

ORGANIC CHEMISTRY

ENTHUSIAST | LEADER | ACHIEVER



STUDY MATERIAL

Nitrogen Containing Compounds

ENGLISH MEDIUM





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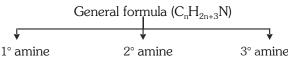


NITROGEN CONTAINING COMPOUND

1.0 Amines

Amines are derivatives of ammonia in which one or more hydrogen atoms are replaced by alkyl group(s). Amines are classified as primary, secondary and tertiary depending on the number of alkyl groups attached to nitrogen atom.

$$NH_3 \xrightarrow{+R} RNH_2$$
 p - amine $\xrightarrow{+R} R_2NH$ $\xrightarrow{+R} R_3N$ tertiary amine R_3N General formula $(C_nH_{2n+3}N)$



2.0 General methods of preparation

- (1) Ammonolysis of alkyl halides and alcohols :
 - (a) From Ammonolysis of alkyl halides [Hofmann's ammonolysis]: When an aqueous solution of ammonia is heated with alkyl halide all the three types of amines and quaternary ammonium salt are formed.

$$R - X \xrightarrow{NH_3} R - NH_2 \xrightarrow{R-X} R_2NH \xrightarrow{R-X} R_3N \xrightarrow{R-X} R_4 \overset{\oplus}{N}\overset{\odot}{X}$$

(Quaternary ammonium salt)

If ammonia is taken in excess, 1° amine is the main product.

(b) Ammonolysis of alcohols: When ROH and NH_3 are passed over Al_2O_3 or ThO_2 at $350^{\circ}C$ all the three types of amines are formed.

- Quaternary ammonium hydroxide is not formed.
- If excess of ammonia is used, then main product will be primary amine.
- (2) By reduction:

(a) With RCONH₂: RCONH₂
$$\xrightarrow{\text{LiAIH}_4}$$
 RCH₂NH₂

(b) With RCN: RCN + 4[H]
$$\xrightarrow{\text{Na/C}_2\text{H}_5\text{OH}}$$
 RCH₂NH₂

This reaction (b) is called Mendius reaction.

The reduction of alkyl isocyanides gives secondary amines.

$$R$$
—NC + 4[H] $\xrightarrow{C_2H_5OH/Na}$ RNHCH₃

- (c) With Oximes: R-CH=N-OH+4[H] $\xrightarrow{\text{LiAlH}_4 \text{ or}} \text{RCH}_2\text{-NH}_2\text{+ H}_2\text{O}$
- (d) With RNO₂: RNO₂ + 6[H] $\xrightarrow{\text{Sn/HCl}}$ RNH₂ + 2H₂O

Sn/HCl is used in laboratory preparation

- (3) By hydrolysis of:
 - (a) R—NC: Alkyl isocyanide undergoes hydrolysis with mineral acid and forms alkyl amine.



(b) RNCO: Alkyl isocyanate undergoes hydrolysis on heating with KOH and forms alkyl amine.

(4) By Hofmann's bromamide reaction (Hofmann's Hypobromite reaction) : This is a general method for the conversion of alkanamides into primary amines having one less carbon.

$$O$$
 \parallel
 $R-C-NH_2+Br_2+4KOH\longrightarrow R-NH_2+K_2CO_3+2KBr+2H_2O$

(5) From Grignard reagent: Alkyl magnesium iodide reacts with chloramine to yield alkyl amine.

$$R - Mg - I + Cl - NH_2 \longrightarrow R - NH_2 + Mg < Cl$$

(6) Gabriel phthalimide synthesis : Phthalimide is first treated with KOH to obtain potassium phthalimide which is then treated with alkyl iodide. Then alkyl phthalimide on hydrolysis yields alkylamine. This method is used in the formation of pure aliphatic primary amines.

