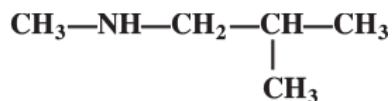


Very Short Answer Questions

Very Short Answer Questions (PYQ)

Q.1. Write the IUPAC name of the given compound:

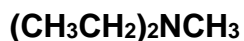


[CBSE North 2016]

Ans. N-methyl-2-methylpropanamine

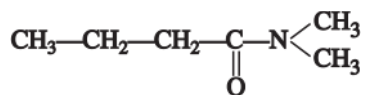
Q.2. Write IUPAC name of the following compound:

[CBSE Delhi 2017]



Ans. N-Ethyl-N-methylethanamine

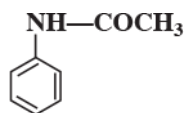
Q.3. Write the IUPAC name of the given compound:



[CBSE (F) 2016]

Ans. N, N – Dimethylbutanamide

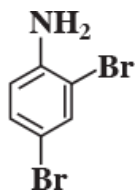
Q.4. Write the IUPAC name of the given compound:



[CBSE East 2016]

Ans. N- Phenyl ethanamide

Q.5. Write the IUPAC name of the given compound:



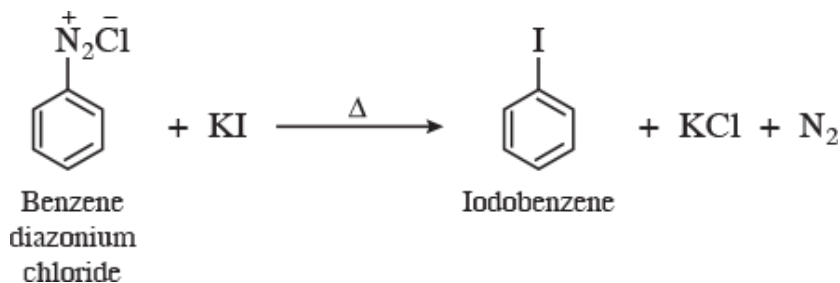
[CBSE South 2016]

Ans. 2,4-Dibromobenzenamine or 2,4-Dibromoaniline

Q.6. Write a chemical reaction in which the iodide ion replaces the diazonium group in a diazonium salt.

[CBSE Delhi 2008]

Ans.



Q.7. The conversion of primary aromatic amines into diazonium salts is known as _____ .

[CBSE (AI) 2014]

Ans. Diazotisation.

Q.8. Arrange the following compounds in increasing order of solubility in water:

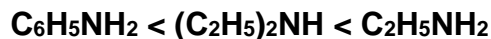
$\text{C}_6\text{H}_5\text{NH}_2$, $(\text{C}_2\text{H}_5)_2\text{NH}$, $\text{C}_2\text{H}_5\text{NH}_2$

[CBSE Delhi 2011, 2014]

Ans. The solubility increases in the order in which molecular mass decreases with increase in hydrogen atoms on nitrogen atom which undergo hydrogen bonding, *i.e.*,

$\text{C}_6\text{H}_5\text{NH}_2 < (\text{C}_2\text{H}_5)_2\text{NH} < \text{C}_2\text{H}_5\text{NH}_2$

Q.9. The solubility increases in the order in which molecular mass decreases with increase in hydrogen atoms on nitrogen atom which undergo hydrogen bonding, *i.e.*,



Ans. $(\text{C}_6\text{H}_5)_2\text{NH} < \text{C}_6\text{H}_5\text{NH}_2 < \text{C}_6\text{H}_5\text{N}(\text{CH}_3)_2 < \text{CH}_3\text{NH}_2$

Q.10. Arrange the following compounds in an increasing order of basic strengths in their aqueous solutions:



[CBSE (AI) 2009]

Ans. $\text{NH}_3 < (\text{CH}_3)_3\text{N} < \text{CH}_3\text{—NH}_2 < (\text{CH}_3)_2\text{NH}$.

Very Short Answer Questions (OIQ)

Q.1. What is the best reagent to convert nitrile to primary amine?

[NCERT Exemplar]

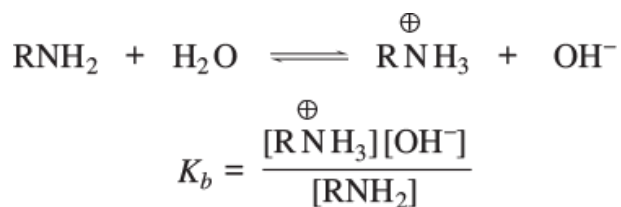
Ans. Reduction of nitriles with sodium/alcohol or LiAlH_4 gives primary amine.

Q.2. Why do amines behave as nucleophiles?

Ans. Due to the presence of a lone pair of electrons on nitrogen atom, amines behave as nucleophiles.

Q.3. For an amine RNH_2 , write the expression for K_b to indicate its strength.

Ans.



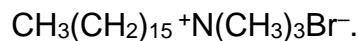
Q.4. What is the role of pyridine in the acylation reaction of amines?

[NCERT Exemplar]

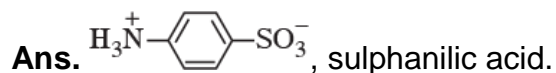
Ans. Pyridine and other bases are used to remove the side product, i.e., HCl from the reaction mixture.

Q.5. Mention the chief use of quaternary ammonium salts derived from long chain amines.

Ans. The quaternary ammonium salts derived from long chain aliphatic amines are used as detergents, such as,



Q.6. Give an example of a zwitter ion.



Q.7. Mention two important uses of sulphhanilic acid.

Ans. Sulphanilic acid is used in the manufacture of (i) dyes (ii) sulpha drugs.

Q.8. What is the role of HNO₃ in the nitrating mixture used for nitration of benzene?

[NCERT Exemplar]

Ans. HNO₃ acts as a base in the nitrating mixture and provides the electrophile NO_2^+ .

Q.9. Why is benzene diazonium chloride not stored and is used immediately after its preparation?

[NCERT Exemplar]

Ans. Benzene diazonium chloride is very unstable.

Q.10. Suggest a route by which the following conversion can be accomplished.



[NCERT Exemplar] [HOTS]

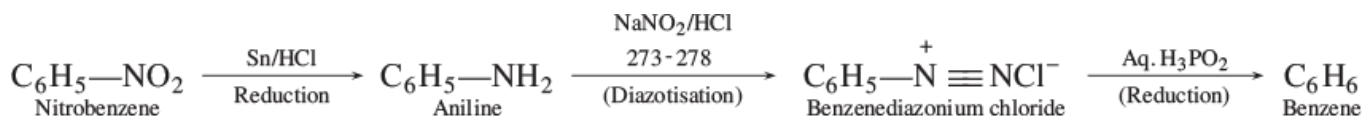
Ans.



Q.11. What are the reactions involved in the reductive removal of nitro group from an aromatic compound?

[HOTS]

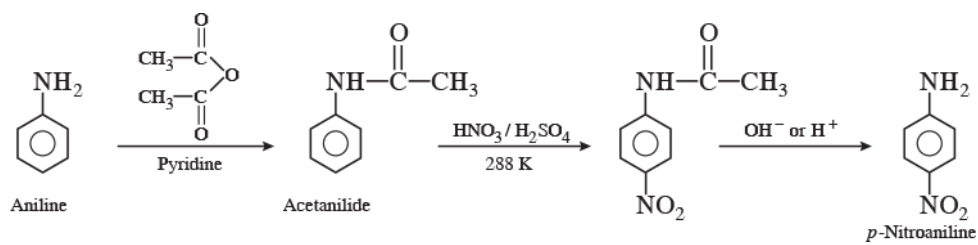
Ans.



Q.12. Convert Aniline into *p*-nitroaniline.

[HOTS]

Ans.



Short Answer Questions-I

Short Answer Questions-I (PYQ)

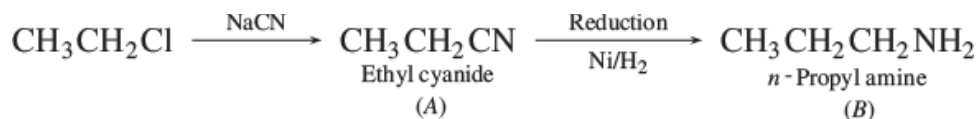
Q.9. Identify *A* and *B* in each of the following processes:

[CBSE (AI) 2010]

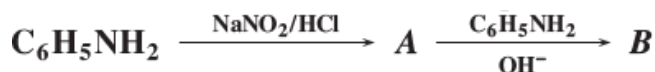
Q.



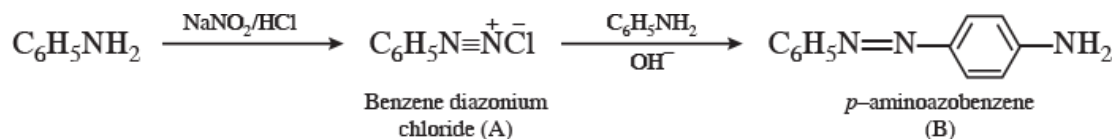
Ans.



Q.



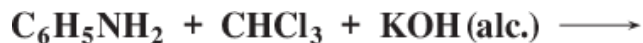
Ans.



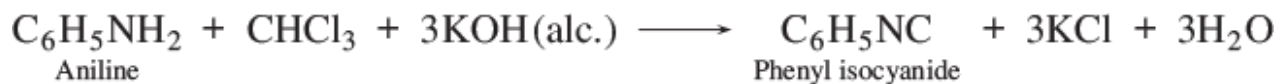
Q.2. Complete the following reaction equations:

[CBSE (F) 2010]

Q.



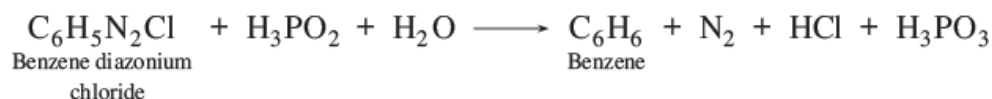
Ans.



Q.



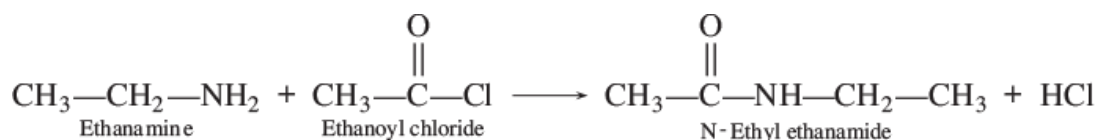
Ans.



Q.3. How are the following conversions carried out?

Q. Ethanamine to N-ethylethanamide

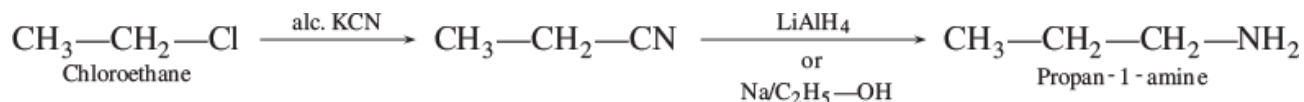
Ans.



Q. Chloroethane to propan-1-amine

[CBSE (F) 2009]

Ans.



Q.4. Explain the following giving a reason in each case:

[CBSE (F) 2010]

Q. Why is an alkylamine more basic than ammonia?

Ans. Alkylamine is more basic than ammonia because in aliphatic amines, the electron releasing alkyl group stabilizes their ammonium cations by dispersing the positive charge and in parent amine makes the nitrogen unshared electrons more available for sharing with a proton.

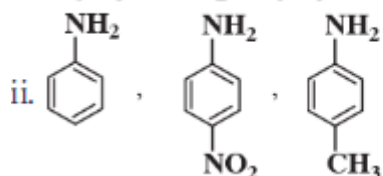
Q. Why do primary amines have higher boiling points than the tertiary amines?

