

Class 12 Amines Important Questions with Answers

Short Answer Type Questions

Q1. What is the role of HNO_3 in the nitrating mixture used for the nitration of benzene?

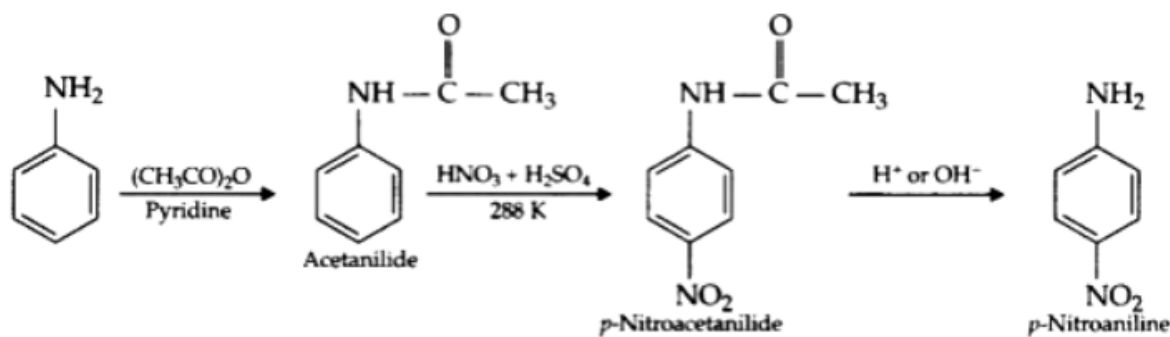
Answer:

HNO_3 acts as a base in the nitrating mixture and provides the electrophile NO_2^+ ion for the nitration of benzene.

Q2. Why is the NH_2 group of aniline acetylated before carrying out nitration?

Answer:

NH_2 group of aniline is acetylated first so that controlled nitration can occur at the para position. If the NH_2 group of aniline is not acetylated, then a mixture of ortho, meta and para products will form.

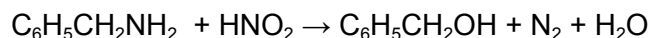


Q3. What is the product when $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$ reacts with HNO_2 ?

Answer:

$\text{C}_6\text{H}_5\text{CH}_2\text{OH}$ is formed.

$\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$ reacts with HNO_2 to form unstable diazonium salt, giving alcohol. Thus, when $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$ reacts with HNO_2 , benzyl alcohol is formed along with N_2 and H_2O .



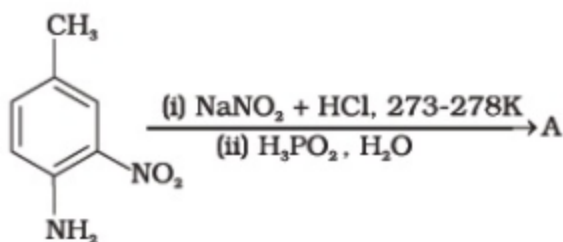
When $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$ reacts with HNO_2 at low temperature, stable Diazonium salt is formed, and no N_2 gas is evolved.

Q4. What is the best reagent to convert nitrile to primary amine?

Answer:

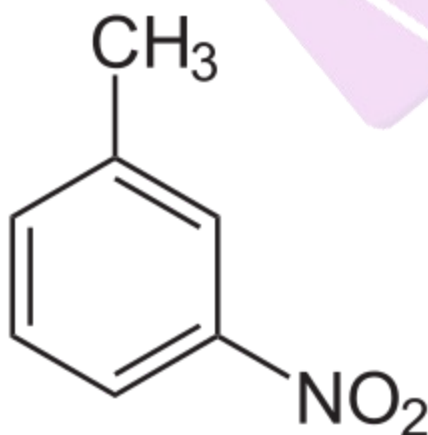
LiAlH_4 and Sodium/Alcohol are the best reagents for converting nitrile to a primary amine. The nitriles are transformed into a corresponding primary amine through reduction.

Q5. Give the structure of 'A' in the following reaction.



Answer:

m-nitrotoluene is formed.



Q6. What is Hinsberg reagent?

Answer:

Hinsberg reagent is an alternative name for benzene sulfonyl chloride ($\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$). It is used to detect and distinguish primary, secondary, and tertiary amines in a given sample.

Q7. Why is benzene diazonium chloride not stored and is used immediately after its preparation?

Answer:

Benzene diazonium chloride cannot be stored and is used immediately after its preparation because of its unstable nature. With a slight increase in temperature, it dissociates to give nitrogen gas.

Q8. Why does acetylation of $-\text{NH}_2$ group of aniline reduce its activating effect?

Answer:

The acetylation of the $-\text{NH}_2$ group of aniline reduces its activating effect as the lone pair of electrons on the nitrogen of acetanilide interacts with the oxygen atom due to resonance.

