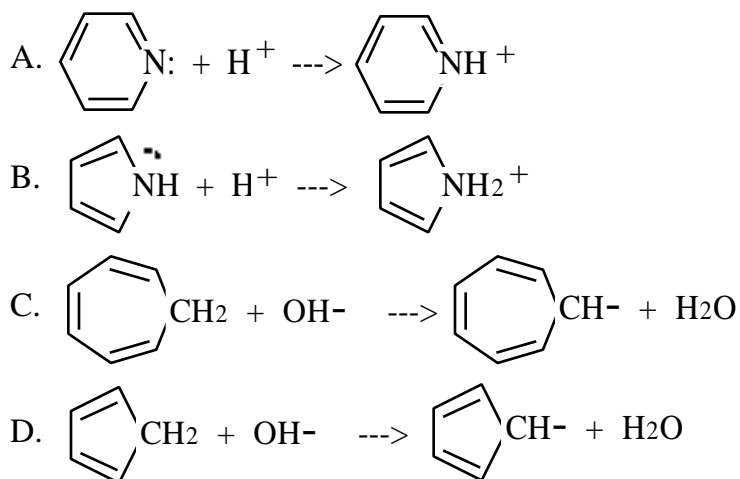


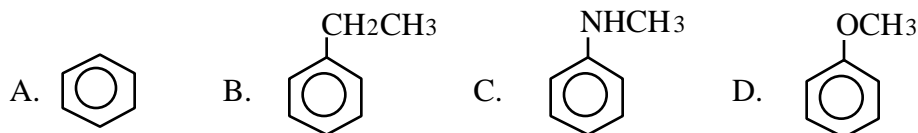
1. Which of the following sequences of reactions gives *m*-chloroethylbenzene from benzene?

- A. $\text{CH}_3\text{CH}_2\text{Br}$, AlCl_3 ; then Cl_2 , FeCl_3
 B. Cl_2 , FeCl_3 ; then $\text{CH}_3\text{CH}_2\text{Br}$, AlCl_3
 C. CH_3COCl , AlCl_3 ; then Zn(Hg) , HCl ; then Cl_2 , FeCl_3
 D. CH_3COCl , AlCl_3 ; then Cl_2 , FeCl_3 ; then Zn(Hg) , HCl

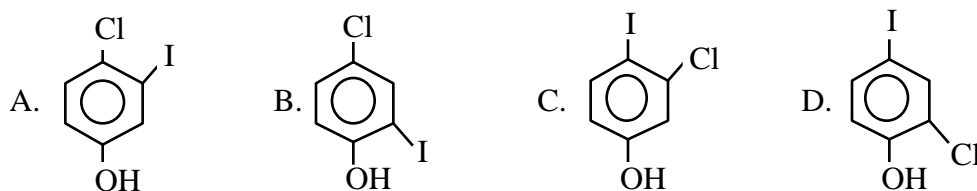
2. Which of the reactions shown has a much higher equilibrium constant (is most favorable) in comparison with similar reactions involving aliphatic species?



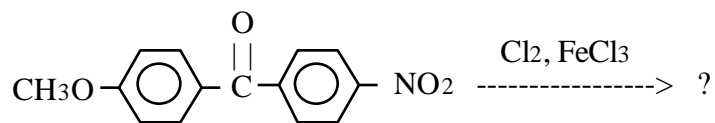
3. Which of the compounds shown gives the SLOWEST reaction with $\text{Cl}_2/\text{FeCl}_3$?

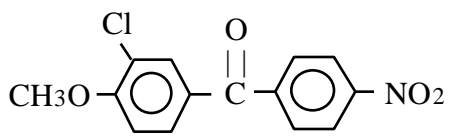
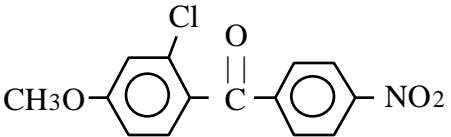
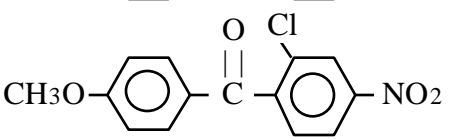
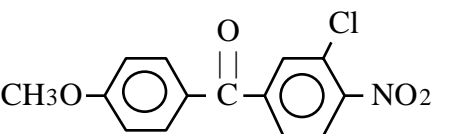