Ans. The boiling points of primary amine are higher than the tertiary amines because strong intermolecular hydrogen bonding takes place between the molecules of primary amine.

Q.5. Arrange the following in increasing order of their basic strength:

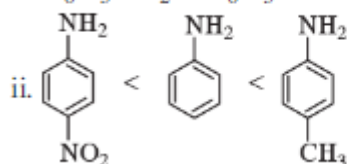
[CBSE Patna 2015]

i. $C_6H_5-NH_2$, $C_6H_5-CH_2-NH_2$, $C_6H_5-NH-CH_3$



Ans.

i. $C_6H_5NH_2 < C_6H_5NHCH_3 < C_6H_5CH_2NH_2$



Q.6. Arrange the following:

[CBSE Guwahati 2015]

Q. In increasing order of their basic strength

$C_6H_5-NH_2$, $CH_3-CH_2-NH_2$, $CH_3-NH-CH_3$

Ans. $C_6H_5NH_2 < CH_3-CH_2-NH_2 < CH_3NHCH_3$

Q. In increasing order of solubility in water

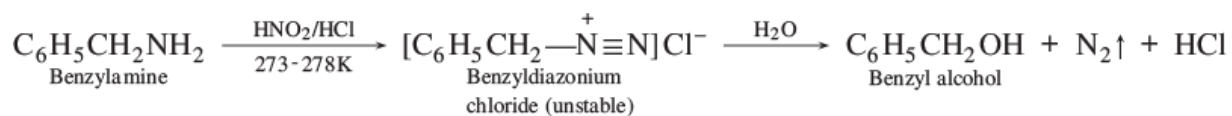
CH_3-NH_2 , $(CH_3)_3N$, $CH_3-NH-CH_3$

Ans. $(CH_3)_3N < (CH_3)_2NH < CH_3NH_2$

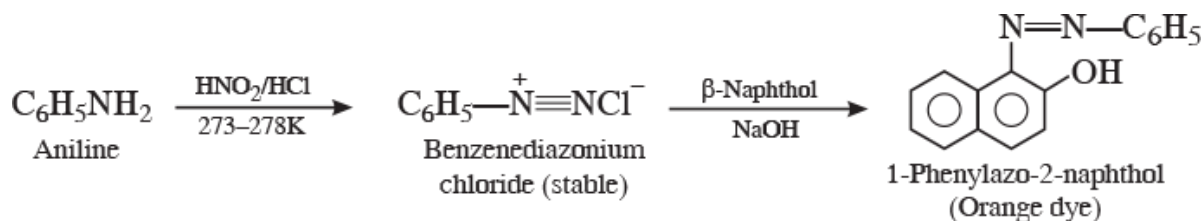
Q.7. Give chemical test to distinguish between $C_6H_5CH_2NH_2$ and $C_6H_5NH_2$.

[CBSE (AI) 2010]

Ans. $C_6H_5CH_2NH_2$ reacts with HNO_2 at 273–278 K to give diazonium salt, which being unstable, decomposes with brisk evolution of N_2 gas.



whereas, $C_6H_5NH_2$ reacts with HNO_2 at 273–278 K to form stable benzenediazonium chloride, which upon treatment with an alkaline solution of β -naphthol, gives an orange dye.



Q.8. Arrange the following in the decreasing order of their basic strength:

- $C_6H_5NH_2$, $C_2H_5NH_2$, $(C_2H_5)_2NH$, NH_3
- Ammonia, triethylamine, aniline, ethylamine and diethylamine.

[CBSE (AI) 2009]

Ans.

- The decreasing order of basic strength of the above amines and ammonia follows the following order:
 $(C_2H_5)_2NH > C_2H_5NH_2 > NH_3 > C_6H_5NH_2$
- Diethylamine > triethylamine > ethylamine > ammonia > aniline.

Q.9. Arrange the following compounds in the order of property indicated for each set :

Q. CH_3NH_2 , $(CH_3)_3N$, $(CH_3)_2NH$ (increasing order of their basic strength in aqueous solution)

[CBSE Delhi 2013]

Ans. $(CH_3)_3N < CH_3NH_2 < (CH_3)_2NH$

Q. $C_6H_5NH_2$, $C_6H_5NHCH_3$, $C_6H_5N(CH_3)_2$ (increasing order of basic strength)

[CBSE Delhi 2014]

Ans. $C_6H_5NH_2 < C_6H_5NHCH_3 < C_6H_5N(CH_3)_2$

Short Answer Questions-I (OIQ)

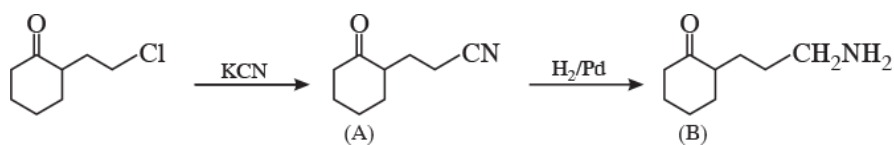
Q.1. Identify A and B in the following reaction.

[NCERT Exemplar]

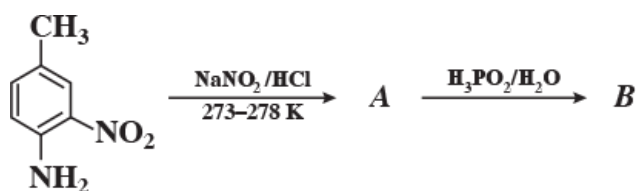
Q.



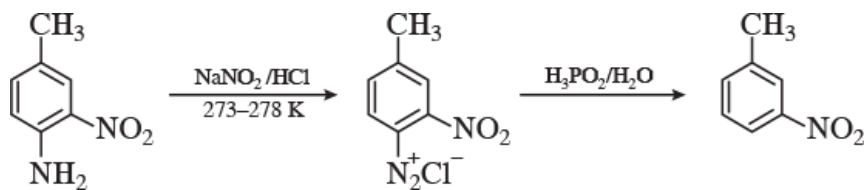
Ans.



Q.



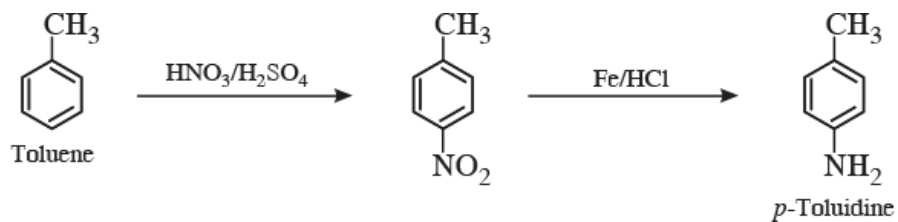
Ans.



Q.2. How will you carry out the following conversions?

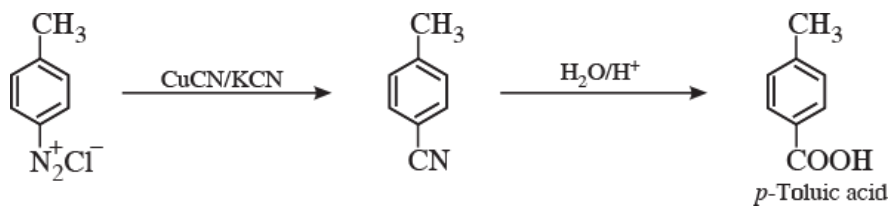
Q. toluene \rightarrow *p*-toluidine

Ans.



Q. *p*-toluidine diazonium chloride \rightarrow *p*-toluic acid

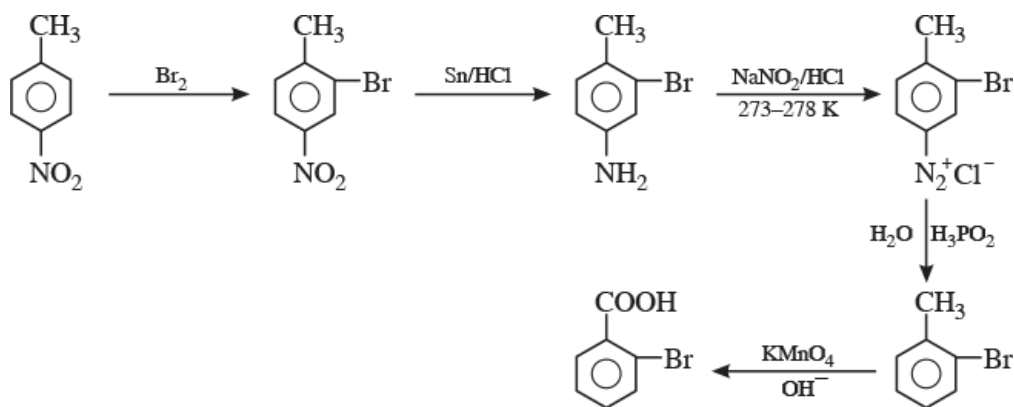
Ans.



Q.3. How will you convert 4-nitrotoluene to 2-bromobenzoic acid?

[HOTS]

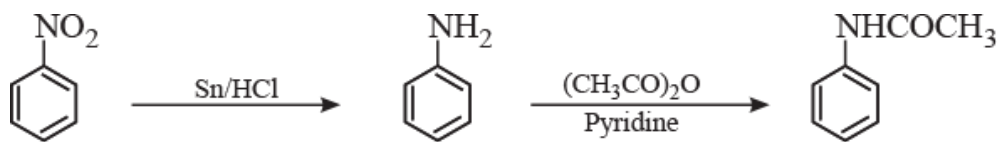
Ans.



Q.4. Write the following conversions:

Q. nitrobenzene \rightarrow acetanilide

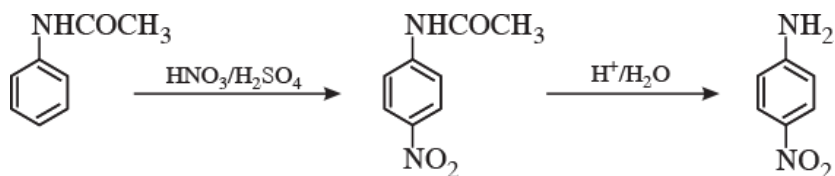
Ans.



Q. acetanilide \rightarrow *p*-nitroaniline

[NCERT Exemplar]

Ans.



Q.5. Account for the following:

Q. Aniline gets coloured on standing in air for a long time.

Ans. Due to electron-donating effect (+R-effect) of —NH₂ group, the electron density on the benzene ring increases. As a result, aniline is easily oxidised on standing in air for a long time to form coloured products.

Q. MeNH₂ is stronger base than MeOH.

[NCERT Exemplar]

Ans. Nitrogen is less electronegative than oxygen therefore lone pair of electrons on nitrogen is readily available for donation. Hence, MeNH₂ is more basic than MeOH.

Q.6. Arrange the following compounds in the order of property indicated for each set :

Q. Methylamine, dimethylamine, aniline, N-methylaniline (increasing order of their acid strength).

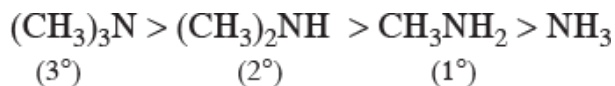
Ans. The acid strength increases in the reverse order of their basic strength, *i.e.*,
dimethylamine < methylamine < N-methylaniline < aniline.

Q. *p*-toluidine, N, N-dimethyl-*p*-toluidine, *p*-nitroaniline, aniline (increasing basicity)

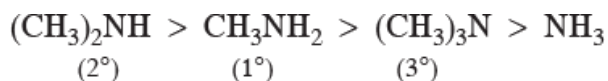
Ans. *p*-nitroaniline < aniline < *p*-toluidine < N, N-dimethyl-*p*-toluidine.