The activating effect of the $-\text{NH}_2$ group is controlled by protecting the $-\text{NH}_2$ group by acetylation with acetic anhydride and then carrying out the desired substitution followed by hydrolysis of the substituted amide to the substituted amine.

Q9. Explain why MeNH_2 is a stronger base than MeOH ?

Answer:

Nitrogen is less electronegative than oxygen; therefore lone pairs of electrons on nitrogen are readily available for donation. Hence, MeNH_2 is more basic than MeOH .

Q10. What is the role of pyridine in the acylation reaction of amines?

Answer:

Pyridine acts as an acceptor for the acid by-product formed in the reaction. Thus, it removes the side product, i.e. HCl , from the reaction mixture.

Q11. Under what reaction conditions (acidic/basic) the coupling reaction of aryl diazonium chloride with aniline is carried out?

Answer:

Coupling reaction of aryl diazonium chloride with aniline is carried out in mildly acidic conditions, i.e. pH=4–5.

Q12. Predict the product of the reaction of aniline with bromine in a nonpolar solvent such as CS₂.

Answer:

The products formed in the reaction of aniline with bromine in a nonpolar solvent such as CS₂ are 4-Bromoaniline and 2-Bromoaniline, where 4-Bromoaniline is the major product. In a nonpolar solvent medium, the activating effect of the –NH₂ group of aniline is reduced because of resonance, and thus, mono-substitution occurs only at ortho- and para-positions.

Q13. Arrange the following compounds in increasing order of dipole moment. CH₃CH₂CH₃, CH₃CH₂NH₂, CH₃CH₂OH.

Answer:

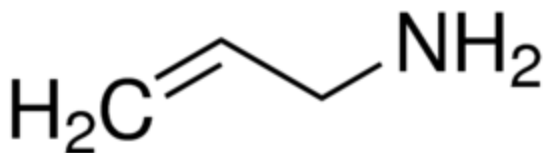
CH₃CH₂CH₃ < CH₃CH₂NH₂ < CH₃CH₂OH

Q14. What is the structure and IUPAC name of the compound, allylamine?

Answer:

The IUPAC name of allylamine is 3-Amino-1-propene.

Structure of allylamine:

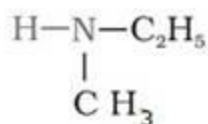


Q15. A compound Z with molecular formula C₃H₉N reacts with C₆H₅SO₂Cl to give a solid, insoluble in alkali. Identify Z.

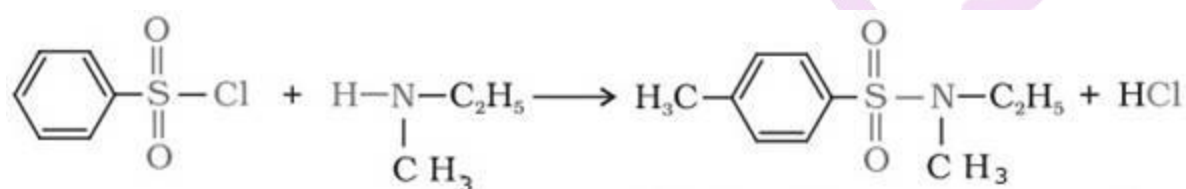
Answer:

C_3H_9N reacts with $C_6H_5SO_2Cl$ or Hinsberg's reagent to give a solid, insoluble in alkali, which means that C_3H_9N is a secondary amine. The product obtained in this reaction has no replaceable hydrogen attached to the nitrogen atom of the amine group.

Thus the structure of the given amine is:



The chemical reaction involved in this case is:

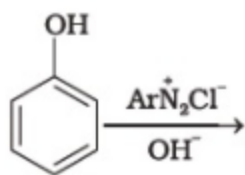


Q16. A primary amine, RNH_2 can be reacted with CH_3-X to get secondary amine, $R-NHCH_3$ but the only disadvantage is that 3° amine and quaternary ammonium salts are also obtained as side products. Can you suggest a method where RNH_2 forms only 2° amine?

Answer:

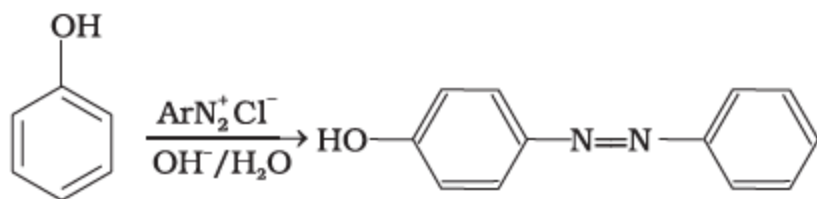
Carbylamine reaction is shown by 1° amine only, which replaces two hydrogen atoms attached to the nitrogen atom of the NH_2 group with one carbon atom. The isocyanide will give a secondary amine with one methyl group on catalytic reduction.

Q17. Complete the following reaction.