$$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} CO \\ CO \end{array} \end{array} NH & \xrightarrow{KOH} \\ \begin{array}{c} \begin{array}{c} CO \\ -H_2O \end{array} \end{array} \end{array} \begin{array}{c} \begin{array}{c} CO \\ NK \end{array} \end{array} \begin{array}{c} 0 \oplus \\ NK \end{array}$$
 RI
R-NH₂ + $\begin{array}{c} \begin{array}{c} COOH \\ COOH \end{array} \end{array} \begin{array}{c} \begin{array}{c} CO \\ CO \end{array} NR \end{array}$

Phthalic acid

(7) Curtius reaction:

(8) Schmidt reaction: In presence of conc. H₂SO₄ alkanoic acid reacts with hydrazoic acid (N₃H) followed by hydrolysis to yield alkylamine.

$$R$$
— $COOH + N_3H$ $\xrightarrow{(1) N_3H,H_2SO_4}$ R — $NH_2 + N_2 + CO_2$

GOLDEN KEY POINTS

• Separation of 1°, 2° and 3° amines

1°, 2°, 3° amine +
$$R_4 \overset{\oplus}{NX}$$
 $\xrightarrow{distillation}$ Mixture of 1°, 2°, 3° amine

 $R_4 \overset{\scriptscriptstyle{\oplus}}{N}\overset{\scriptscriptstyle{\ominus}}{X}$ does not undergo distillation

Mixture of 1°, 2°, 3° amine can be separated by following methods.

^{*} Aniline is not formed by this reaction.



- **(i) Fractional distillation :** The mixture of amines may be separated by fractional distillation because their boiling points are quite different. It is used in industry.
- (ii) **Hinsberg method**: In this method mixture of amines is seperated by using benzene sulphonyl chloride (Hinsberg's reagent).

$$C_6H_5SO_2Cl + 1^\circ$$
 amine \longrightarrow Product \xrightarrow{KOH} Soluble (ppt.)

$$C_6H_5SO_2Cl + 2^\circ$$
 amine \longrightarrow Product \xrightarrow{KOH} insoluble (ppt.)

3° amine does not react with benzene sulphonyl chloride. (No ppt. formed)

(iii) Hofmann method: In this method mixture of amines is separated by using ethyl oxalate.

 1° amine + ethyl oxalate \longrightarrow solid product

 2° amine + ethyl oxalate \longrightarrow liquid product

 3° amine + ethyl oxalate \longrightarrow No reaction

3.0 PHYSICAL PROPERTIES

- (i) CH_3NH_2 is gas and $C_2H_5NH_2$ is a volatile liquid.
- (ii) Higher amines have fishy smell.
- (iii) H –Bonding (weaker as compared to H—O —H).

In 3° amine (due to absence of H-atom) H-bonding is not possible.

(iv) **Boiling point :** Due to weak intermolecular H-bonding the B.P. of 1° and 2° amines are lower than those of alcohols of comparable molecular weight. The boiling point of 3° amines which form no H-bonds are near to those of alkanes of comparable molecular weight.

Boiling point α molecular weight

Order of B.P.:
$$1^{\circ}$$
 amine $> 2^{\circ}$ amine $> 3^{\circ}$ amine so order of volatility: 3° amine $> 2^{\circ}$ amine $> 1^{\circ}$ amine

(v) **Solubility:** Low molecular weight amines are soluble in water. The water solubility of amines decreases with increasing size of alkyl group.

