

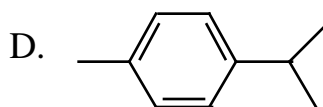
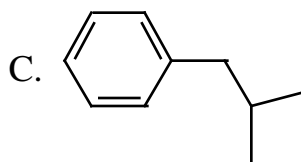
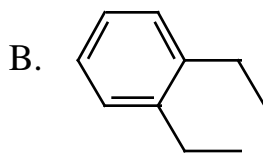
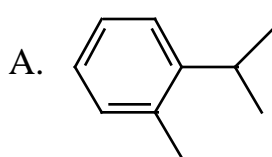
1. What is the structure of the compound having the formula $C_{10}H_{14}$ and the following proton NMR spectrum data?

7.1 ppm, multiplet, 4 H

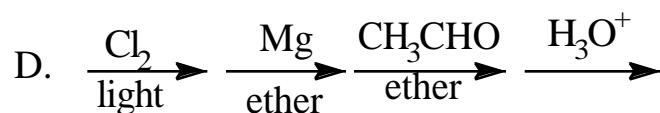
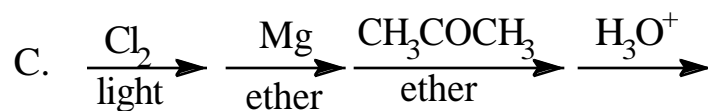
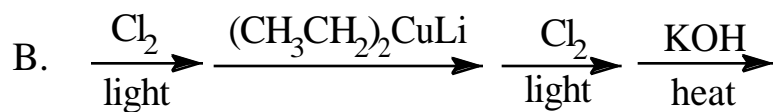
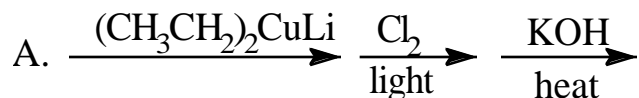
2.8 ppm, septet, 1 H

2.3 ppm, singlet, 3 H

1.2 ppm, doublet, 6 H



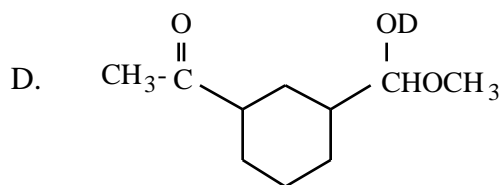
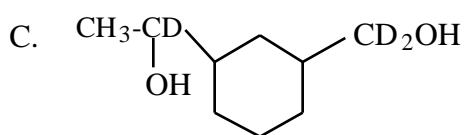
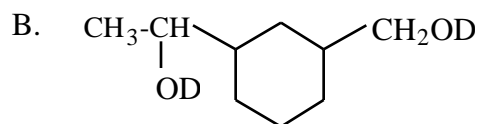
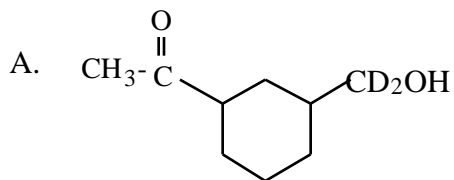
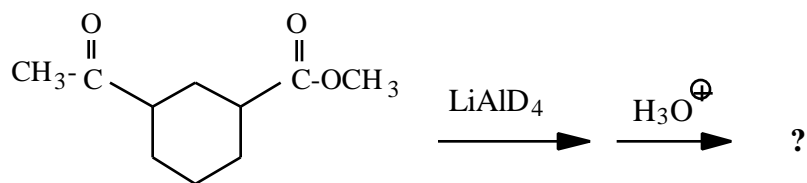
2. Which of the following pathways is the BEST for the synthesis of 2-butanol from ethane?



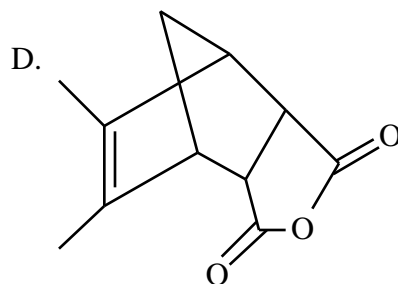
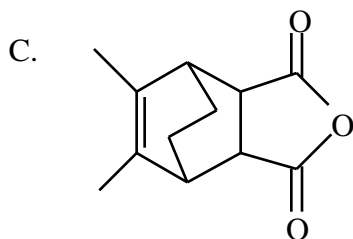
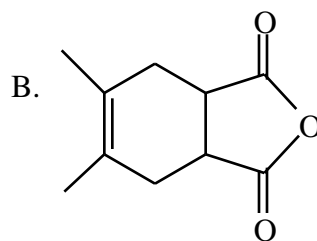
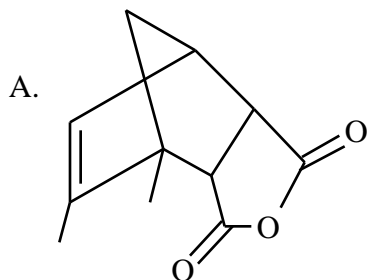
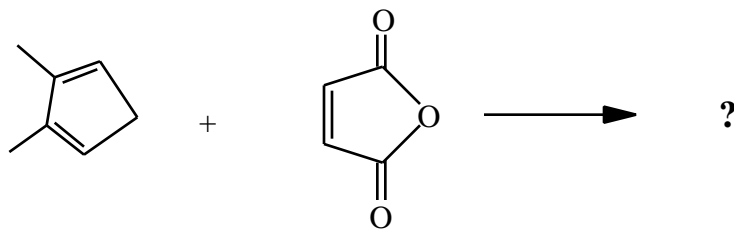
3. Which of the following functional groups is present in all polypeptides?