4. Which of the following compounds is 3-chloro-4-iodophenol?

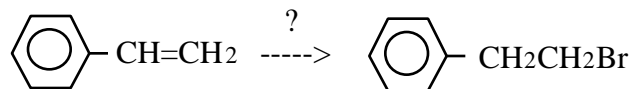


5. What is the major organic product of the reaction shown?



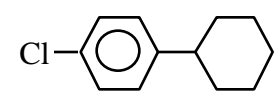
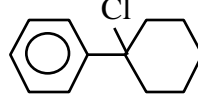
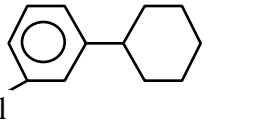
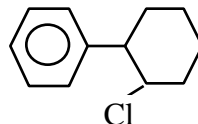
- A.  $\text{CH}_3\text{O}-\text{C}_6\text{H}_3(\text{Cl})-\text{C}(=\text{O})-\text{C}_6\text{H}_4-\text{NO}_2$
- B.  $\text{CH}_3\text{O}-\text{C}_6\text{H}_3(\text{Cl})-\text{C}(=\text{O})-\text{C}_6\text{H}_4-\text{NO}_2$
- C.  $\text{CH}_3\text{O}-\text{C}_6\text{H}_4-\text{C}(=\text{O})-\text{C}_6\text{H}_3(\text{Cl})-\text{NO}_2$
- D.  $\text{CH}_3\text{O}-\text{C}_6\text{H}_3(\text{Cl})-\text{C}(=\text{O})-\text{C}_6\text{H}_3(\text{Cl})-\text{NO}_2$

6. Which of the following methods give the best yield in the synthesis shown?

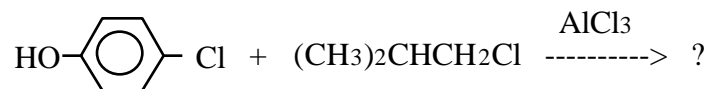


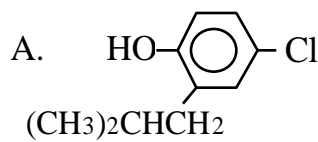
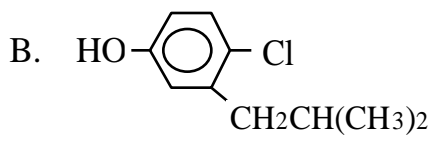
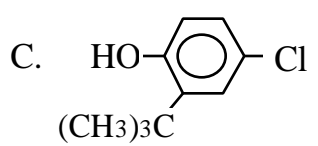
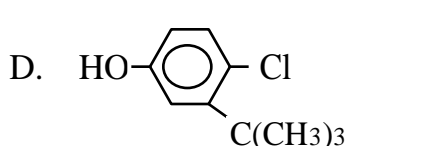
- A. HBr, no peroxides B. HBr, peroxides C. $\text{Br}_2, \text{FeBr}_3$ D. Br_2, HBr
7. What is the major organic product of the reaction shown?



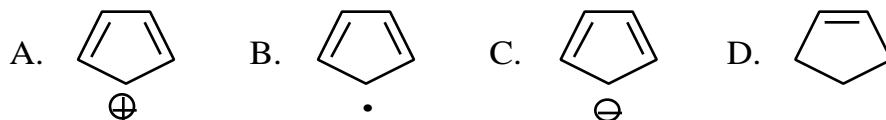
- A.  $\text{Cl}-\text{C}_6\text{H}_4-\text{C}_6\text{H}_{11}$
- B.  $\text{C}_6\text{H}_5-\text{C}(\text{Cl})(\text{C}_6\text{H}_{11})-\text{C}_6\text{H}_5$
- C.  $\text{C}_6\text{H}_3(\text{Cl})-\text{C}_6\text{H}_{11}$
- D.  $\text{C}_6\text{H}_5-\text{C}_6\text{H}_{10}(\text{Cl})$

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

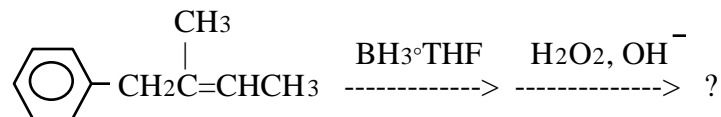


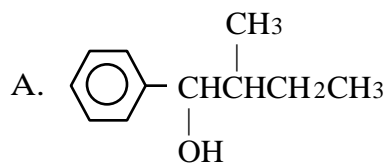
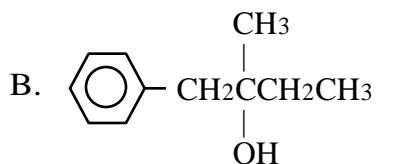
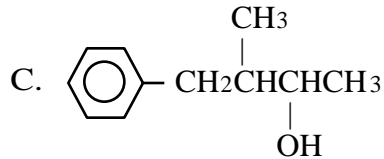
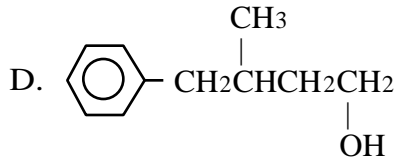
- A.  B. 
- C.  D. 

9. Which of the following species is aromatic?

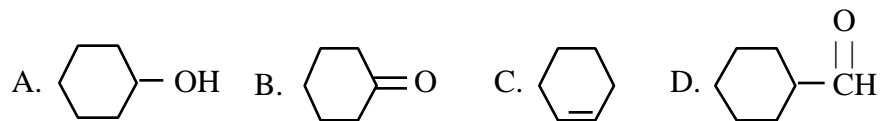


10. What is the major organic product of the reaction shown?

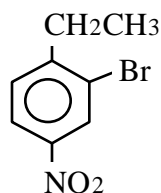


- A.  B. 
- C.  D. 

