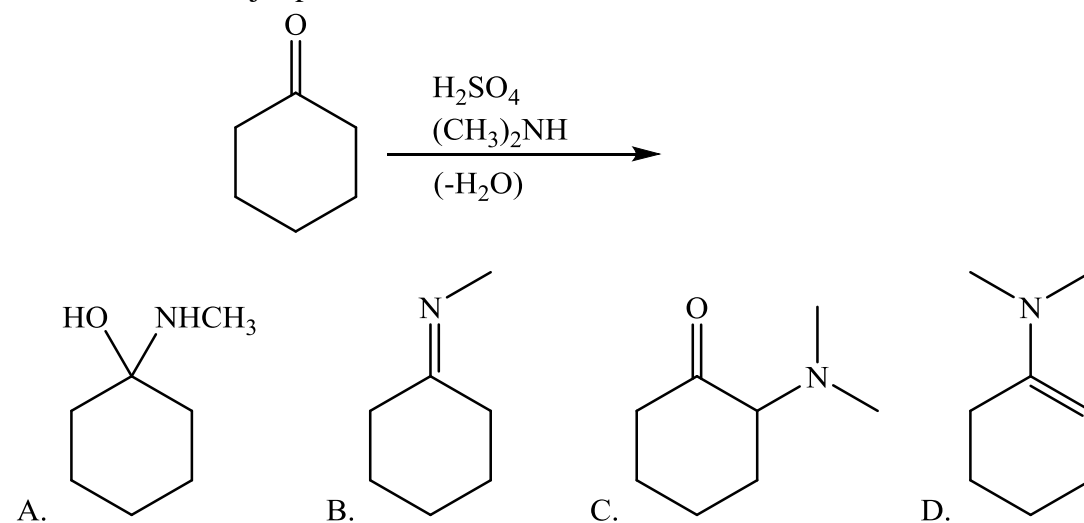
44. Which step is not part of the base-catalyzed aldol condensation mechanism?



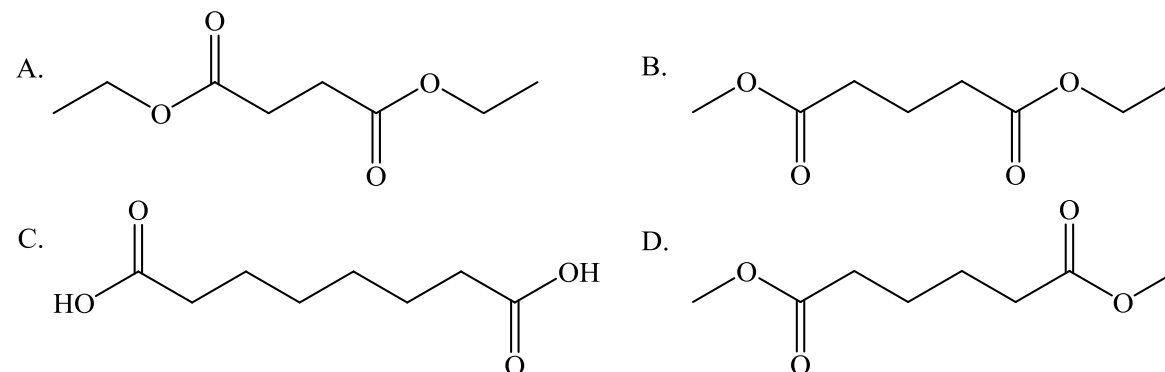
45. Which is true for aromatic but **not** antiaromatic compounds?

- A. Are cyclic and planar
- B. Are monocyclic
- C. Have a conjugated system with p orbital at every vertex
- D. Satisfy Hückel's rule

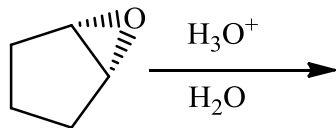
46. What is the major product of this reaction?



47. A compound with the molecular formula $\text{C}_8\text{H}_{14}\text{O}_4$ shows an IR band at 1740 cm^{-1} but not $2500\text{-}3500\text{ cm}^{-1}$. The proton NMR spectrum consists only of a triplet at 1.3 ppm, a triplet at 2.6 ppm and a singlet at 4.2 ppm. The most likely structure is:

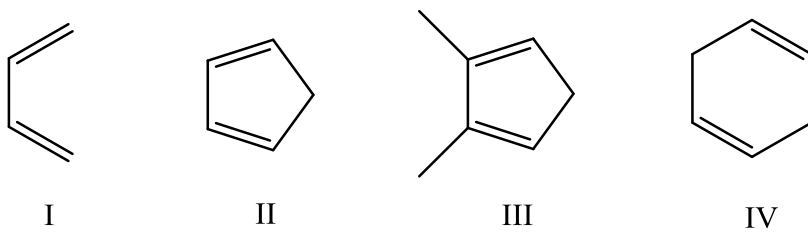


48. Predict the product(s) for the following reaction.



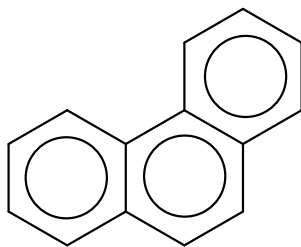
- A.
- B.
- C. + enantiomer
- D.

49. Rank the reactivity of the following dienes with maleic anhydride, starting with the fastest.



- A. IV > I > II > III
 B. III > IV > II > I
 C. III > II > I > IV
 D. IV > III > II > I

50. How many pi electrons are there in the following aromatic compound?



- A. 14
 B. 16
 C. 12
 D. 18