Q.7. Predict, giving reasons, the order of basicity of the following compounds in (i) gaseous phase and (ii) in aqueous solutions (CH₃)₃N, (CH₃)₂NH, CH₃NH₂, NH₃.

Ans. In gaseous phase, basic character of amines increases with the increase in number of electron releasing groups, due to +I effect, so trend of basic character is



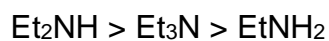
But in aqueous phase, solvation of ammonium cation occurs by water molecules, greater the size of ion, lesser will be the solvation, and lesser will be the stability of ion, so on combining +I effect and solvation effect, in aqueous phase trend changes to



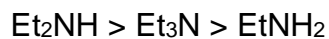
Q.8. Explain the observed K_b order:

Q. $\text{Et}_2\text{NH} > \text{Et}_3\text{N} > \text{EtNH}_2$ in aqueous solution

Ans. Due to combination of +I effect, solvation effect and steric hindrance of ethyl group the basic strength of ethyl substituted amines in aqueous solution is as follows:



As a stronger base has a higher K_b value, therefore, K_b value decreases in the order:



Short Answer Questions-II

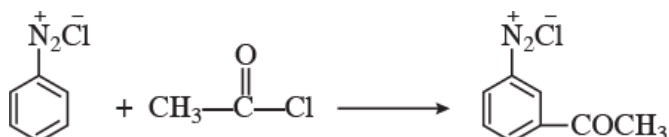
Short Answer Questions-II (PYQ)

Q.1. Complete the following reaction equations:

[CBSE (AI) 2009]



Ans.



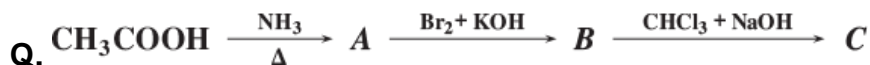
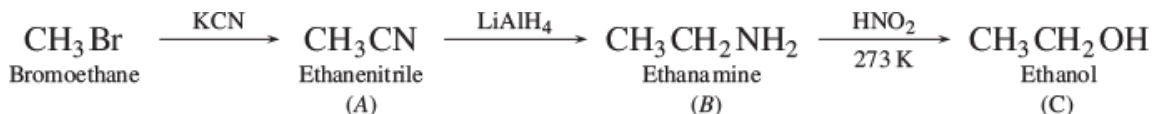
Q.2. Give the structures of A, B and C in the following reactions:

[CBSE Delhi 2014]

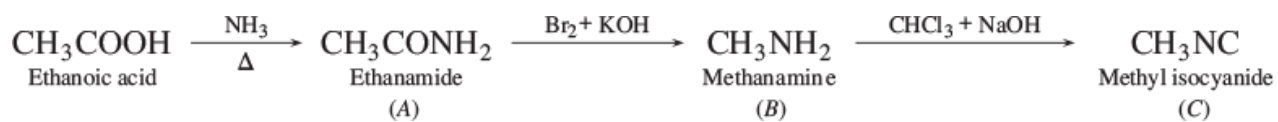
Q.



Ans.



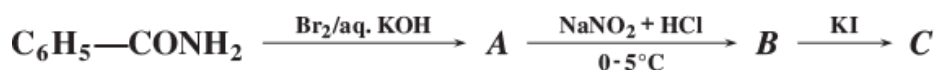
Ans.



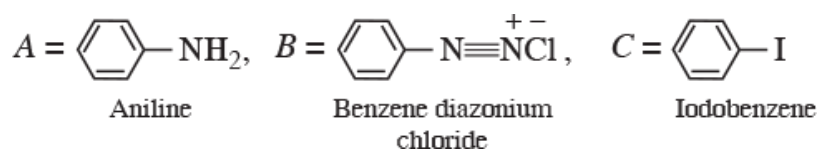
Q.3. Write the structures of A, B and C in the following:

[CBSE Delhi 2016]

Q.



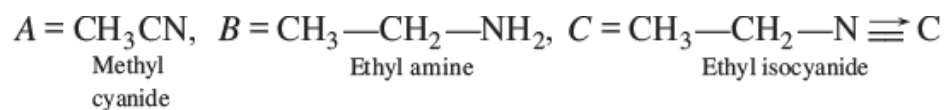
Ans.



Q.



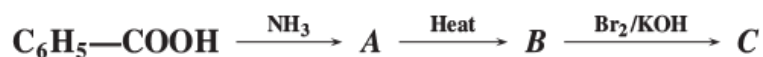
Ans.



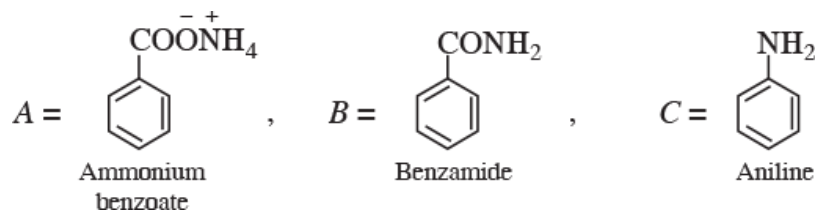
Q.4. Complete the following reactions:

[CBSE East 2016]

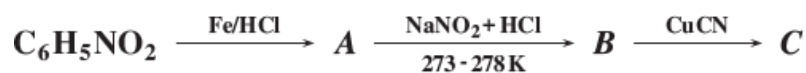
Q.



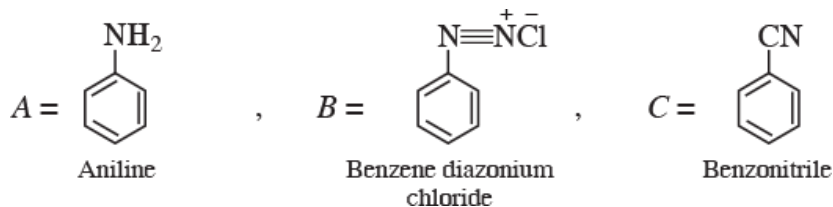
Ans.



Q.

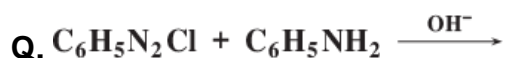


Ans.

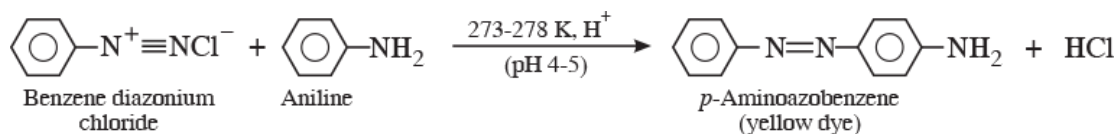


Q. Complete the following chemical equations:

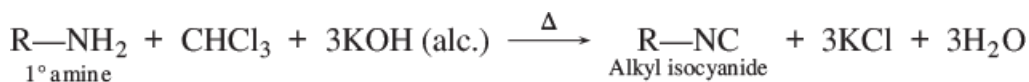
[CBSE Delhi 2010]



Ans.



Ans.



Q.6. How are the following conversions carried out:

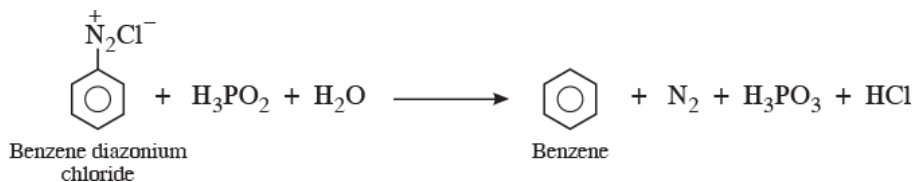
Q. Aniline to fluorobenzene

Ans. Aniline to fluorobenzene



Q. Benzene diazonium chloride to benzene

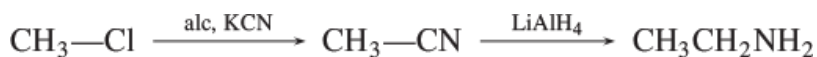
Ans. Benzene diazonium chloride to benzene



Q. Methyl chloride to ethylamine

[CBSE (F) 2013]

Ans. Methyl chloride to ethylamine

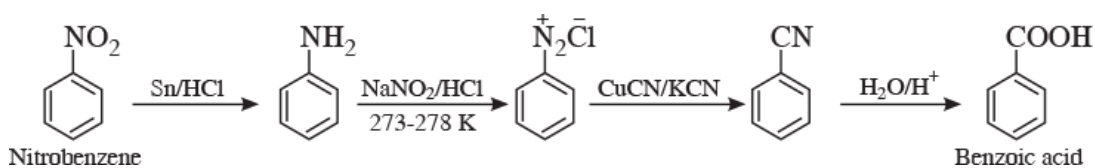


Q.7. Write chemical equations for the following conversions:

[CBSE Delhi 2012]

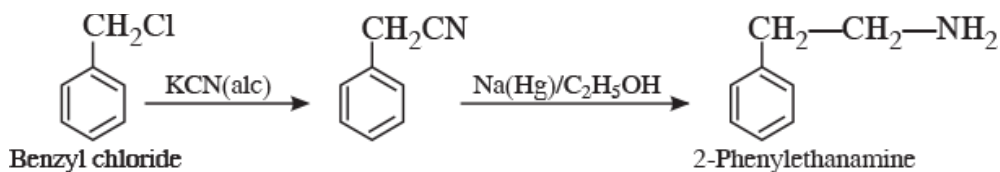
Q. Nitrobenzene to benzoic acid

Ans.



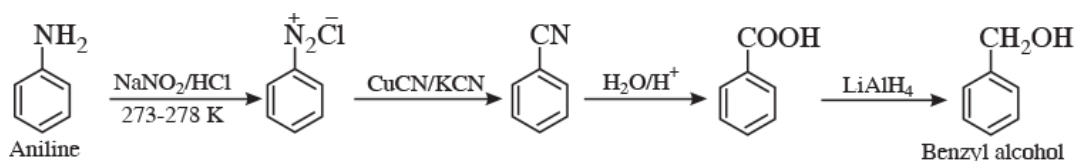
Q. Benzyl chloride to 2-phenylethanamine

Ans.

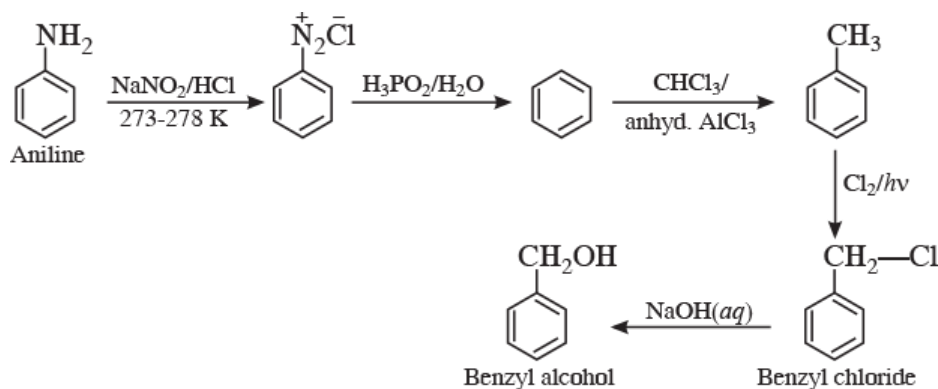


Q. Aniline to benzyl alcohol

Ans.



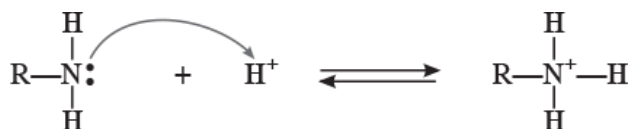
Alternatively,



Q.9. Answer the following questions:

Q. Explain why an alkylamine is more basic than ammonia.

Ans.