Order of solubility \longrightarrow p- amine > s- amine > t- amine



4.0 Chemical properties

- Basic character of amines is due to the presence of lone pair of electrons on the N atom.
- Basic strength depends on electron donating tendency.
- (iii) Order of basic character in aqueous solution : $(CH_3)_2 NH > CH_3 NH_2 > (CH_3)_3 N > NH_3$

$$(C_2H_5)_2 NH > (C_2H_5)_3N > C_2H_5 NH_2 > NH_3$$

GOLDEN KEY POINTS

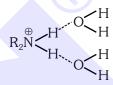
- Tertiary amine is less basic then secondary due to following reasons:
 - Steric hindrance: In tertiary amines (R₂N), three alkyl groups attached to N are bulkier and as such exert steric hindrance.
 - Decrease in hydration:

In tertiary amine

 $R_3 \stackrel{\oplus}{N} - H - O \stackrel{H}{<} I$

Protonated t-amine can form H-bonding with water molecule only at one point [less stable]

In secondary amine



Protonated s-amine can form H bonding with water molecules at two points (more stable)

Conjugate acid of 3° amine are less stable as compare to 2° amine due to low hydration so less basic.

- The basic strength of aniline is less than aliphatic amines as the lone pair of electron present on N- atom interact with the delocalized π - orbital of benzene ring. Hence it is less available for protonation on N-atom.
 - (1) Reactions showing basic nature:

It reacts with acids to form salts.

$$RNH_2 + HCl \longrightarrow [RNH_3] \stackrel{\Theta}{Cl} \stackrel{\Delta}{\longrightarrow} R-Cl + NH_3$$

Alkyl ammonium chloride

(Acidic salt)

$$2RNH_2 \xrightarrow{H_2SO_4} (RNH_3)_2 SO_4^{-2}$$
 Alkyl ammonium sulphate

(2) Reaction with alkyl halides: Alkyl amine reacts with alkyl halides and form sec., ter. amines and quaternary ammonium salt.

$$RNH_2 + R-X$$
 $\xrightarrow{-HX}$ $R_2NH \xrightarrow{RX}$ $R_3N \xrightarrow{RX}$ R_4NX

(3) Acetylation: Acetylation takes place when alkyl amine combines with acetyl chloride or acetic anhydride.

$$\label{eq:RNH2} \begin{aligned} \text{RNH}_2 \ + \ \text{CICOCH}_3 &\longrightarrow & \text{RNHCOCH}_3 + \text{HCl} \\ & \text{(N -alkyl acetamide)} \end{aligned}$$

$$RNH_2 + (CH_3CO)_2O \longrightarrow RNHCOCH_3 + CH_3COOH$$



(4) Benzoylation (Schotten Baumann reaction):

COCl
$$\longrightarrow$$
 CONHR \longrightarrow $+$ H-NH-R \longrightarrow \longrightarrow $+$ HCl Benzoylchloride \longrightarrow N-alkyl benzamide

(5) Acidic nature: Amines are very weak acids only 1° and 2° amines show acidic nature with active metals.

N- alkyl sodamide

(6) Reaction with Tilden reagent:

$$R-NH_2 + NOCl \longrightarrow RCl + N_2 + H_2O$$

(7) Reaction with aldehydes:

$$R-NH_2 + O = C - R \xrightarrow{-H_2O} RCH = NR (Schiff's base)$$

(8) Carbylamine Reaction (Isocyanide test): When alkyl amine heated with chloroform and alc. KOH alkyl isocyanide is formed which has very bad smell.

This test is also given by aniline. This is a test for p-amines.

$$R-NH_2 + CHCl_3 + 3 KOH$$
 \longrightarrow $R-N = C + 3KCl + 3H_2O$

(9) Hofmann's mustard oil test: When alkyl amine is heated with carbon disulphide and mercuric chloride alkyl isothiocyanate is formed which has smell like mustard oil.

$$R-NH_{2} + \overset{S}{C} = S \longrightarrow R-NH - \overset{S}{C} - SH \xrightarrow{HgCl_{2}} R - N = C = S + HgS + 2HCl$$
 Alkyl isothiocyanate
$$R_{2}NH + C = S \longrightarrow R_{2}N-C - SH \xrightarrow{HgCl_{2}} No \ reaction$$

(10) Reaction with HNO₂:

(a) Primary amines react with nitrous acid to produce nitrogen gas [seen as bubbles]

$$R-NH_2 + HONO \longrightarrow R-OH + N_2 \uparrow + H_2O$$

$$CH_3 NH_2 + HNO_2 \longrightarrow CH_3 - O - CH_3$$
 $R_2 NH + HONO \longrightarrow R_2 N - NO + H_2O$

(b)
$$R_2 NH + HONO \longrightarrow R_2 N-NO + H_2O$$

Dialkylnitroso amine (Yellow oily layer)

(c)
$$R_3N + HONO \longrightarrow R_3NHNO_2^{\Theta}$$
 Trialkyl ammonium nitrite (Soluble in water)



Points to Remember:

- (i) Nitrosoamines are carcinogens (Cancer causing agents)
- (ii) Amines can have chiral N-atom but cannot be resolved into enantiomeric forms because of rapid inversion of one enantiomeric form into the other.
- (iii) The Schiff's bases formed by reaction of 1°-amines and aldehyde/ketones are also called anils.
- (iv) The mixture of 1°, 2°, 3° amines can be distinguished by Hofmann's test or Hinsberg's reagent or nitrous acid test.

5.0 ANILINE $(C_6H_5NH_2)$

5.1 General Methods of Preparation

(1) Lab method:

$$C_6H_5NO_2 \xrightarrow{Sn+HCl} C_6H_5NH_2 + H_2O$$

(2) Industrial method:

$$C_6H_5$$
— NO_2 — F_{e+HCl} C_6H_5 — NH_2 + H_2O

(3) From Phenol:

$$C_6H_5OH + NH_3 \xrightarrow{ZnCl_2} C_6H_5NH_2 + H_2O$$

(4) From benzamide (Hofmann's bromamide reaction):

$$C_6H_5CONH_2 + Br_2 + 4KOH \longrightarrow C_6H_5NH_2 + K_2CO_3 + 2KBr + 2H_2O$$

(5) From benzoic acid (Schmidt reaction):

$$\begin{array}{cccc} C_6H_5COOH & + & N_3H & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & \\ & & & \\ &$$

(6) From Grignard reagent:

$$C_6H_5MgBr + ClNH_2 \longrightarrow C_6H_5NH_2 + Mg < Cl$$

(7) From phenyl isocyanide:

$$C_6H_5N \stackrel{?}{=} C + 2H_2O \longrightarrow C_6H_5NH_2 + HCOOH$$

5.2 Physical Properties

- (i) Fresh aniline is a colourless oily liquid. On standing the colour becomes dark brown due to action of air and light.
- (ii) It's B.P. is 183°C.
- (iii) It is heavier than water.
- (iv) It has characteristic unpleasent odour. It is toxic in nature.

Reactions due to -NH₂ group

(1) Basic nature: Aniline is weak base but it forms salt with strong acids. It accepts a proton.

$$C_6H_5-NH_2+H^+$$
 \longrightarrow $C_6H_5NH_3$ Anilinium ion $C_6H_5NH_2+HCl$ \longrightarrow $C_6H_5NH_3Cl$ Anilinium hydrochloride $2C_6H_5NH_2+H_2SO_4$ \longrightarrow $(C_6H_5NH_3)_2SO_4$ Anilinium sulphate $2C_6H_5NH_2+H_2PtCl_6$ \longrightarrow $(C_6H_5NH_3)_2PtCl_6^{-2}$ Anilinium platinic chloride Chloroplatinic acid



(2) Alkylation: Aniline reacts with alkyl halides forming secondary, tertiary and quaternary ammonium salts depending on the concentration of alkyl halides.

(Trimethyl phenyl ammonium iodide)

(3) Acylation: Aniline reacts with acid chlorides or anhydrides to form corresponding amides called anilides. [The reaction of $C_6H_5NH_2$ with benzoyl chloride is example of "Schotten Baumann reaction"]

$$C_6H_5-NH_2+Cl-C-CH_3 \xrightarrow{Base} C_6H_5-NH-C-CH_3$$
 (Acetanilide)

(4) Carbylamine reaction:

$$C_6H_5NH_2 + CHCl_3 + 3KOH \longrightarrow C_6H_5NC + 3KCl + 3H_2O$$

Phenyl isocyanide (Foul smell compound)

Note: (1) Intermediate species is dichloro carbene [: CCl₂].