A. Alcohol B. Carboxylic acid C. Amine D. Amide

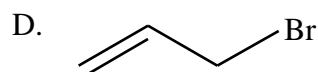
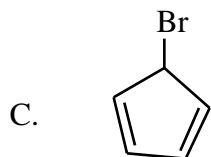
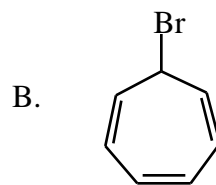
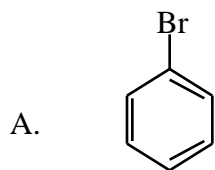
4. What is the major product of the reaction shown?



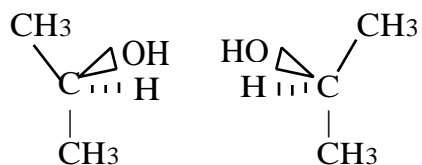
5. What is the major organic product of the reaction shown?



6. Which of the following bromides would ionize most rapidly to form a carbocation?

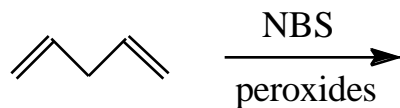


7. What is the relationship between the structures shown?



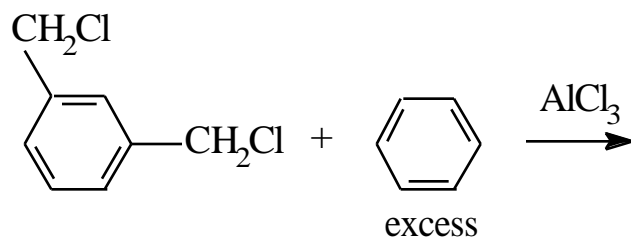
- A. Same compound
- B. Enantiomers
- C. Diastereomers
- D. Structural isomers

8. What is(are) the major organic product(s) expected from the following reaction?



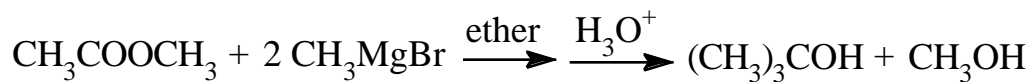
- A.
- B.
- C.
- D.

9. What is the major organic product expected from the following reaction?



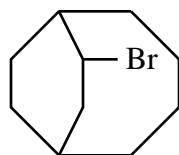
- A. c1ccccc1Cl B. ClC1=CC=C(Cl)C=C1
 C. ClC1=CC=C(Cl)C=C1 D. c1ccc(cc1)CC2=CC=C(Cc3ccccc3)C=C2

10. Which of the following is an INTERMEDIATE in the following reaction?



- A. CH3CH(OH)CH3 B. CH3COO[Mg+](Br)-
 C. (CH3)2CO D. [Mg+](Br)C(=O)CH3

11. What is the IUPAC name of the compound shown?



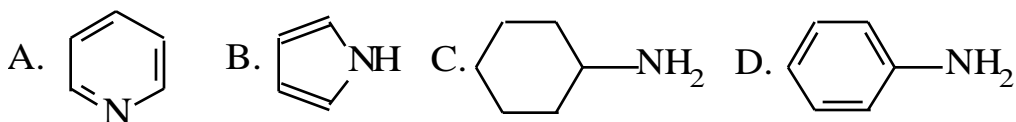
- A. 2-bromobicyclo[4.2.2]decane
 B. 3-bromobicyclo[4.2.2]decane
 C. 7-bromobicyclo[4.2.2]decane
 D. 8-bromobicyclo[4.2.2]decane

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

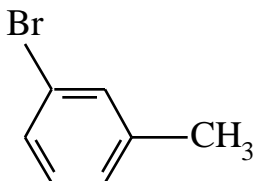


- A. $\text{CH}_3\text{CONHCH}_3$ B. $\text{CH}_3\text{COONHCH}_3$
C. $\text{CH}_3\text{COO}^\ominus \text{NH}_3^\oplus \text{CH}_3$ D. $\text{CH}_3\text{COO}^\ominus \text{NH}_4^\oplus$