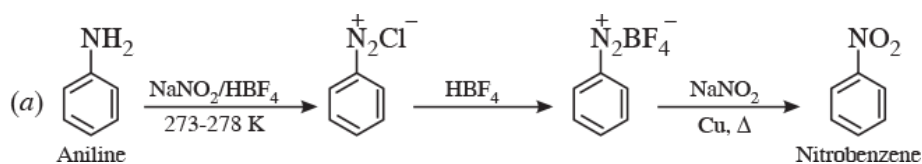
Due to electron releasing nature, the alkyl group (R) pushes electrons towards nitrogen in alkyl amine and thus makes the unshared electron pair more available for sharing with the proton of the acid. Therefore, alkyl amines are more basic than ammonia.

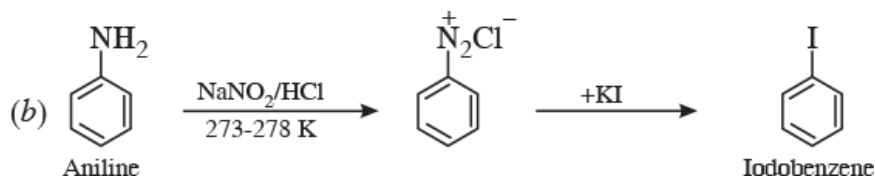
Q. How would you convert

- Aniline to nitrobenzene?
- Aniline to iodobenzene?

[CBSE Delhi 2011]

Ans.





Q.9. Give reasons:

Q. Acetylation of aniline reduces its activation effect.

Ans. Due to resonance the lone pair of electrons on nitrogen of acetanilide gets delocalised towards carbonyl group.



Hence the electrons are less available for donation to benzene ring by resonance. Therefore, activation effect of aniline is reduced.

Q. CH₃NH₂ is more basic than C₆H₅NH₂.

Ans. In CH₃—NH₂, +I-effect of —CH₃ group increases the electron density on the nitrogen atom making lone pair more available for donation. On the other hand, in aniline lone pair of electron on the nitrogen atom is delocalised over benzene ring due to resonance and thus making it less available for donation. That is why CH₃NH₂ is more basic than C₆H₅NH₂.

Q. Although —NH₂ is *o/p* directing group, yet aniline on nitration gives a significant amount of *m*-nitroaniline.

[CBSE Delhi 2017]

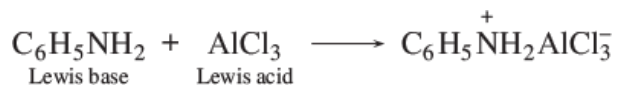
Ans. This is because in a strongly acidic medium aniline is protonated to form the anilinium ion which is meta directing.

Q.10. Give reasons for the following:

[CBSE Central 2016]

Q. Aniline does not undergo Friedal-Crafts reaction.

Ans. Aniline being a Lewis base, reacts with Lewis acid AlCl₃ to form a salt.



As a result, N of aniline acquires positive charge and hence it acts as a strong deactivating group for electrophilic substitution reaction. Consequently, aniline does not undergo Friedel–Crafts reaction.

Q. $(\text{CH}_3)_2\text{NH}$ is more basic than $(\text{CH}_3)_3\text{N}$ in an aqueous solution.

Ans. This is due to combination of three factors, +ve I effect, solvation effect and steric hindrance of alkyl groups in aqueous solutions.

Q. Primary amines have higher boiling point than tertiary amines.

Ans. In primary amines, two hydrogen atoms are present on N-atom and they undergo extensive intermolecular hydrogen bonding which results in association of molecules while in tertiary amines, no hydrogen atom is present on N-atom. Hence, there is no hydrogen bonding in tertiary amines. As a result of this primary amines have higher boiling point than tertiary amines.

Q.11. Account for the following:

[CBSE (AI) 2014] [HOTS]

Q. pK_b of aniline is more than that of methylamine.

Ans. In aniline due to resonance, the lone pair of electrons on the N-atom are delocalised over the benzene ring. Due to this, electron density on the nitrogen decreases. On the other hand, in CH_3NH_2 , +I-effect of CH_3 increases the electron density on the N-atom. Consequently aniline is a weaker base than methylamine and hence its pK_b value is higher than that of methylamine.

Q. Although trimethylamine and *n*-propylamine have the same molecular weight, but the former boils at a lower temperature (276 K) than the latter (322 K). Explain.

Ans. *n*-Propylamine has two H-atoms on the N-atom and hence undergoes intermolecular H-bonding, thereby raising its boiling point. Trimethylamine, $(\text{CH}_3)_3\text{N}$, being a tertiary amine does not have any H-atom on the N-atom. As a result, it does not undergo H-bonding and hence its boiling point is low.

Q. $(\text{CH}_3)_2\text{NH}$ is more basic than $(\text{CH}_3)_3\text{N}$ in an aqueous solution.

Ans. The basicity of amine in aqueous solution depends upon the stability of the substituted ammonium cation. Here the combination of three factors, +ve I effect of CH_3 groups, hydrogen bonding and steric hindrance favour greater stability for ammonium cation of dimethyl amine than ammonium cation of trimethyl amine. Hence dimethylamine is stronger base than trimethyl amine.

Q.12. In the following cases rearrange the compounds as directed:

[CBSE Delhi 2010]

Q. In an increasing order of basic strength:

C₆H₅NH₂, C₆H₅N(CH₃)₂, (C₂H₅)₂NH and CH₃NH₂

Ans. Increasing order of basic strength is:

C₆H₅NH₂ < C₆H₅N(CH₃)₂ < CH₃NH₂ < (C₂H₅)₂NH

Q.12. In a decreasing order of basic strength:

Aniline, *p*-nitroaniline and *p*-toluidine

Ans. *p*-Toluidine > Aniline > *p*-nitroaniline

Q.13. In an increasing order of *pK_b* values:

C₂H₅NH₂, C₆H₅NHCH₃, (C₂H₅)₂NH and C₆H₅NH₂

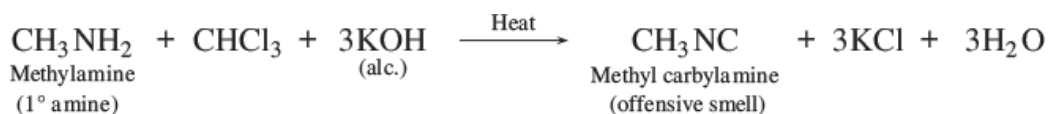
Ans. (C₂H₅)₂NH < C₂H₅NH₂ < C₆H₅NHCH₃ < C₆H₅NH₂

Q.13. Give one chemical test each to distinguish between the compounds in the following pairs:

[CBSE (F) 2009]

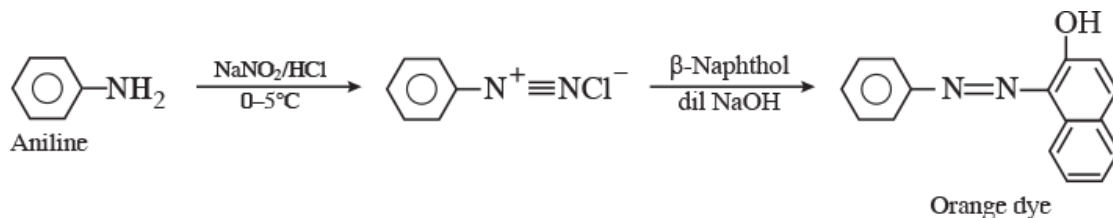
Q. Methylamine and dimethylamine

Ans. Methylamine on treatment with alcoholic KOH and CHCl₃ gives offensive smell of methyl isocyanide but dimethyl amine does not.



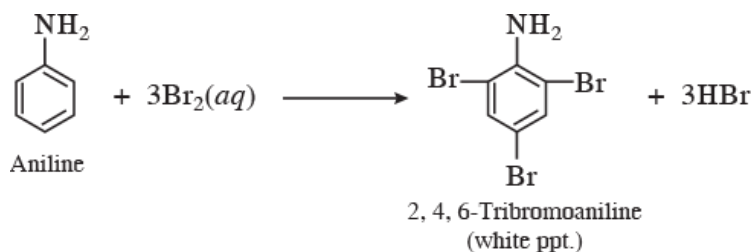
Q. Aniline and benzylamine

Ans. Aniline on treatment with NaNO₂/HCl (HNO₂) at 0–5°C followed by treatment with an alkaline solution of β-naphthol gives an orange coloured azodye while benzylamine does not give this test.



Q. Ethylamine and aniline

Ans. On adding $\text{Br}_2(\text{aq})$, aniline forms white ppt. while ethyl amine does not form such ppt.

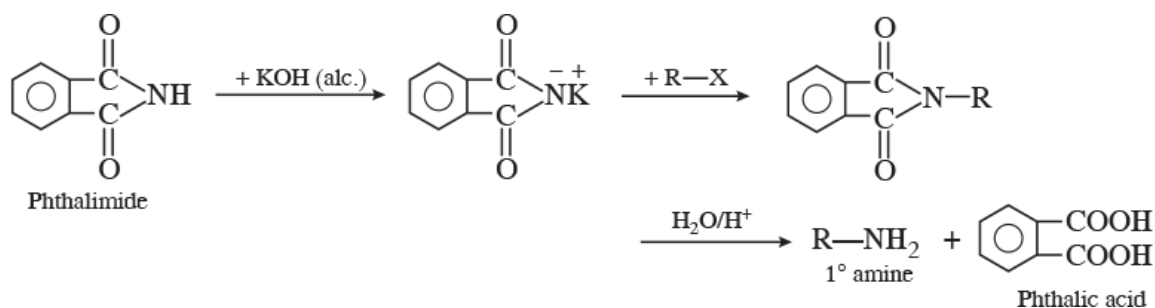


Q.14. Illustrate the following reactions giving a chemical equation in each case:

[CBSE (F) 2011]

Q. Gabriel phthalimide synthesis

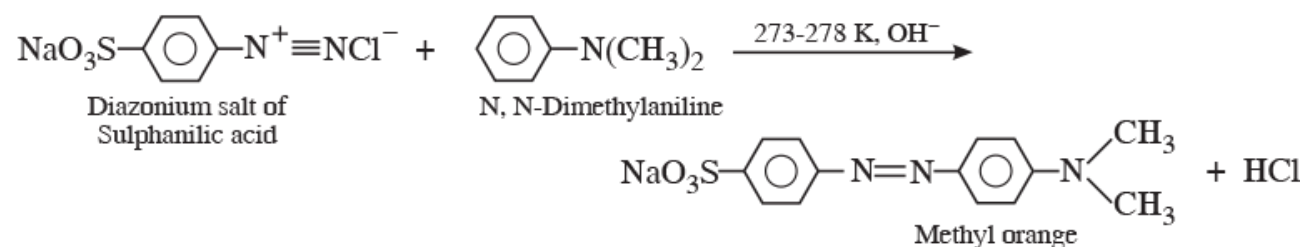
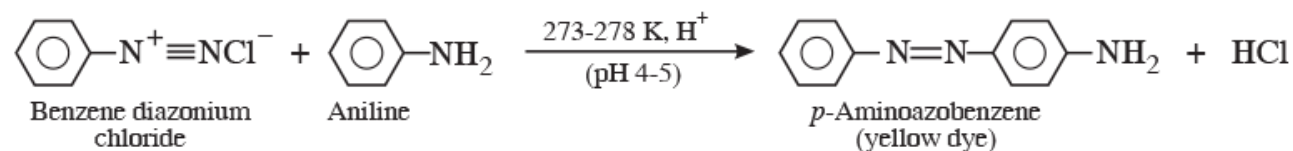
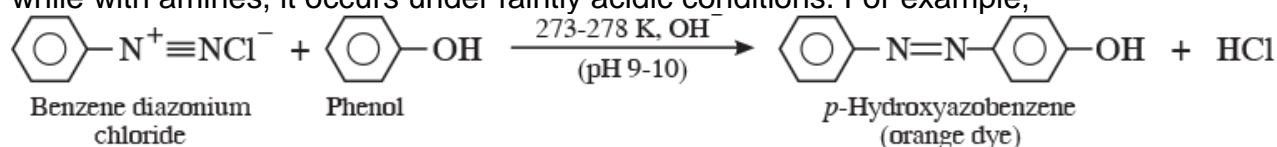
Ans. Gabriel phthalimide synthesis: This reaction is used for the preparation of aliphatic primary amines. In this reaction, phthalimide is first of all treated with ethanolic KOH to form potassium phthalimide. Potassium phthalimide on treatment with alkyl halide gives N-alkyl phthalimide, which on hydrolysis with dilute hydrochloric acid gives a primary amine as the product.