Answer:

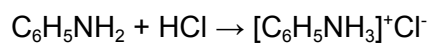
The reaction exhibits azo-coupling of phenols. In mild alkaline conditions, phenol moiety participates in the azo-coupling, and the para position of phenol is occupied.



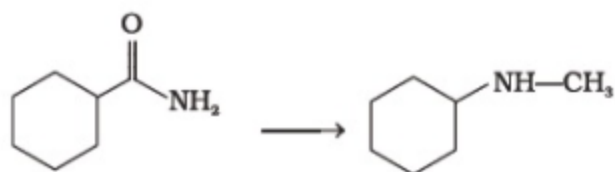
Q18. Why is aniline soluble in aqueous HCl?

Answer:

Aniline forms the salt anilinium chloride, which is water-soluble.

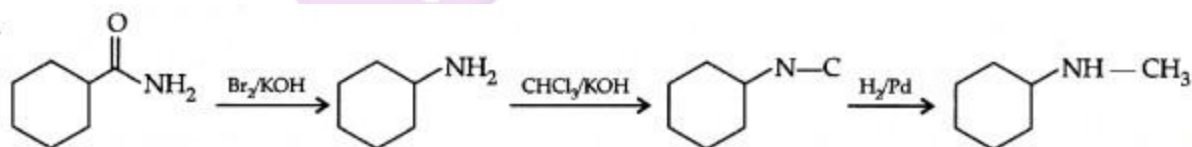


Q19. Suggest a route by which the following conversion can be accomplished.

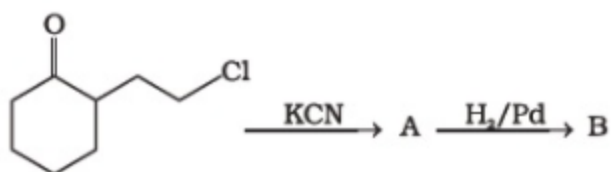


Answer:

We can convert it as

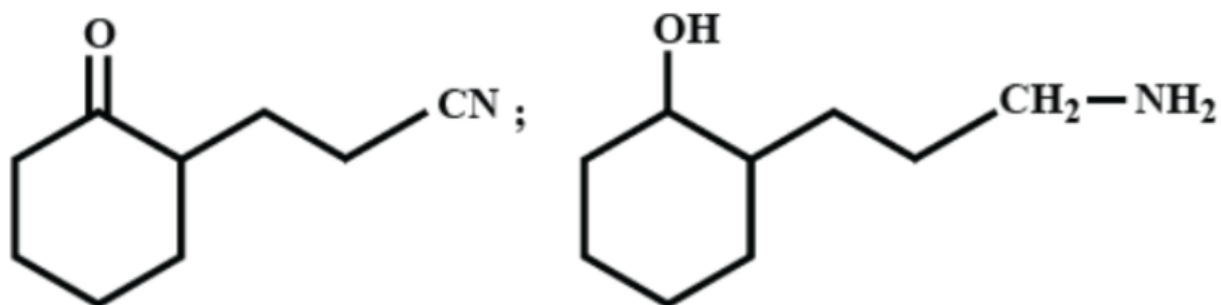


Q20. Identify A and B in the following reaction.



Answer:

Here, A and B will be



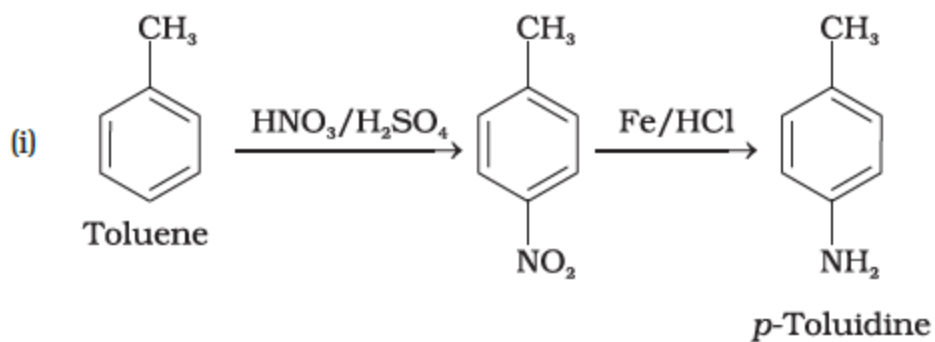
Q21. How will you carry out the following conversions?