13. Which of the following compounds is the weakest base?

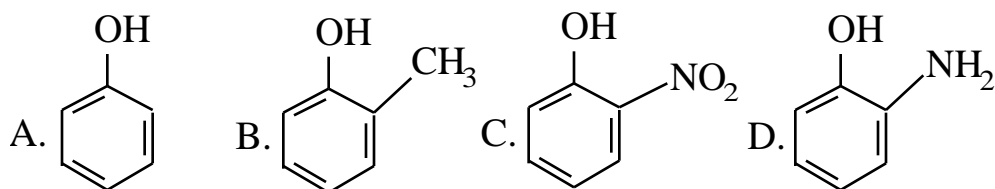


14. Which of the following pathways is the best for the synthesis of *m*-bromotoluene (the formula is shown below) from benzene?

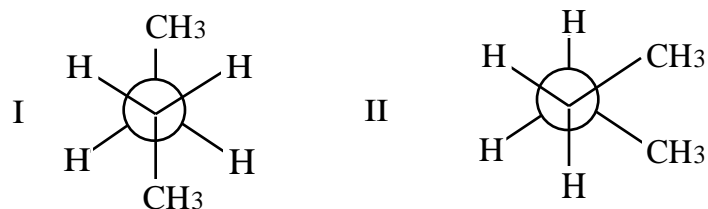


- A. $\text{CH}_3\text{COCl} \xrightarrow{\text{AlCl}_3} \text{Br}_2 \xrightarrow{\text{FeBr}_3} \text{Zn(Hg)} \xrightarrow{\text{HCl}}$
- B. $\text{CH}_3\text{COCl} \xrightarrow{\text{AlCl}_3} \text{Zn(Hg)} \xrightarrow{\text{HCl}} \text{Br}_2 \xrightarrow{\text{FeBr}_3}$
- C. $\text{CH}_3\text{Br} \xrightarrow{\text{AlCl}_3} \text{HNO}_3 \xrightarrow{\text{H}_2\text{SO}_4} \text{H}_2 \xrightarrow{\text{Pt}} \text{NaNO}_2 \xrightarrow{\text{HCl, } -5^\circ\text{C}} \text{H}_3\text{PO}_2 \xrightarrow{\text{H}_2\text{O, heat}} \text{Br}_2 \xrightarrow{\text{FeBr}_3}$
- D. $\text{CH}_3\text{Br} \xrightarrow{\text{AlCl}_3} \text{HNO}_3 \xrightarrow{\text{H}_2\text{SO}_4} \text{H}_2 \xrightarrow{\text{Pt}} \text{Br}_2 \xrightarrow{\text{FeBr}_3} \text{NaNO}_2 \xrightarrow{\text{HCl, } -5^\circ\text{C}} \text{H}_3\text{PO}_2 \xrightarrow{\text{H}_2\text{O, heat}}$

15. Which of the following is the strongest acid?

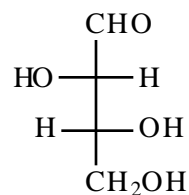


16. Which of the following statements about the relative stabilities of the structures shown is TRUE?



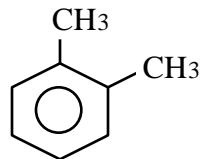
- A. I has more torsional strain.
- B. I has more steric strain.
- C. II has more torsional strain.
- D. II has more steric strain.

17. Which of the following terms does NOT describe the carbohydrate shown?



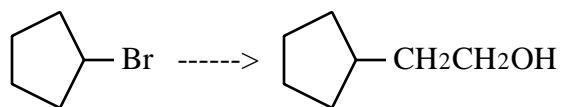
- A. L sugar B. Reducing sugar C. Aldose D. Tetrose

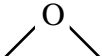
18. How many signals are present in the ^{13}C spectrum of the following compound?



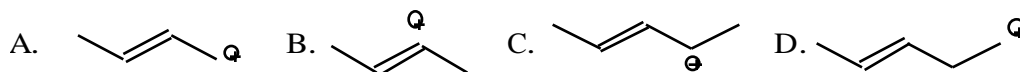
- A. 3 B. 4 C. 5 D. 6

19. What reagents would you use to carry out the following transformation?

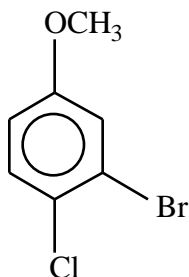


- A. Mg, then $\text{CH}_2=\text{O}$, then $\text{H}_3\text{O}^{\oplus}$
B. Mg, then $\text{CH}_3\text{CH}_2\text{I}$, then H_2O
C. Mg, then $\text{CH}_3\text{CH}=\text{O}$, then $\text{H}_3\text{O}^{\oplus}$
D. Mg, then , then $\text{H}_3\text{O}^{\oplus}$