Q. A coupling reaction

Ans. Coupling reaction: The reaction of diazonium salts with phenols and aromatic amines to form azo compounds of the general formula, $\text{Ar-N}=\text{N-Ar}$ is called coupling reaction. The mechanism is basically that of electrophilic substitution where the diazonium ion is electrophile. In this reaction, the nitrogen atoms of the diazo group are retained in the product. The coupling with phenols takes place in mildly alkaline medium

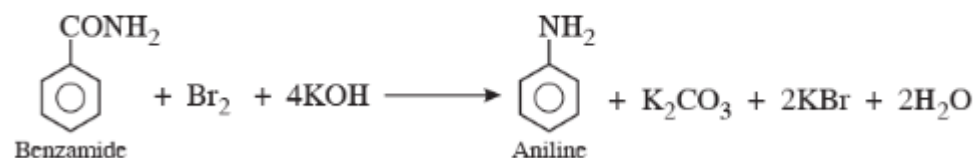
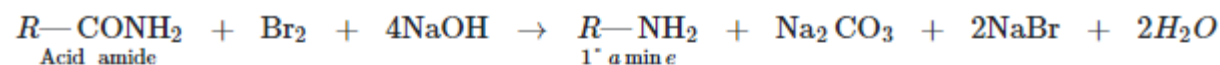
while with amines, it occurs under faintly acidic conditions. For example,



Coupling generally occurs at the *p*-position, w.r.t., the hydroxyl or the amino group, if free, otherwise it takes place at the *o*-position.

Q. Hoffmann's bromamide reaction

Ans. Hoffmann bromamide reaction: When a primary acid amide is heated with an aqueous or ethanolic solution of NaOH or KOH and bromine (*i.e.*, NaOBr or KOBr), it gives a primary amine with one carbon atom less.

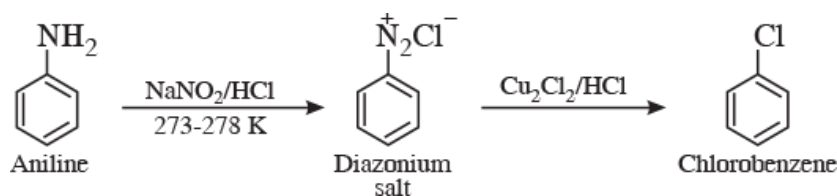


Q.15. How will you convert the following:

[CBSE (F) 2013]

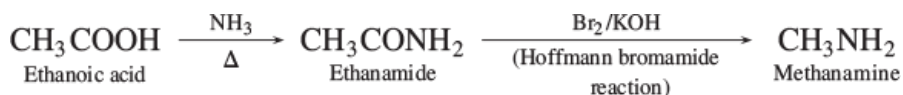
Q. Aniline to chlorobenzene

Ans. Aniline to chlorobenzene



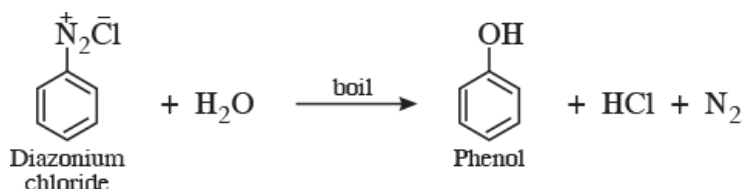
Q. Ethanoic acid to methanamine

Ans. Ethanoic acid to methanamine



Q. Benzene diazonium chloride to phenol

Ans. Benzene diazonium chloride to phenol



Short Answer Questions-II (OIQ)

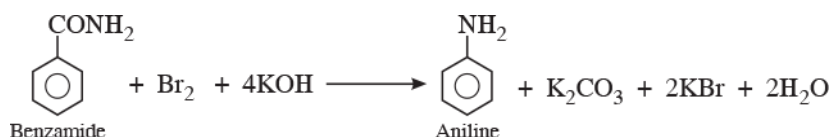
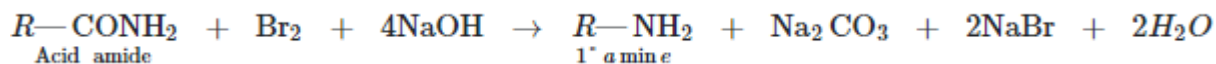
Q.1. Answer the following questions:

[CBSE Sample Paper 2017]

Q. Illustrate the following reactions:

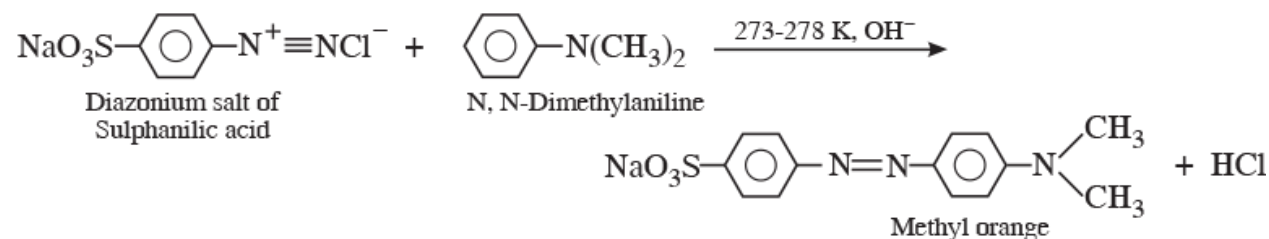
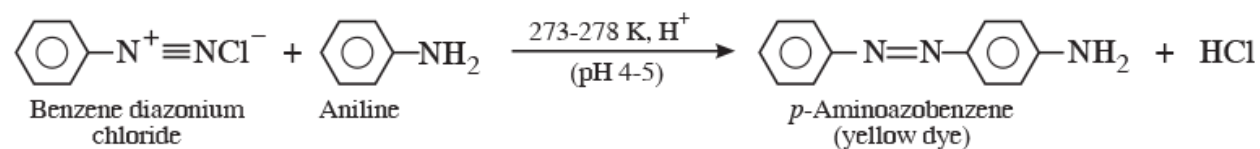
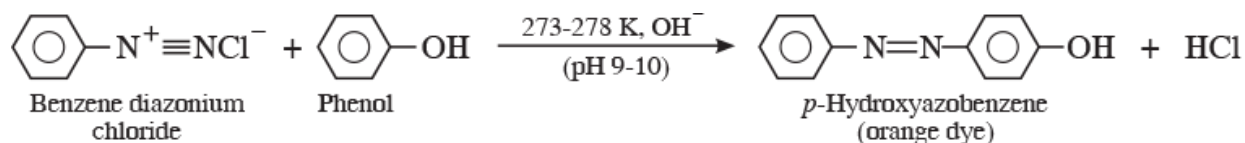
- Hoffmann bromamide degradation reaction.
- Coupling reaction.

Ans. (a) Hoffmann bromamide reaction: When a primary acid amide is heated with an aqueous or ethanolic solution of NaOH or KOH and bromine (*i.e.*, NaOBr or KOBr), it gives a primary amine with one carbon atom less.



(b) Reactions involving retention of diazo group:

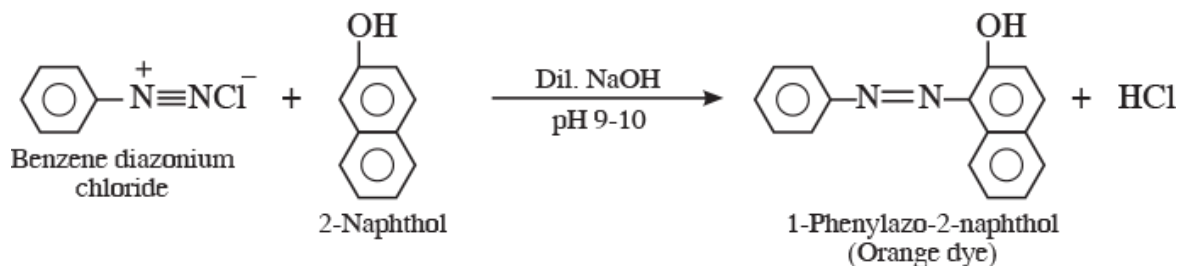
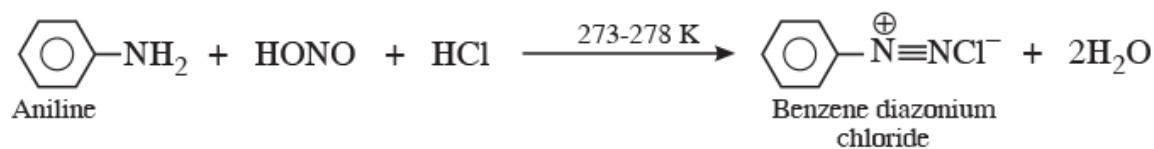
Coupling reaction: The reaction of diazonium salts with phenols and aromatic amines to form azo compounds of the general formula, Ar—N = N—Ar is called coupling reaction. The mechanism is basically that of electrophilic substitution where the diazonium ion is electrophile. In this reaction, the nitrogen atoms of the diazo group are retained in the product. The coupling with phenols takes place in mildly alkaline medium while with amines, it occurs under faintly acidic conditions. For example,



Coupling generally occurs at the *p*-position, w.r.t., the hydroxyl or the amino group, if free, otherwise it takes place at the *o*-position.

Q. Write a chemical test to distinguish between aniline and methylamine.

Ans.

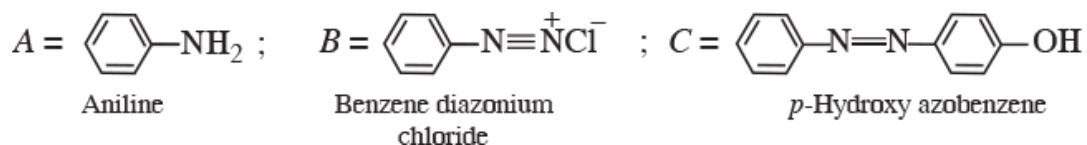


Q.2. Give the structures of A, B and C in the following reactions:

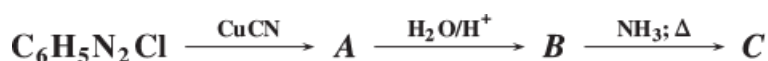
Q.



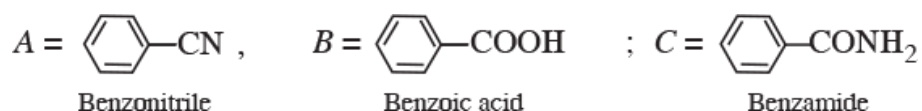
Ans.



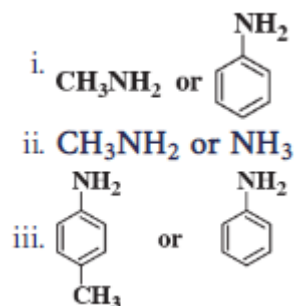
Q.



Ans.