(i) toluene \rightarrow p-toluidine

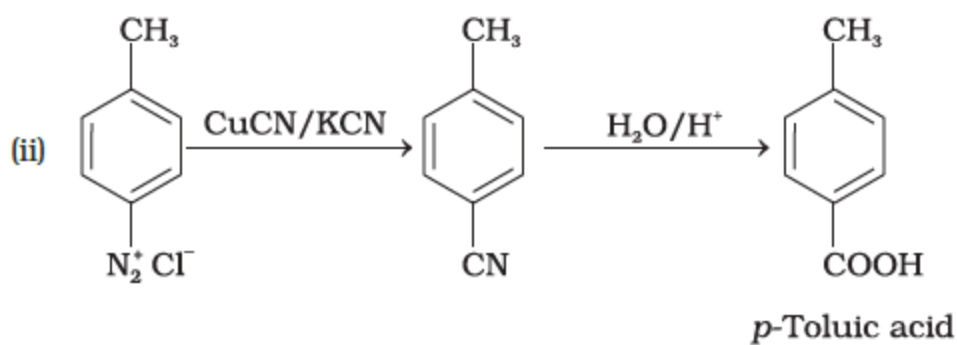
(ii) p-toluidine diazonium chloride \rightarrow p-toluic acid

Answer:

(i) toluene \rightarrow p-toluidine



(ii) p-toluidine diazonium chloride \rightarrow p-toluic acid

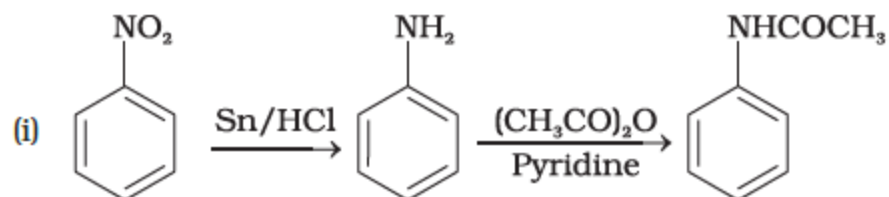


Q22. Write following conversions:

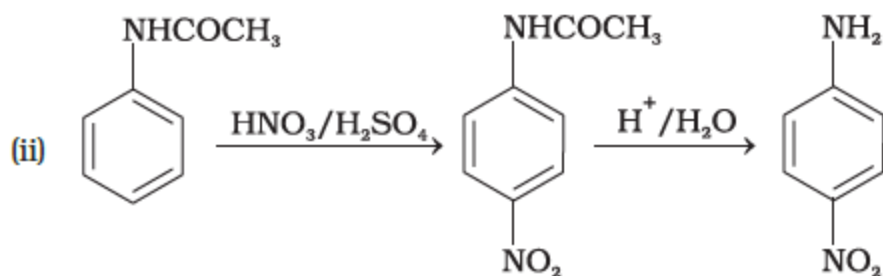
- (i) nitrobenzene \rightarrow acetanilide
 (ii) acetanilide \rightarrow p-nitroaniline

Answer:

- (i) nitrobenzene \rightarrow acetanilide



- (ii) acetanilide \rightarrow p-nitroaniline

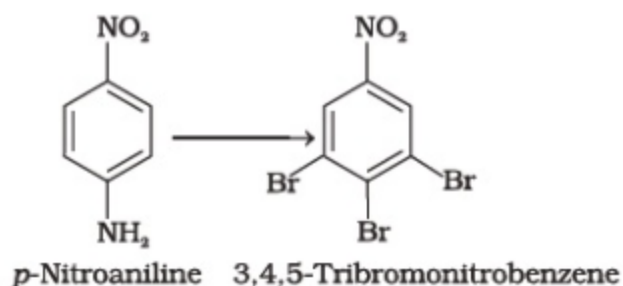


Q23. A solution contains 1 g mol each of p-toluene diazonium chloride and p-nitrophenyl diazonium chloride. 1 g mol of an alkaline solution of phenol is added to this. Predict the major product. Explain your answer.

Answer:

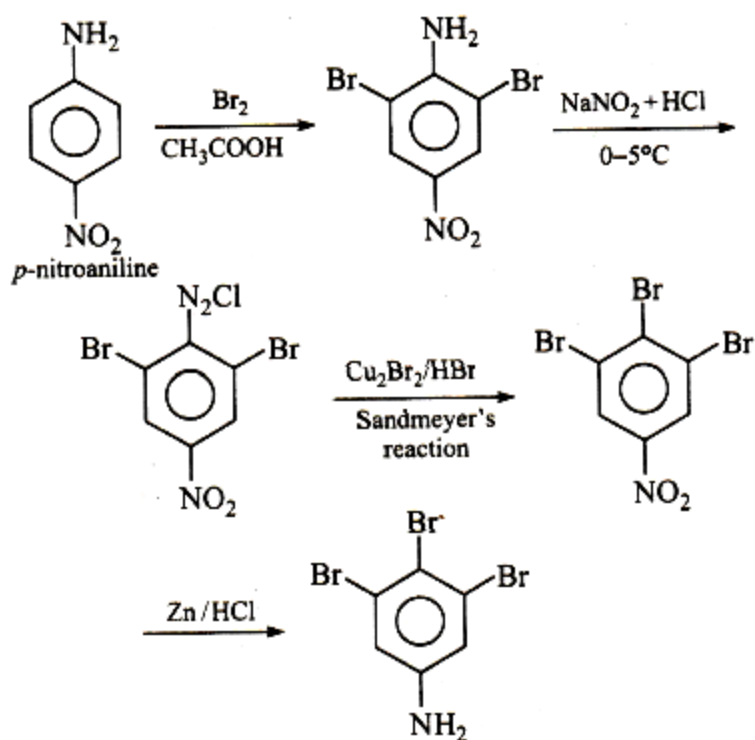
This reaction is an example of electrophilic aromatic substitution. In an alkaline medium, phenol generates phenoxide ion, which is more electron-rich than phenol and hence more reactive for an electrophilic attack. The electrophile in this reaction is aryl diazonium cation. The stronger the electrophile the faster the reaction. p-Nitrophenyldiazonium cation is a stronger electrophile than p-toluene diazonium cation. Therefore, it couples preferentially with phenol.