20. Which of the following carbocations is the LEAST stable?

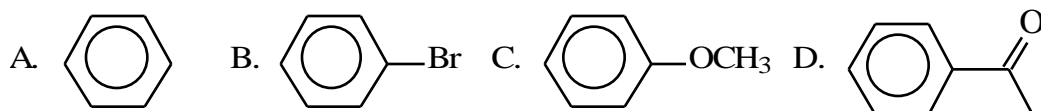


21. What is the name of the compound shown?

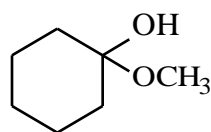


- A. 3-bromo-4-chloroanisole
B. 3-bromo-4-chloroaniline
C. 1-chloro-2-bromo-4-anisole
D. 1-bromo-2-chloro-5-aniline

22. Which of the following compounds will react the SLOWEST with $\text{Cl}_2/\text{FeCl}_3$?

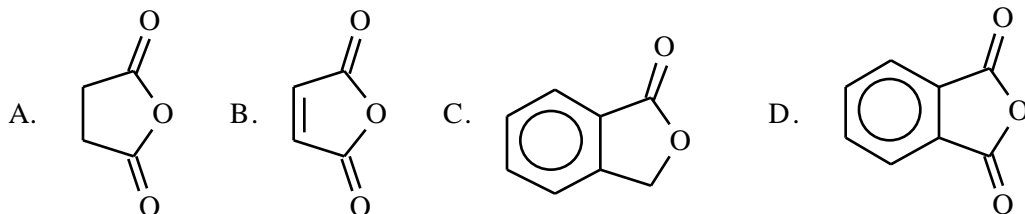


23. What functional group does the following molecule contain?

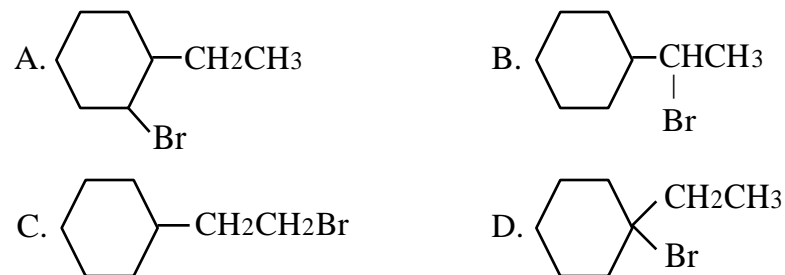


- A. Lactone B. Hemilactone C. Acetal D. Hemiacetal

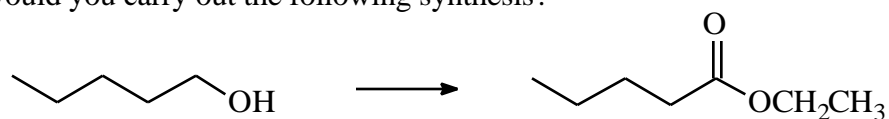
24. What is the structure of phthalic anhydride?



25. Which of the following compounds gives the SLOWEST S_N1 reaction?

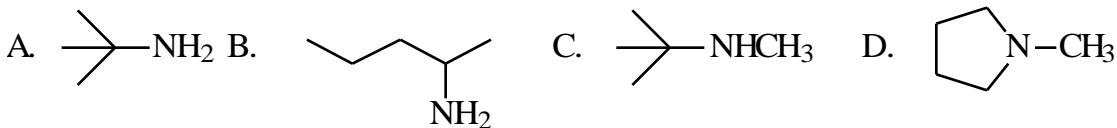


26. How would you carry out the following synthesis?

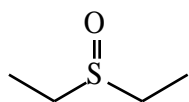


- A. Add PCC then $\text{CH}_3\text{CH}_2\text{OH}$
B. Add $\text{CrO}_3/\text{H}_2\text{O}$ then SOCl_2 then $\text{CH}_3\text{CH}_2\text{OH}$
C. Add LiAlH_4 then SOCl_2 then $\text{CH}_3\text{CH}_2\text{OH}$
D. Add PCC then SOCl_2 then $\text{CH}_3\text{CH}_2\text{OH}$

27. Which of the following is a secondary amine?

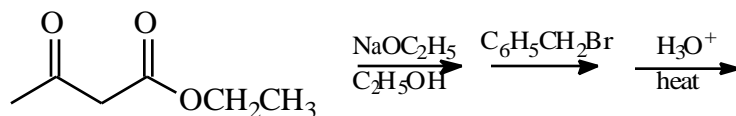


28. What functional group is present in the molecule shown?



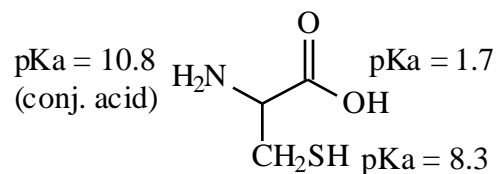
- A. Sulfoxide B. Thioketone C. Sulfone D. Thioether

29. What is the product of the following sequence of reactions?



- A. B.
- C. D.