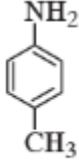
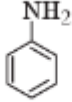


Q.3. In the following pairs which one is more basic and why?



Ans.

- i. In CH_3NH_2 , the +I effect of $-\text{CH}_3$ group makes lone pair of electrons on N-atom more available for donation. On the other hand in $\text{C}_6\text{H}_5\text{NH}_2$, the resonance effect causes delocalisation of lone pair of electrons over benzene ring and makes it less available for donation. Hence, CH_3NH_2 is more basic than $\text{C}_6\text{H}_5\text{NH}_2$.
- ii. CH_3NH_2 is more basic than NH_3 . CH_3 group due to its +ve I effect pushes electron towards nitrogen in $\text{CH}_3\ddot{\text{N}}\text{H}_2$ and this makes the unshared electron pair more available for sharing with the proton of the acid.

iii.  is stronger base than  as CH₃ group is electron releasing by +I effect and hyperconjugation effect.

Q.4. Answer the following questions:

[NCERT Exemplar]

Q. Arrange the following compounds in increasing order of dipole moment.

CH₃CH₂CH₃, CH₃CH₂NH₂, CH₃CH₂OH

Ans. CH₃CH₂CH₃ < CH₃CH₂NH₂ < CH₃CH₂OH

Q. Give possible explanation for each of the following:

- The presence of a base is needed in the ammonolysis of alkyl halides.
- Amides are more acidic than amines.

Ans. (a). To remove HX formed so that the reaction shifts in the forward direction.

(b)



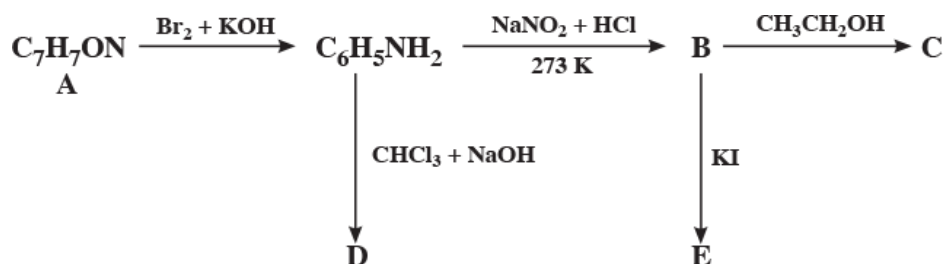
Due to +R effect, availability of lone pair of electron on N of —NH₂ group decreases. As a result, acid amide is much weaker base than amines. Because of the positive charge on N, as a result of resonance, N can easily lose a proton and behaves, as a weak acid.

Long Answer Questions

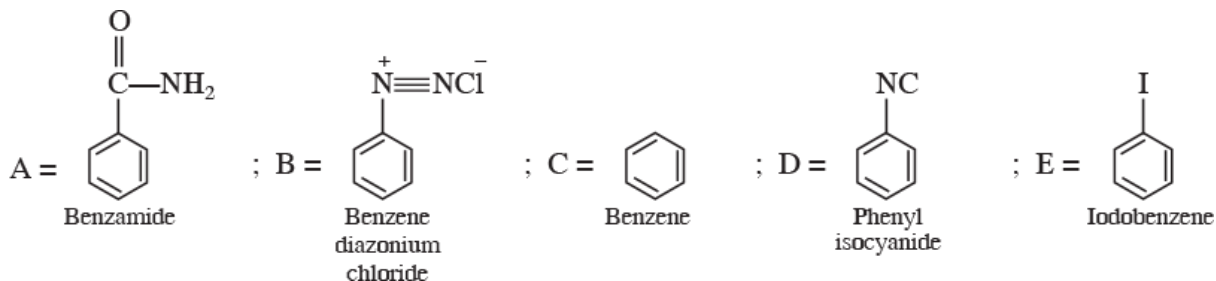
Long Answer Questions (PYQ)

Q.1. An aromatic compound 'A' of molecular formula C_7H_7ON undergoes a series of reactions as shown below. Write the structures of A, B, C, D and E in the following reactions:

[CBSE Delhi 2015] [HOTS]

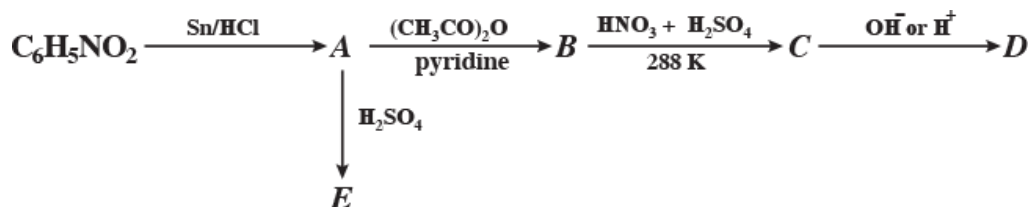


Ans.

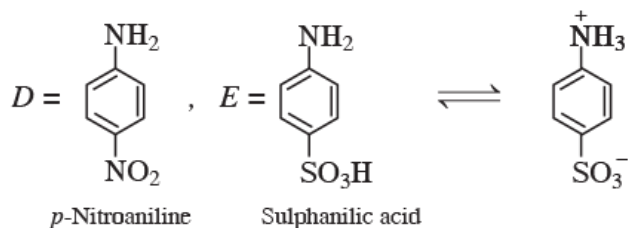
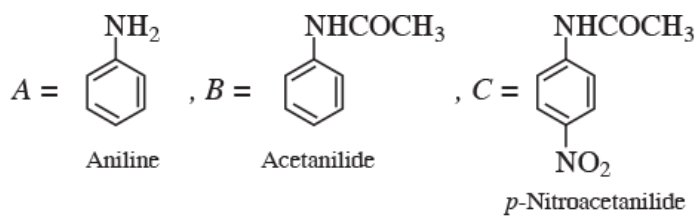


Q. Write the structures of A, B, C, D and E in the following reactions:

[CBSE (F) 2017]



Ans.



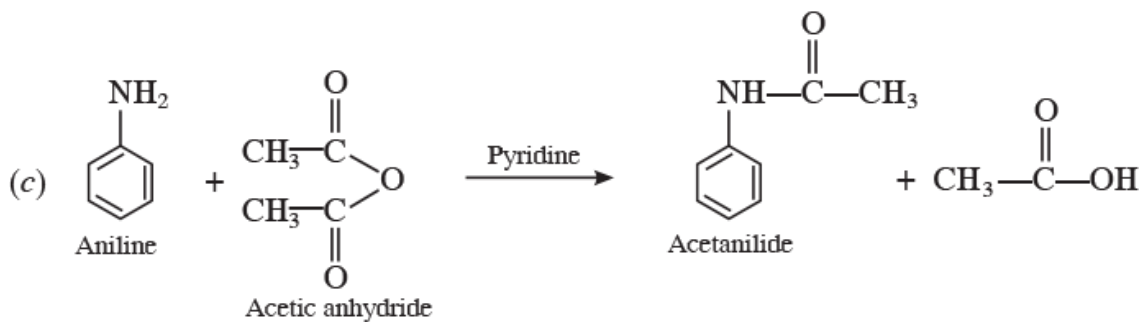
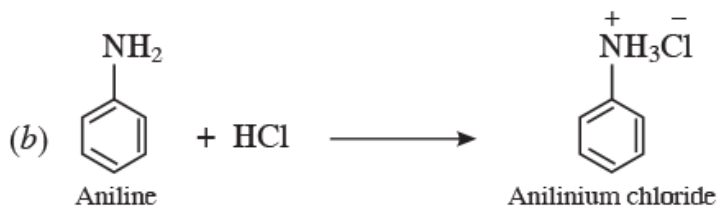
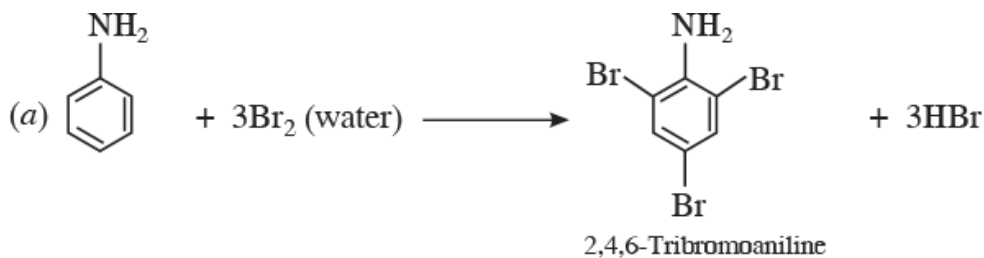
Q.3. Answer the following questions

[CBSE Delhi 2015]

Q. Write the structures of main products when aniline reacts with the following reagents:

(a) Br_2 water (b) HCl (c) $(\text{CH}_3\text{CO})_2\text{O}$ /pyridine

Ans.



Q. Arrange the following in the increasing order of their boiling point:

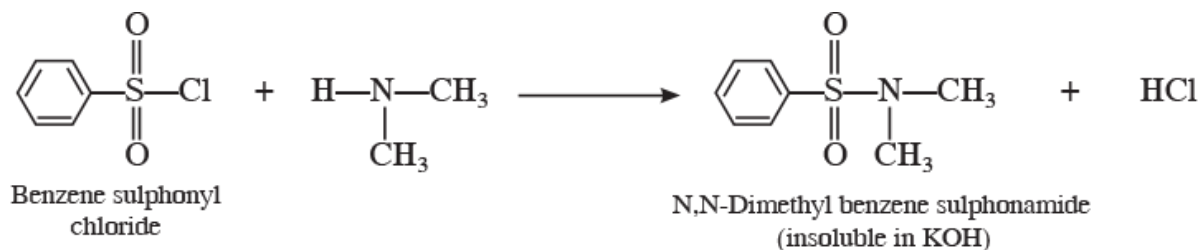
C₂H₅NH₂, C₂H₅OH, (CH₃)₃N

Ans. (CH₃)₃N < C₂H₅NH₂ < C₂H₅OH

Q. Give a simple chemical test to distinguish between the following pair of compounds:

(CH₃)₂NH and (CH₃)₃N

Ans. Dimethyl amine and trimethyl amine can be distinguished by using Hinsberg's reagent, *i.e.*, C₆H₅SO₂Cl. When treated with Hinsberg's reagent dimethylamine being a 2° amine gives N, N-dimethyl benzene sulphonamide which is insoluble in aqueous KOH solution while trimethyl amine being a 3° amine does not react with Hinsberg's reagent.