Q24. How will you bring out the following conversion?

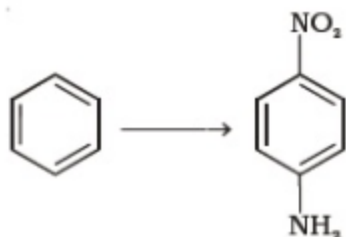


Answer:

We can convert p-nitro aniline to 3,4,5-tribromobenzene as-

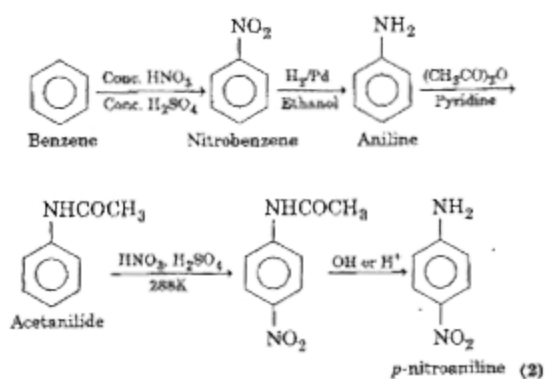


Q25. How will you carry out the following conversion?

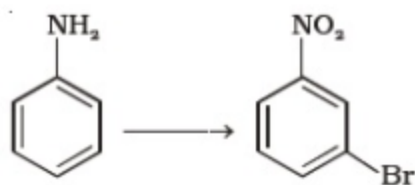


Answer:

We can convert benzene to p-nitroaniline as-

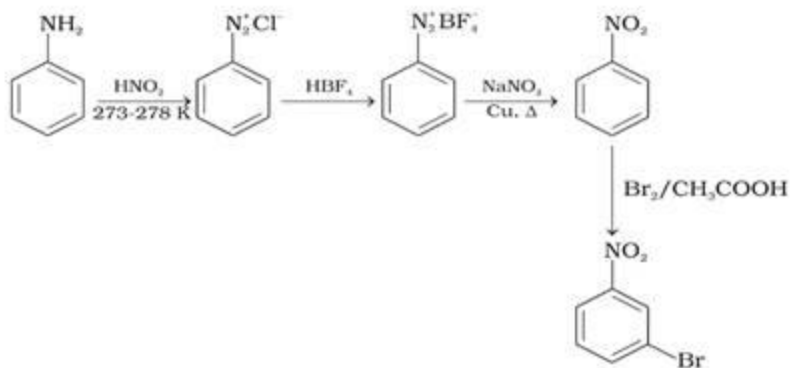


Q26. How will you carry out the following conversion?

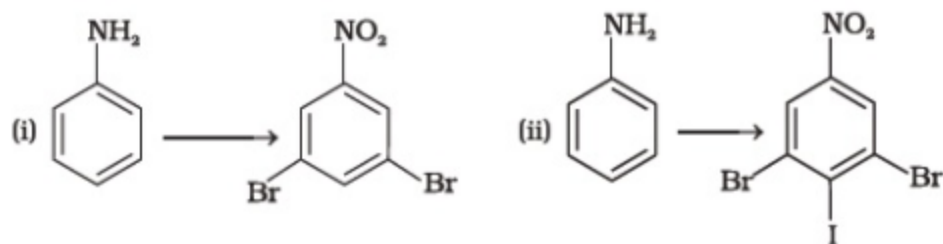


Answer:

We can convert aniline to m-bromonitrobenzene as:

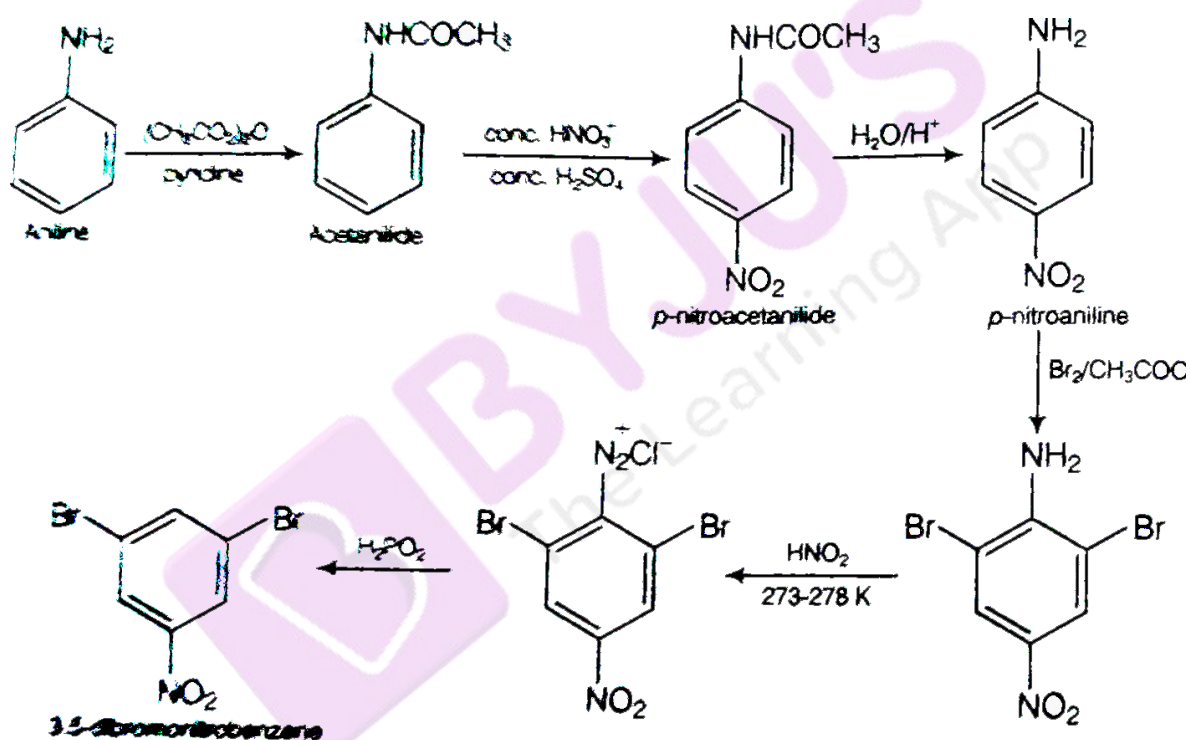


Q27. How will you carry out the following conversions?

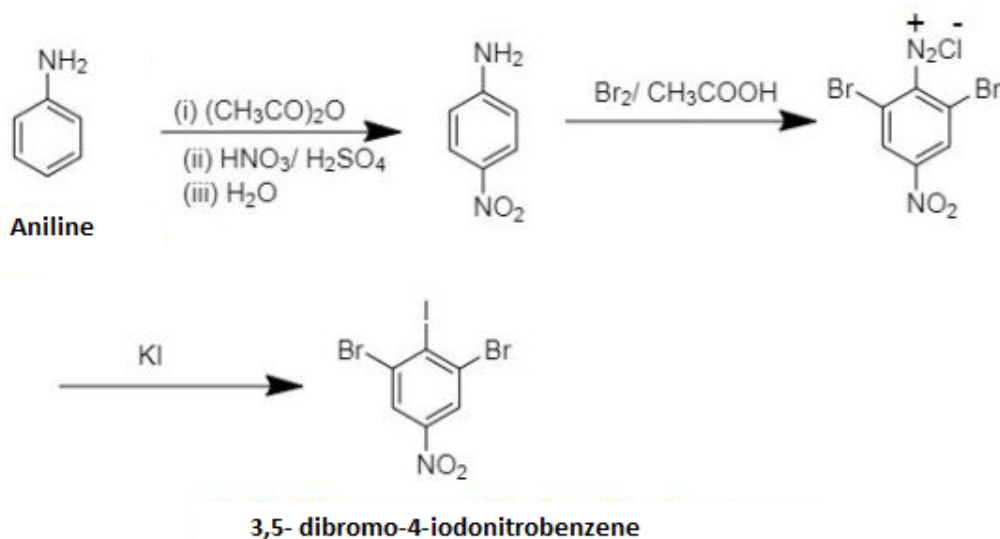


Answer:

(i) We can convert aniline to 3,5-dibromonitrobenzene as



(ii) We can convert aniline to 3,5-dibromo-4-iodonitrobenzene as

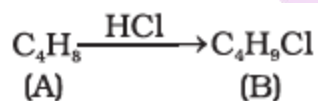


Long Answer Type Questions

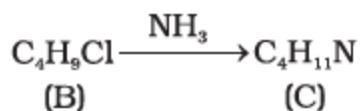
Q1. A hydrocarbon 'A', (C_4H_8) on reaction with HCl gives a compound 'B', ($\text{C}_4\text{H}_9\text{Cl}$), which on reaction with 1 mol of NH_3 gives compound 'C', ($\text{C}_4\text{H}_{11}\text{N}$). On reacting with NaNO_2 and HCl followed by treatment with water, compound 'C' yields optically active alcohol, 'D'. Ozonolysis of 'A' gives 2 moles of acetaldehyde. Identify compounds 'A' to 'D'. Explain the reactions involved.