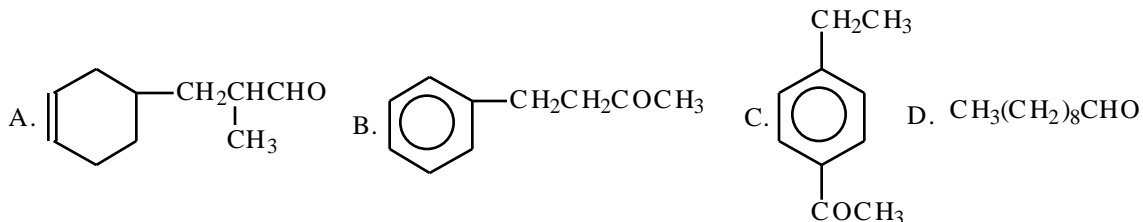
30. What is the dominant form of cysteine (shown below) at pH = 9?



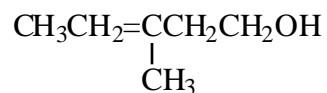
- A. B. C. D.

31. What compound has a molecular formula $C_{10}H_{12}O$ and the following proton NMR spectrum:

singlet, 2.1, 3 H
 multiplet, 3.0, 4 H
 multiplet, 7.1, 5 H

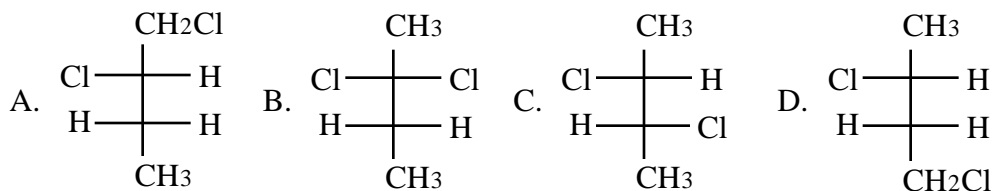
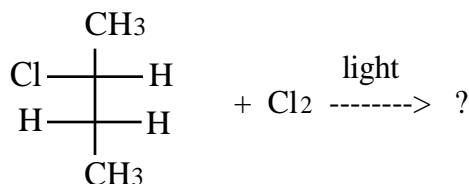


32. Which of the following does NOT give a positive test with the compound shown?

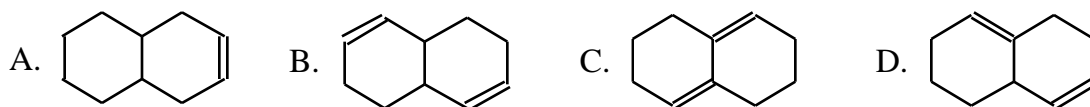


A. cold $KMnO_4$ B. Br_2/CCl_4 C. $Ag(NH_3)_2^+$ D. Jones (chromic acid) reagent

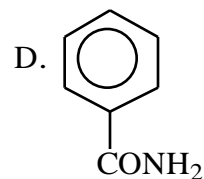
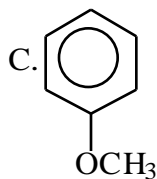
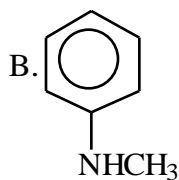
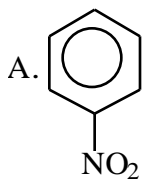
33. Which of the following compounds is formed WITH ITS DIASTEREOMER as a product of the reaction shown?



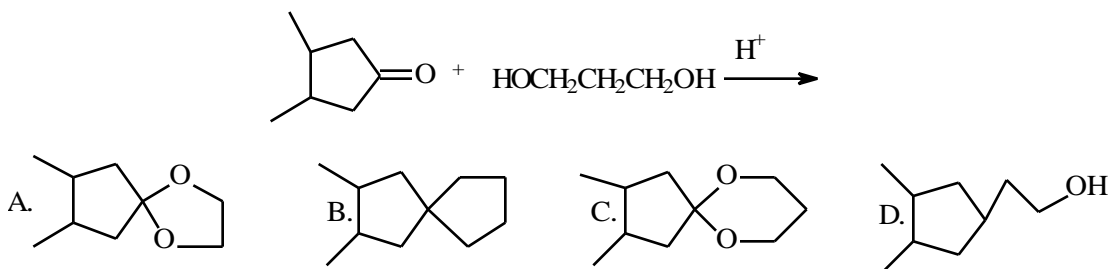
34. Which of the following has an absorption maximum above 200 nm in its UV/Vis spectrum?