Q.4. Answer the following questions

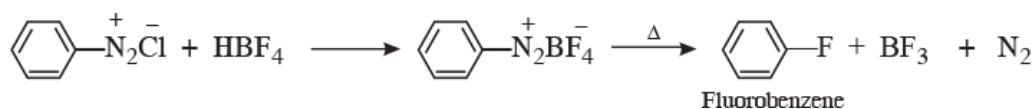
[CBSE (F) 2015]

Q. Write the structures of main products when benzene diazonium chloride (C₆H₅N₂⁺Cl⁻) reacts with the following reagents:

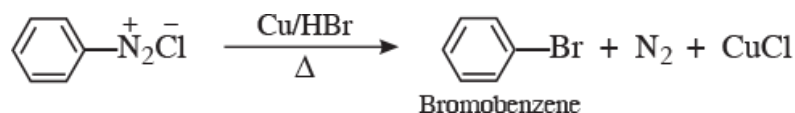
(a) HBF₄/D

(b) Cu/HBr

Ans. (a)



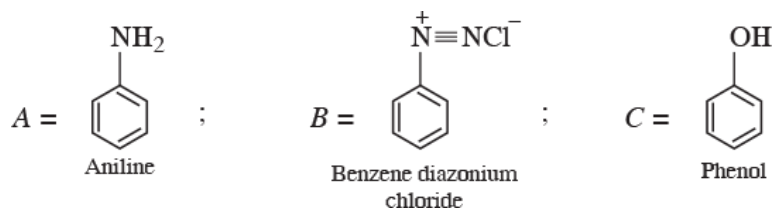
(b)



Q. Write the structures of A, B and C in the following reactions:



Ans. (a)

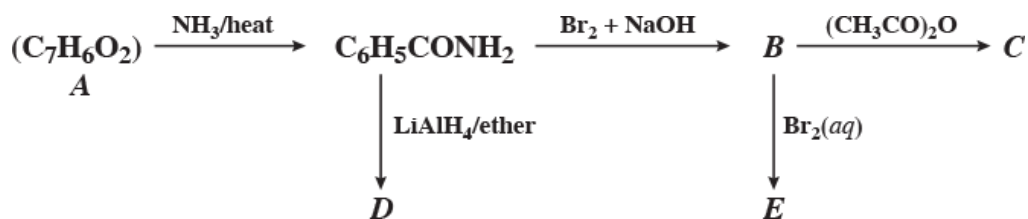


(b)

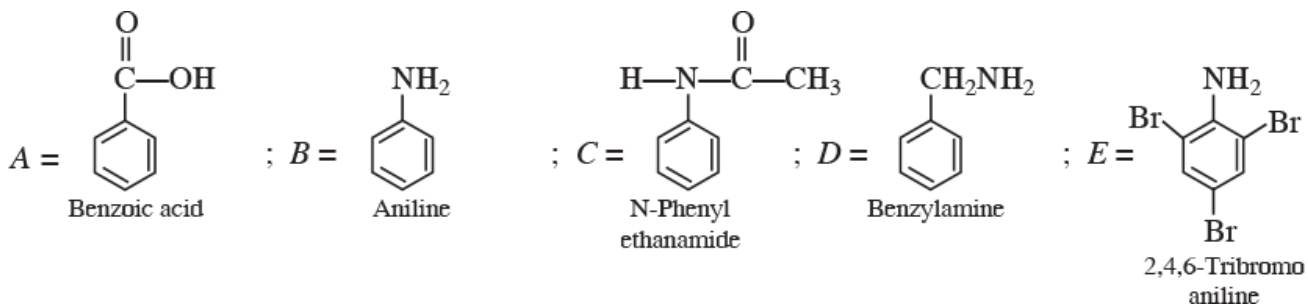


Q.5. An aromatic compound 'A' of molecular formula $\text{C}_7\text{H}_6\text{O}_2$ undergoes a series of reactions as shown below. Write the structures of A, B, C, D and E in the following reactions:

[CBSE Allahabad 2015]



Ans.

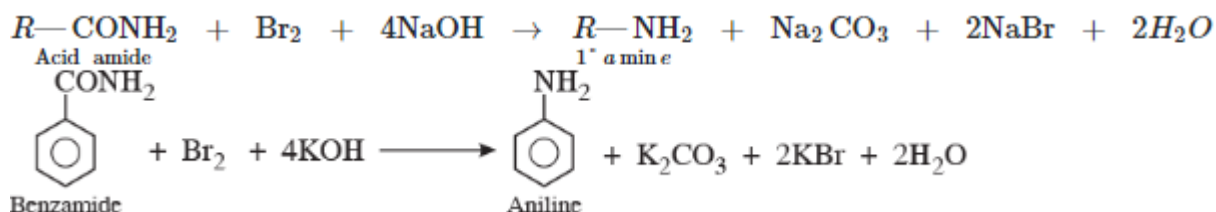


Q.6. Answer the following questions

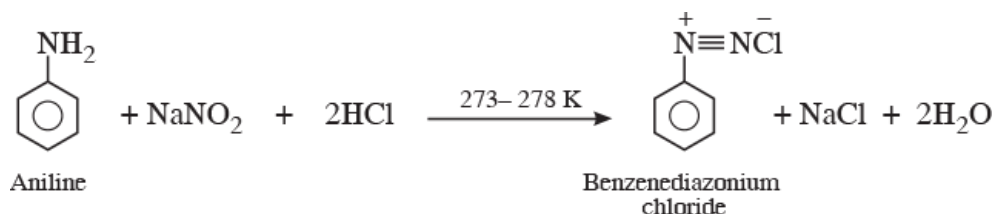
Q. Illustrate the following reactions giving suitable example in each case:

- Hoffmann bromamide degradation reaction
- Diazotisation
- Gabriel phthalimide synthesis

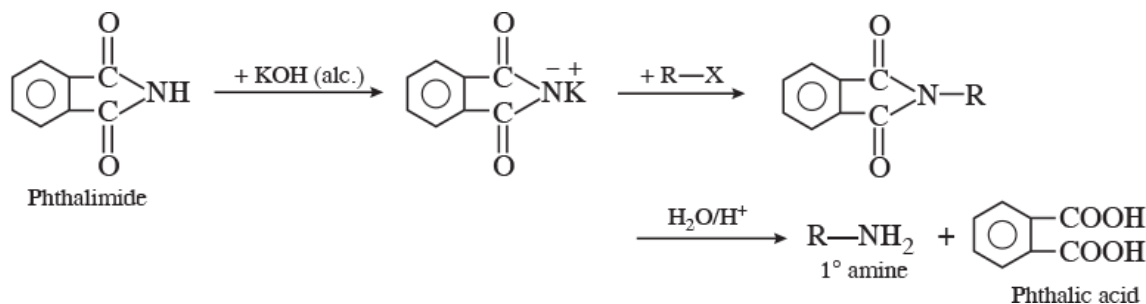
Ans. (a) **Hoffmann bromamide reaction:** When a primary acid amide is heated with an aqueous or ethanolic solution of NaOH or KOH and bromine (*i.e.*, NaOBr or KOBr), it gives a primary amine with one carbon atom less.



(b) **Diazotization:**



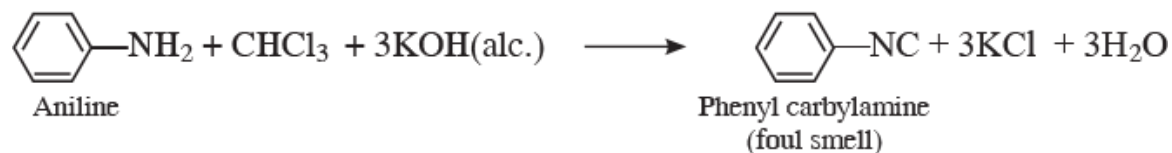
(c) **Gabriel phthalimide synthesis:** This reaction is used for the preparation of aliphatic primary amines. In this reaction, phthalimide is first of all treated with ethanolic KOH to form potassium phthalimide. Potassium phthalimide on treatment with alkyl halide gives N-alkyl phthalimide, which on hydrolysis with dilute hydrochloric acid gives a primary amine as the product.



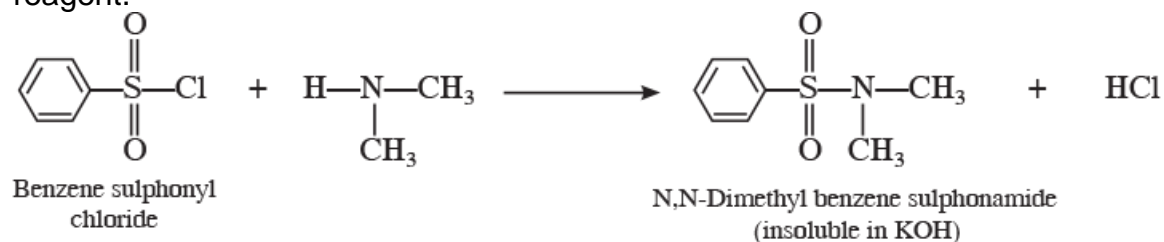
Q. Distinguish between the following pairs of compounds:

- Aniline and N-methylaniline
- $(\text{CH}_3)_2\text{NH}$ and $(\text{CH}_3)_3\text{N}$

Ans. (a). Aniline being a primary amine gives carbylamine test, *i.e.*, when heated with an alcoholic solution of KOH and CHCl_3 , it gives foul smell of phenyl carbylamine whereas N-methylaniline being a secondary amine does not give this test.



(b). Dimethyl amine and trimethyl amine can be distinguished by using Hinsberg's reagent, *i.e.*, $\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$. When treated with Hinsberg's reagent dimethylamine being a 2° amine gives N, N-dimethyl benzene sulphonamide which is insoluble in aqueous KOH solution while trimethyl amine being a 3° amine does not react with Hinsberg's reagent.



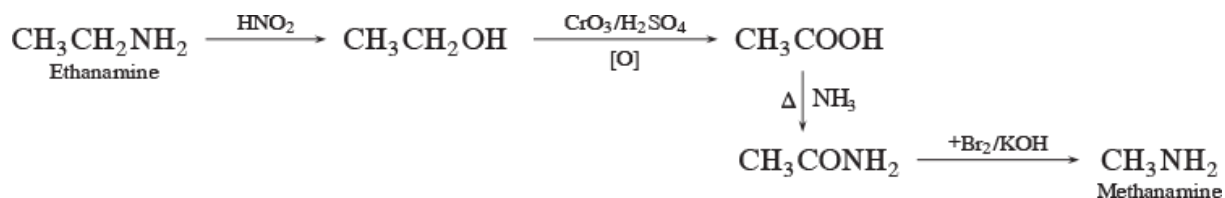
Long Answer Questions (OIQ)

Q.1. Answer the following questions:

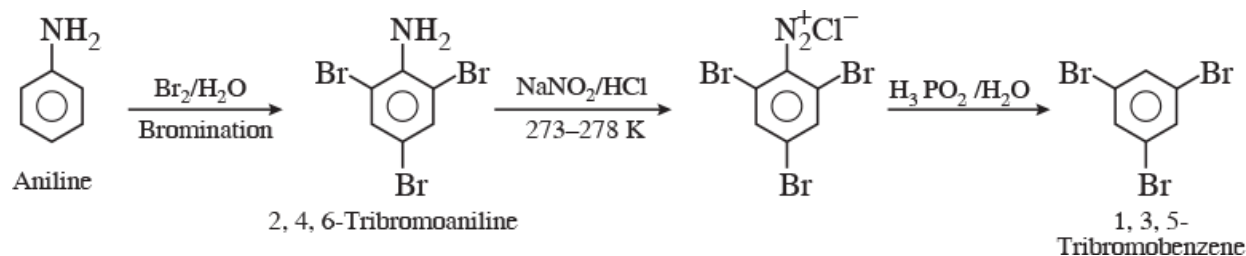
Q. How will you bring about the following conversions?

- Ethanamine into methanamine
- Aniline into 1,3,5-tribromobenzene
- Aniline into 4-bromoaniline

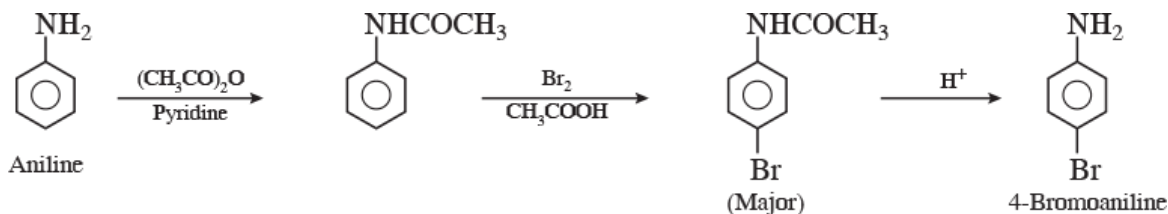
Ans. (a).



(b).



(c).