Answer:

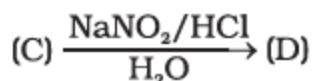
The addition of HCl has occurred on 'A'. This implies 'A' is an alkene.



NH_3 substitutes Cl in compound 'B' to give 'C'.



'C' gives a diazonium salt with NaNO_2/HCl that liberates N_2 to give optically active alcohol.



This means that 'C' is an aliphatic amine.

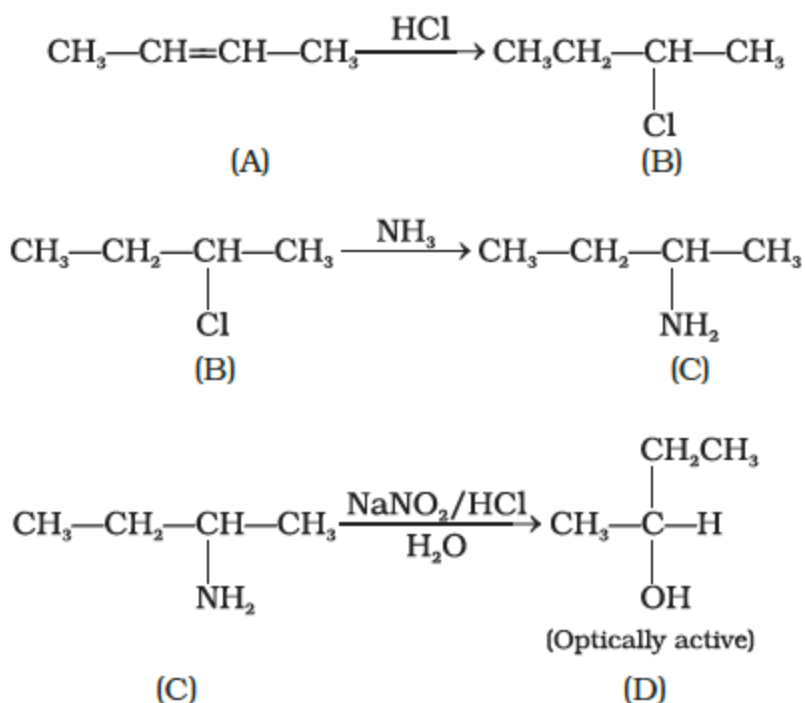
The number of carbon atoms in amine is the same as in compound 'A'.

Since products of ozonolysis of compound 'A' are $\text{CH}_3\text{—CH=O}$ and O=CH—CH_3 .



Thus, compound 'A' is $\text{CH}_3\text{—CH=CH—CH}_3$.

Based on the structure of 'A' reactions can be explained as follows:



Q2. A colourless substance 'A' ($\text{C}_6\text{H}_7\text{N}$) is sparingly soluble in water and gives a water-soluble compound 'B' on treatment with mineral acid. On reacting with CHCl_3 and alcoholic potash, 'A' produces an obnoxious smell due to compound 'C' formation. The reaction of 'A' with benzene sulphonyl chloride gives compound 'D', which is soluble in alkali. With NaNO_2 and HCl , 'A' forms compound 'E', which reacts with phenol in an alkaline medium to give 'F' orange dye. Identify compounds 'A' to 'F'.

Answer:

Here,

A = Aniline

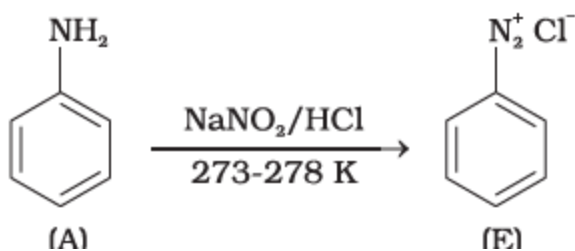
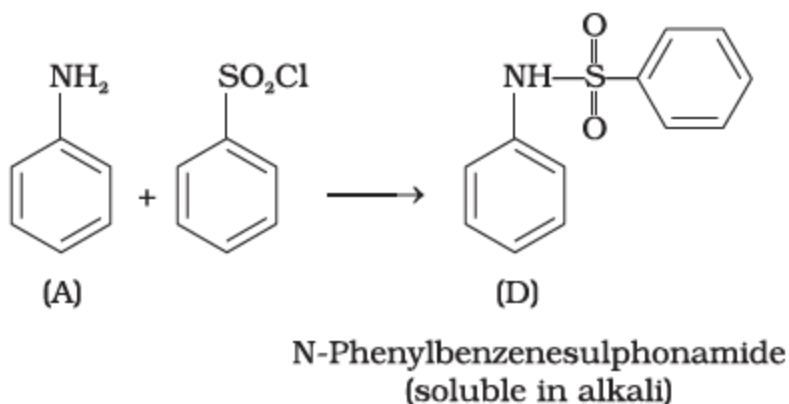
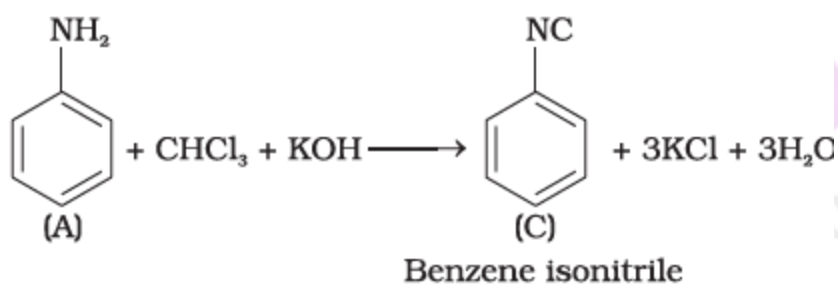
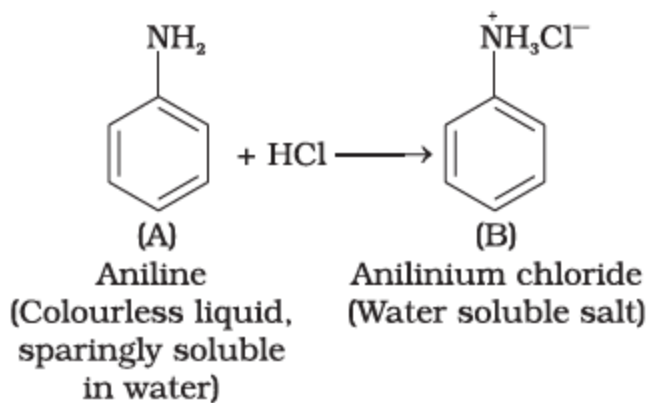
B = Anilinium chloride

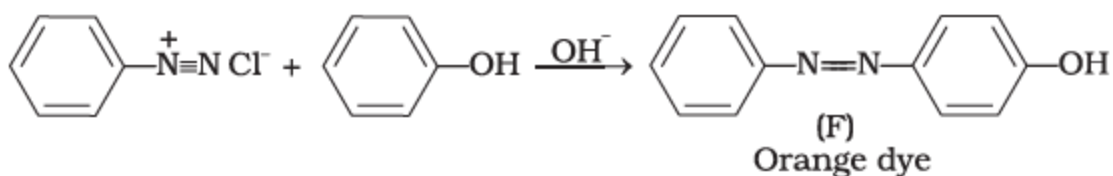
C = Benzeneisocyanide

D = N-phenylbenzenesulphonamide

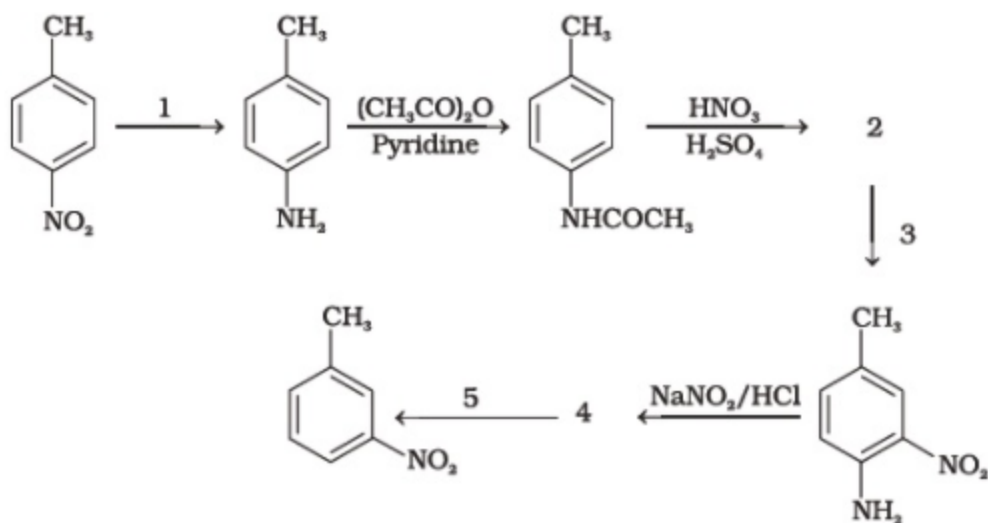
E = Benzenediazonium chloride

F = 4-hydroxyazobenzene





Q3. Predict the reagent or the product in the following reaction sequence.



Answer:

The reagent or the product in the following reaction sequence are:

1 = Sn/HCl

2 = 4-methyl-2-nitroacetanilide

3 = H₂/OH⁻

4 = Toluenediazonium chloride

5 = H₃PO₂/H₂O and Cu⁺