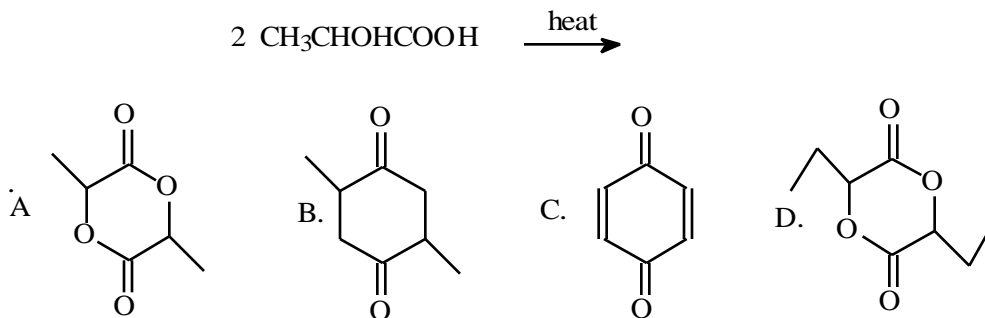
35. Which of these reacts most rapidly with $\text{CH}_3\text{I}/\text{AlCl}_3$?



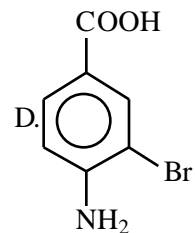
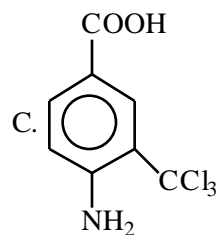
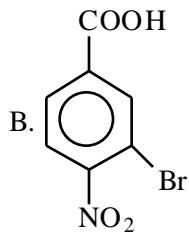
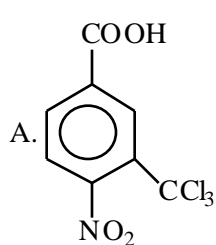
36. What is the product of the reaction shown?



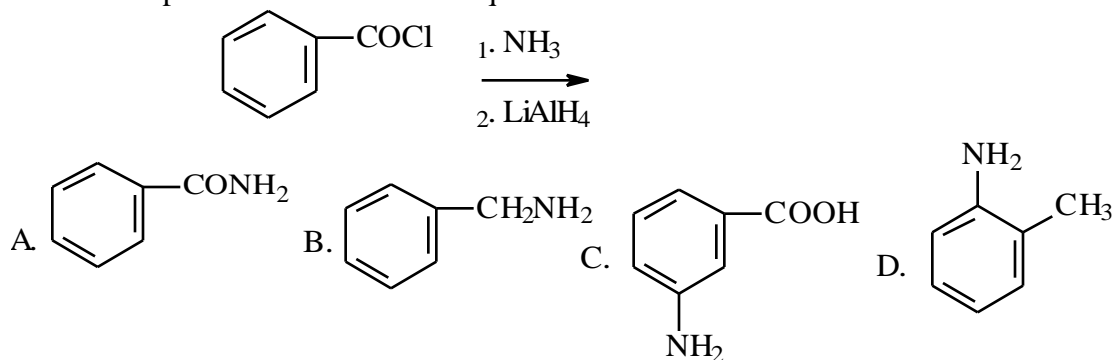
37. What is the product of the reaction shown?



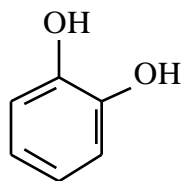
38. Which of the following is the strongest acid?



39. What is the product of the reaction sequence shown?



40. What is the name of the following compound?



- A. catechol
- B. resorcinol
- C. cresol
- D. diphenol

41. Which of the following is the most stable carbocation?

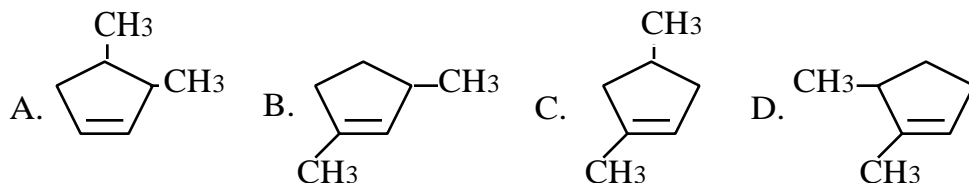
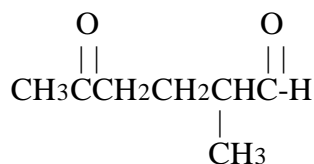
- A. $(\text{C}_6\text{H}_5)_3\text{C}^+$
- B. $(\text{CH}_3)_2\text{CH}^+$
- C. $\text{CH}_3\text{CH}=\text{CHC}^+(\text{CH}_3)_2$
- D. $\text{CH}_2=\text{CH}^+$