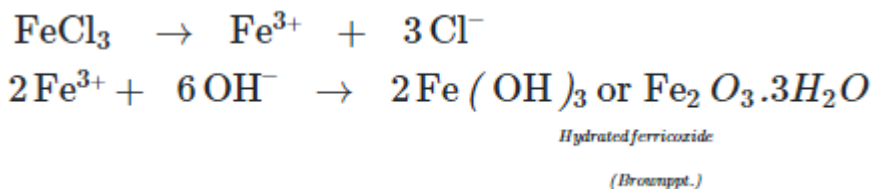
Q. Account for the following:

- Methylamine in water reacts with ferric chloride to precipitate hydrated ferric oxide.
- Diazonium salts of aromatic amines are more stable than those of aliphatic amines.

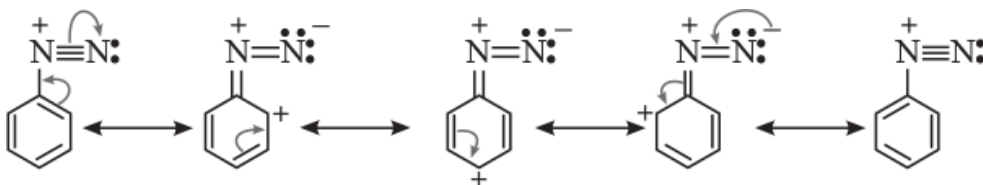
Ans. (a). Methylamine being more basic than water, accepts a proton from water, liberating OH^- ions.



These OH^- ions combine with Fe^{3+} ions present in H_2O to form brown precipitate of hydrated ferric oxide.



(b) The diazonium salts of aromatic amines are more stable than those of aliphatic amines due to dispersal of the positive charge on the benzene ring as shown below:

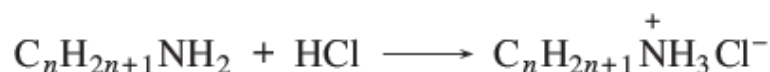


Q.2. [A], [B], [C], [D], [E], [F] and [G] are amines each of which forms a hydrochloride containing 32.42% chlorine. [A], [B], [C] and [D] evolve N_2 on reaction with HNO_2 , but [E], [F], [G] and [H] do not. Give structures of [A] to [H] with reasons.

[HOTS]

Ans. Let the molecular formula of the six amines be $C_nH_{2n+1}NH_2$, where $n = 1, 2, 3$, etc.

As all the seven amines react with HCl to form hydrochlorides, therefore, the molecular formula of their hydrochloride is



As all these hydrochlorides contain 32.4% of Cl, therefore molecular mass of amines

$$\frac{100 \times 35.5}{32.42} = 109.5$$

Now, molecular mass of = 109.5

$$12n + 2n + 1 + 14 + 3 + 35.5 = 109.5$$

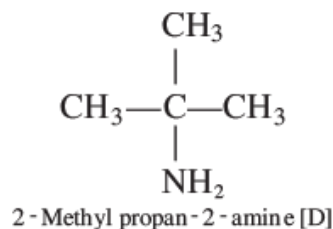
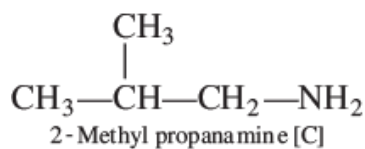
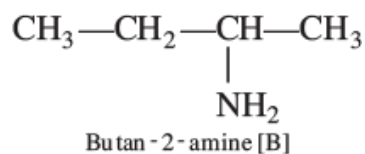
$$\text{or } 14n = 56 \Rightarrow n = 4$$

\therefore Molecular formula of the six amines = $C_4H_9NH_2$

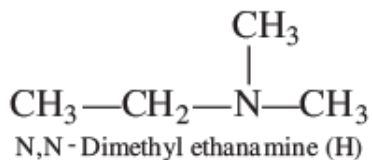
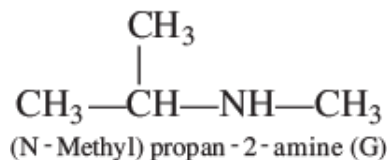
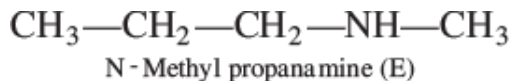
As amines [A], [B], [C] and [D] evolve N_2 on treatment with HNO_2 , they must be primary amines



The four primary amines having molecular formula $C_4H_9NH_2$ are



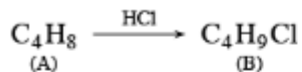
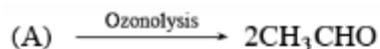
As amines [E], [F], [G] and [H] do not react with HNO_2 , to evolve N_2 , therefore, they must be either secondary or tertiary amines.



Q.3. 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 an optically active alcohol, 'D'. Ozonolysis of 'A' gives 2 moles of acetaldehyde. Identify the compounds 'A' to 'D'. Explain the reactions involved.

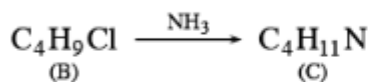
[HOTS]

Ans.



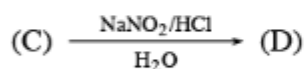
implies 'A' is an alkene.

Addition of HCl has occurred on 'A'. This



NH_2 to give 'C'.

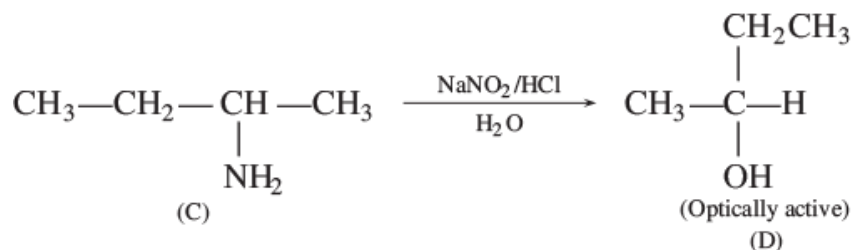
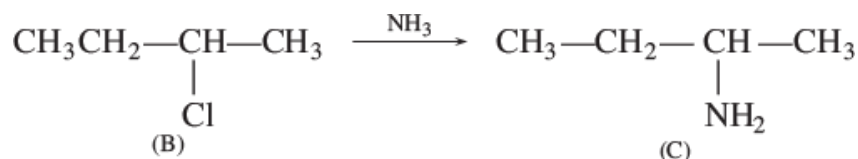
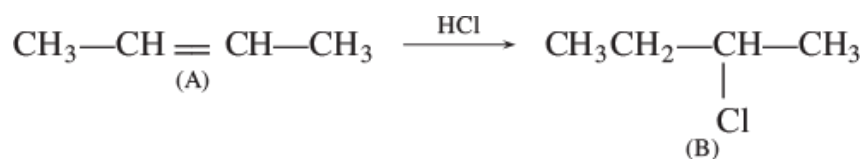
Cl in compound 'B' is substituted by



'C' gives a diazonium salt with NaNO_2/HCl that liberates N_2 to give optically active alcohol. This means that 'C' is a primary amine. Number of carbon atoms in amine is same as compound 'A'.

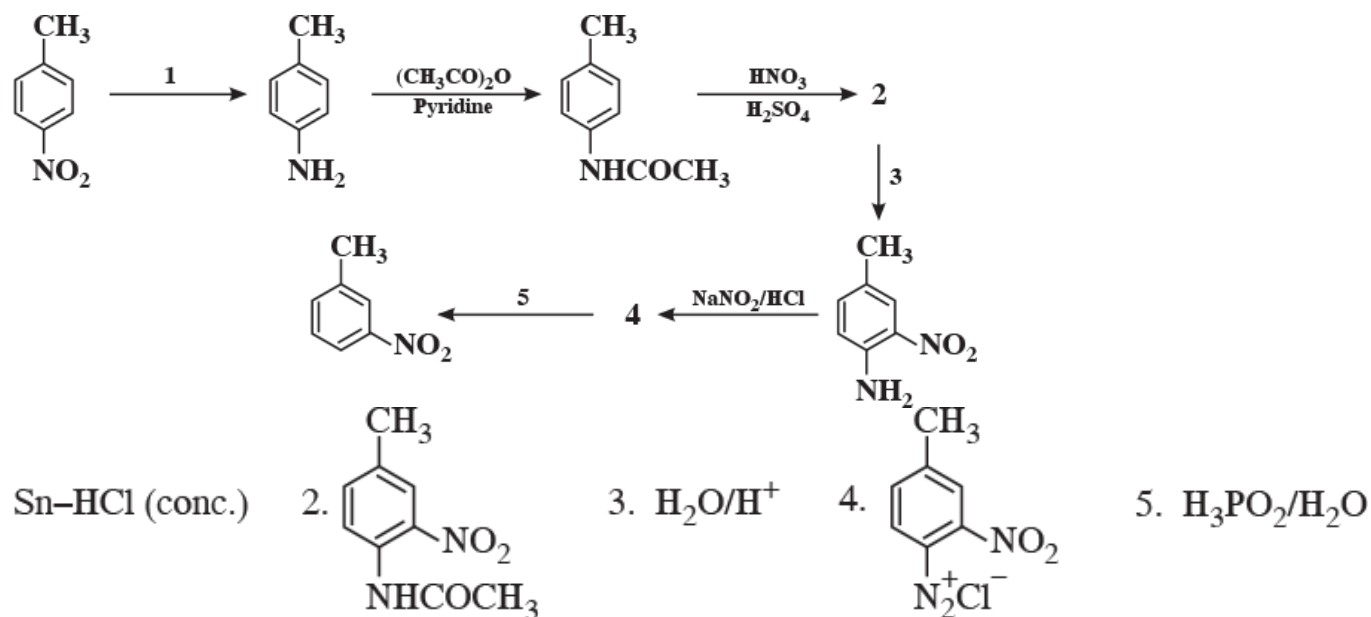
Since products of ozonolysis of compound 'A' are $\text{CH}_3\text{—CH=O}$ and O=CH—CH_3 . Therefore, the compound 'A' is $\text{CH}_3\text{—CH=CH—CH}_3$.

On the basis of structure of 'A', the reactions can be explained as follows:

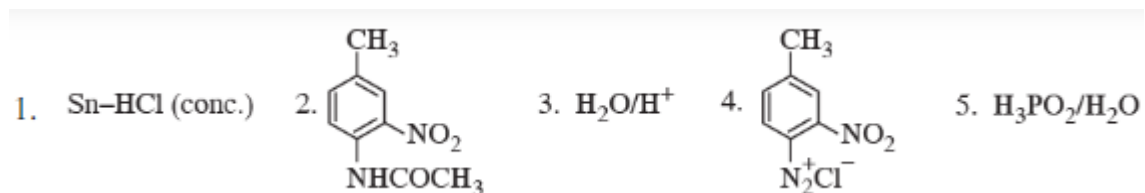


Q.4. Predict the reagents or the products in the following reaction sequence:

[HOTS]

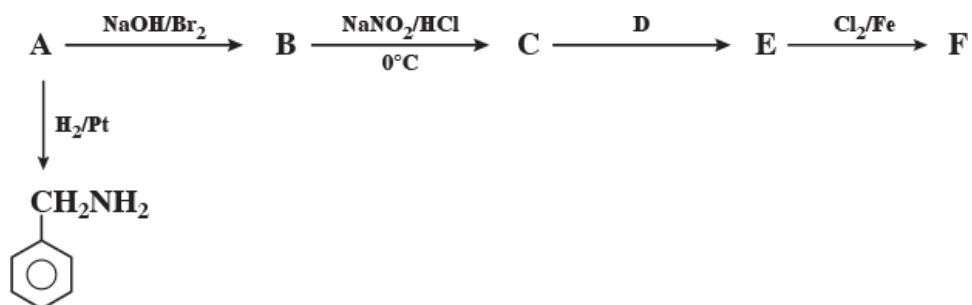


Ans.



Q.5. Write the structures of reagents/organic compounds (A to F) in the following sequence of reactions:

[HOTS]



Ans.