- (2) This is test of aniline and other primary amine, known as **Isocyanide test.**
- (5) Hoffmann's mustard oil reaction: When aniline is heated with alc. CS₂ and excess of HgCl₂ phenyl isothiocyanate having a characteristic smell of mustard oil is formed.

$$C_6H_5NH_2 + S=C=S$$
 $\xrightarrow{HgCl_2}$ $C_6H_5N=C=S$

Phenyl isothiocyanate

This is a test of aniline and other primary amines.

(6) Reaction with aldehydes: Aniline condenses with aldehydes to form schiff's base.

$$\begin{array}{ccc} C_6H_5NH_2 & + & H-C-C_6H_5 & \longrightarrow & C_6H_5N = CHC_6H_5 & + & H_2O\\ & & & Benzylidene \ aniline\\ & & (schiff's \ base) \end{array}$$

(7) Reaction with Hinsberg's reagent:

$$C_6H_5 \hspace{-0.1cm} -\hspace{-0.1cm} SO_2Cl \hspace{0.1cm} + \hspace{0.1cm} HNHC_6H_5 \hspace{0.1cm} \xrightarrow{\hspace{0.1cm} -\hspace{0.1cm} HCl} \hspace{0.1cm} C_6H_5SO_2NHC_6H_5$$

(N- Phenylbenzene sulphonamide)

(8) Diazotisation: Diazotisation is a reaction in which ice cooled solution of aniline in an inorganic acid reacts with sodium nitrite solution leading to the formation of diazonium salt.

$$C_6H_5NH_2 + NaNO_2 + HCl \xrightarrow{0^{\circ}-5^{\circ}C} C_6H_5N_2Cl$$

Benzene diazonium chloride is a useful synthetic reagent. It is used in the preparation of many organic compounds



Cu/HCl C₆H₅Cl Δ (Gattermann reactions) Cu/HBr C_6H_5Br Δ Cu₂Cl₂/HCl $C_6H_5Cl + N_2 + HCl$ Δ Cu₂Br₂/HBr Sandmeyer $C_6H_5Br + N_2 + HCl$ reactions Cu2(CN)2/HCN/A $C_9H_5CN + N_9 + HCl$ or CuCN/KCN/Δ KI (aq.) $C_6H_5I + N_2 + KCI$ $NaBF_4/\Delta$ C₆H₅N₂Cl · $C_6H_5F + BF_3 + NaCl$ Balz-Schiemann reaction or HBF_4/Δ H_2O C₆H₅OH C₂H₅OH $C_6H_6 + CH_3CHO + N_2 + HCl$ $H_3PO_2 + H_2O$ $C_6H_6 + H_3PO_3 + N_2 + HCl$ C₆H₅NHNH₂(Phenyl hydrazine) SnCl₂ + HCl N₂-C₆H₅ β-Naphthol (Red orange dye) 10% NaOH C₆H₅OH $C_6H_5N=N-C_6H_4OH$ pH 8-10 Coupling p-Hydroxy azobenzene (Orange dye)/ reactions C₆H₅NH₂ $C_6H_5N=N-C_6H_4NH_2$ pH 4-5 p-Amino azobenzene (aniline yellow or yellow dye)

(1) Halogenation: In polar and nonpolar medium Chlorine and bromine react with aniline and form trichloro and tribromo aniline respectively.