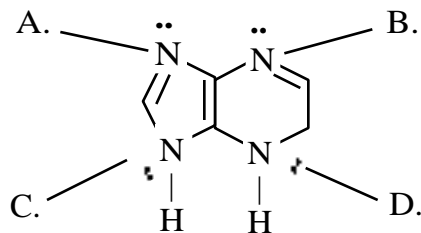
11. Which of the following compounds gives an orange precipitate with the DNP reagent (2,4-dinitrophenylhydrazine) and no reaction with Tollens' reagent?



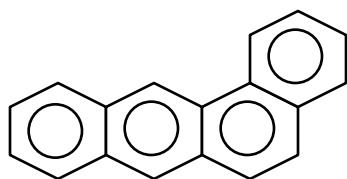
12. Which of the following is the best synthesis of the compound shown from benzene?



- A. $\text{HNO}_3/\text{H}_2\text{SO}_4$, then $\text{CH}_3\text{CH}_2\text{Br}/\text{AlCl}_3$, then $\text{Br}_2/\text{FeBr}_3$
 B. $\text{HNO}_3/\text{H}_2\text{SO}_4$, then $\text{Br}_2/\text{FeBr}_3$, then $\text{CH}_3\text{CH}_2\text{Br}/\text{AlCl}_3$
 C. $\text{CH}_3\text{CH}_2\text{Br}/\text{AlCl}_3$, then $\text{Br}_2/\text{FeBr}_3$, then $\text{HNO}_3/\text{H}_2\text{SO}_4$
 D. $\text{CH}_3\text{CH}_2\text{Br}/\text{AlCl}_3$, then $\text{HNO}_3/\text{H}_2\text{SO}_4$, then $\text{Br}_2/\text{FeBr}_3$
13. Which of the indicated nitrogen atoms is the least basic (least nucleophilic)?

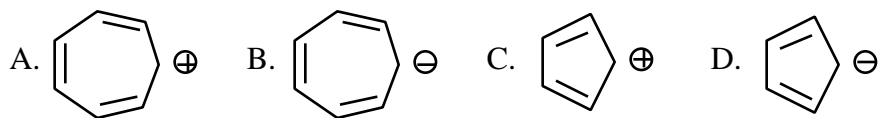
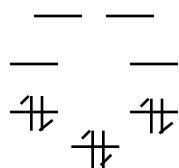


14. How many electrons are present in the structure shown?

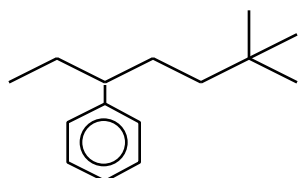


- A. 24 B. 20 C. 18 D. 14

15. Which of the following ions has the pi orbital energy level diagram shown?



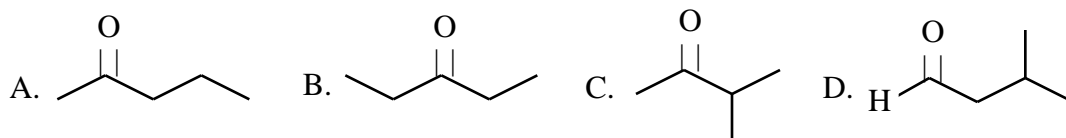
16. What is the IUPAC name of the compound shown?



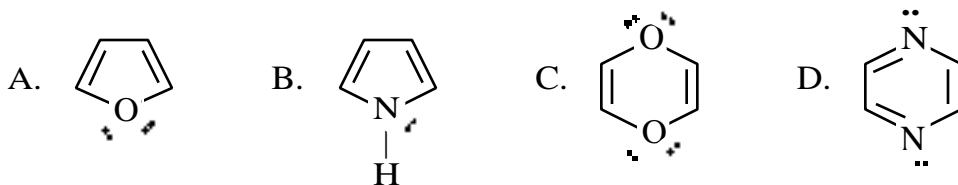
- A. 2,2-dimethyl-5-phenylheptane
 B. 2,2-dimethyl-5-benzylheptane
 C. 3-phenylnonane
 D. 3-benzylnonane
17. A compound having the formula $C_5H_{10}O$ has a strong peak near 1710 cm^{-1} in its IR spectrum. The proton magnetic resonance spectrum of this compound follows.

pmr: triplet, 0.9, 3H
 multiplet, 1.7, 2H
 singlet, 2.2, 3H
 triplet, 2.5, 2H

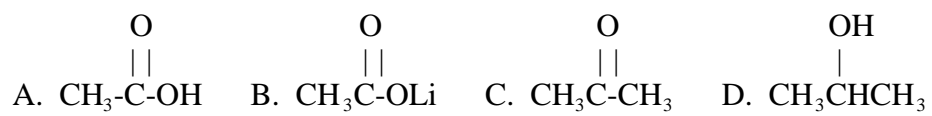
What is the structure of this unknown?



18. Which of the following species is NOT aromatic?



19. Which of the following compounds has the LOWEST boiling point?



20. Which of the following reactions gives benzaldehyde as the major product?