42. Which of the following is an intermediate involved in the reaction shown?

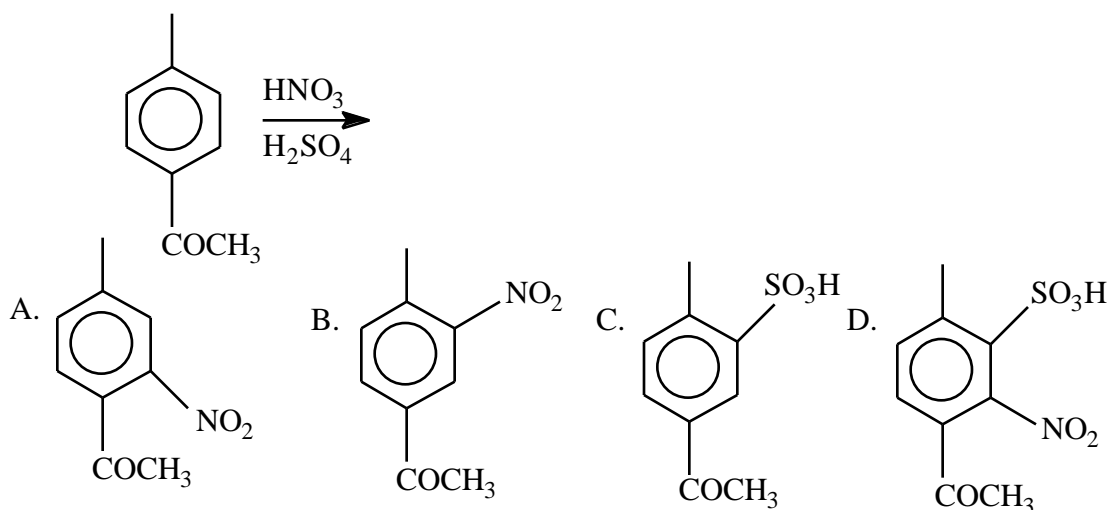


- A. $\text{C}_6\text{H}_5\dot{\text{C}}\text{HCH}_2\text{Br}$
- B. $\text{C}_6\text{H}_5\text{CHBr}\dot{\text{C}}\text{H}_2$
- C. $\text{C}_6\text{H}_5\dot{\text{C}}\text{HCH}_3$
- D. $\text{C}_6\text{H}_5\text{CH}_2\dot{\text{C}}\text{H}_2$

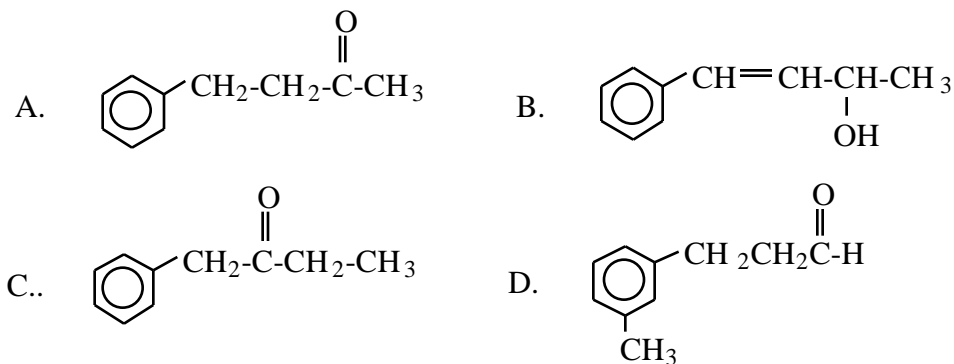
43. An unknown compound having the formula C_7H_{12} gave the compound shown when treated with O_3 followed by Zn and H_2O . What is the structure of this unknown?



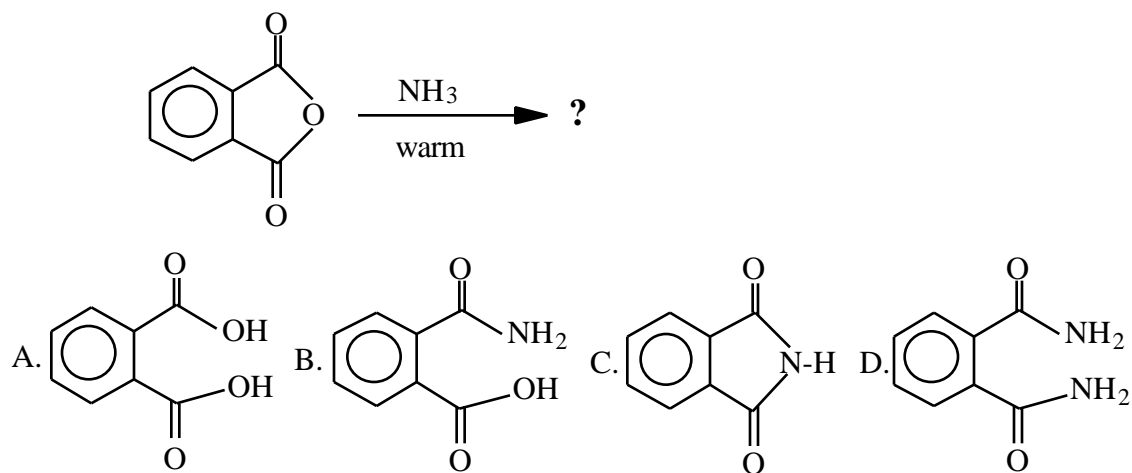
44. What is the major product of the following reaction:



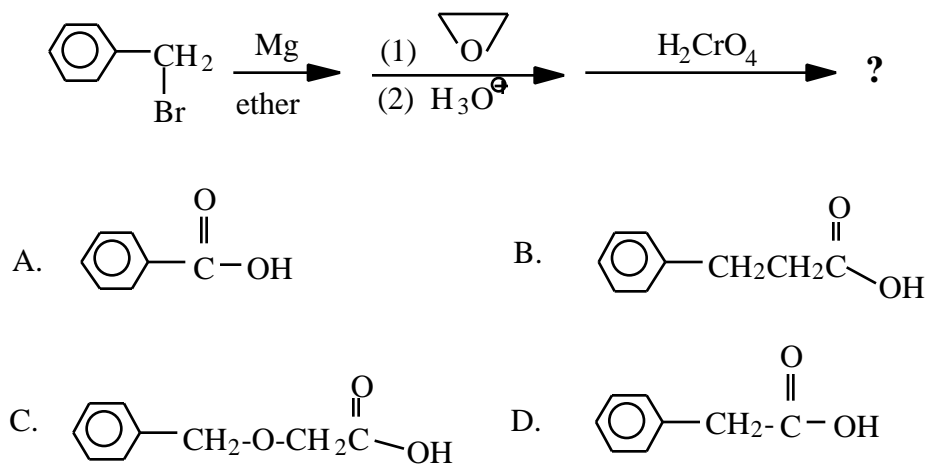
45. Compound X has the molecular formula $C_{10}H_{12}O$. The IR spectrum of X has a strong band near 1710 cm^{-1} . Compound X forms a phenylhydrazone, but gives a negative Tollens' test and a positive iodoform test. What is the structure of the compound?



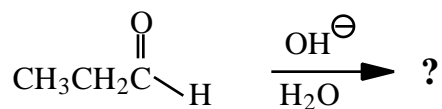
46. What is the major organic product of the reaction shown?



47. What is the final organic product of the following reaction sequence?



48. What is the major product of the following reaction?

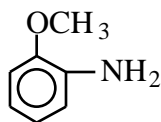
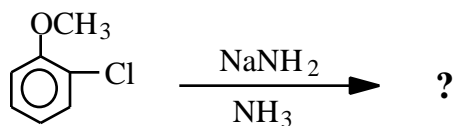


- A. $\text{CH}_3\text{CH}_2\underset{\text{OH}}{\text{CH}}\text{CH}_2\text{CH}_2\overset{\text{O}}{\parallel}{\text{C}}\text{H}$ B. $\text{CH}_3\text{CH}_2\underset{\text{OH}}{\text{CH}}-\underset{\text{CH}_3}{\text{CH}}\overset{\text{O}}{\parallel}{\text{C}}\text{H}$
- C. $\text{CH}_3\text{CH}_2\underset{\text{OH}}{\text{CH}}-\overset{\text{O}}{\parallel}{\text{C}}\text{CH}_2\text{CH}_3$ D. $\text{CH}_3\text{CH}_2\overset{\text{O}}{\parallel}{\text{C}}\text{OH}$

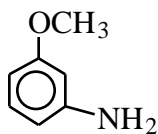
49. How could you convert an unsaturated fatty acid into a saturated fatty acid?

- A. $\text{KMnO}_4, \text{OH}^-$ B. $\text{OH}^-, \text{H}_2\text{O}, \text{heat}; \text{then } \text{H}_3\text{O}^+$
 C. $\text{H}_2, \text{Ni}, \text{pressure}$ D. $\text{O}_3; \text{then } \text{Zn}, \text{H}_2\text{O}$

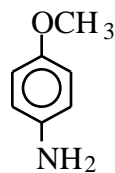
50. What product(s) would you expect from the following reaction?



I



II



III

- A. **I** alone B. **II** alone C. **III** alone D. **I** and **II**