Note: However, monobromo or chloro derivative of aniline can be prepared if $-NH_2$ group is first protected by acetyl group. Here the reactivity decreases due less +M effect on benzene ring.

$$\begin{array}{c} \text{NH}_2 \\ \text{NHCOCH}_3 \\ \text{(Acetanilide)} \\ \end{array} \begin{array}{c} \text{NHCOCH}_3 \\ \text{Br}_2 \\ \text{CH}_3\text{COOH} \\ \end{array} \begin{array}{c} \text{Br}_2 \\ \text{H}_2\text{O} \\ \text{NH}_2 \\ \text{NH}_2 \\ \text{NH}_2 \\ \end{array} \begin{array}{c} \text{NH}_2 \\ \text{NH}_2 \\ \text{O- and p-Bromo aniline} \\ \end{array}$$

(2) Nitration:

(3) **Sulphonation :** Aniline reacts with fuming H_2SO_4 to give sulphanilic acid.(p-Amino-benzene sulphonic acid)

$$\begin{array}{c} \text{NH}_2 \\ \hline \\ \text{NH}_2 \\ \\ \text{H}_2 \\ \text{SO}_4 \\ \text{(Fuming)} \end{array} \\ \begin{array}{c} \overset{\bigoplus}{\text{NH}_3 \\ \text{HSO}_4} \\ \hline \\ \hline \\ \text{180°C} \end{array} \\ \begin{array}{c} \text{NHSO}_3 \\ \hline \\ \\ \text{Rearrangement} \\ \\ \text{SO}_3 \\ \\ \text{Sulphanilic acid} \\ \end{array}$$

- This process is called baking.
- Sulphanilic acid is an important intermediate in the manufacturing of dyes and drugs.
- The compounds in which both proton donating & proton accepting groups present are called ampholite (dipolar ion).

(4) Catalytic hydrogenation : Aniline undergoes hydrogenation in presence of Ni at high temp. to form cyclohexanamine.

5.3 Tests of Aniline

(i) Carbylamine test: Aniline gives carbylamine test or Isocyanide test.

$$C_6H_5NH_2 + CHCl_3 + KOH \longrightarrow C_6H_5NC$$
(Bad smelling)



- (ii) Dye test: Aniline is first diazotised. On adding alkaline solution. of β -naphthol to the diazotised product a red-orange dye is formed.
- (iii) On heating with bromine water, a white ppt. is formed.

BEGINNER'S BOX-1

- 1. Which one of following reaction is Schotten–Baumann reaction?
 - (1) Acetylation of RNH₂

(2) Acylation of RNH₂

(3) Benzoylation of RNH₂

- (4) All of them
- 2. Which of the following pair will yield primary amine on hydrolysis?
 - (1) CH₃NCO, CH₃NC

(2) CH₃CN, CH₃NC

(3) (CH₂)₂NH, CH₃—CH=NOH

- (4) None of the above
- **3.** Methylamine on treatment with chloroform and ethanolic caustic alkali gives foul smelling compound, the compound is
 - (1) CH₃NCO
- (2) CH₃CNO
- (3) CH₃CN
- (4) CH₂NC

6.0 NITRO BENZENE [C₆H₅NO₂]

It is also called as artificial oil of bitter almonds or oil of mirbane as its odour is like that of bitter almonds.

6.1 General Methods of Preparation

(1) Lab method:

$$\bigcirc$$
 + Conc. H₂SO₄ + Conc. HNO₃ \longrightarrow \bigcirc \bigcirc \bigcirc \bigcirc

(2) From diazonium salt:

$$\begin{array}{c}
N_2Cl \\
\hline
(i) HBF_4 \\
\hline
(ii) NaNO_2, Cu, \Delta
\end{array}$$

$$+ N_2 + NaBF_4$$

6.2 Physical Properties

- (i) Nitro benzene is light yellow oily liquid
- (ii) It has smell of bitter almonds
- (iii) It is steam voltile. It's vapours are poisonous in nature.
- (iv) It is heavier than water
- (v) It's B. P. is 211°C
- (vi) Smell of nitro benzene and benzaldehyde is same

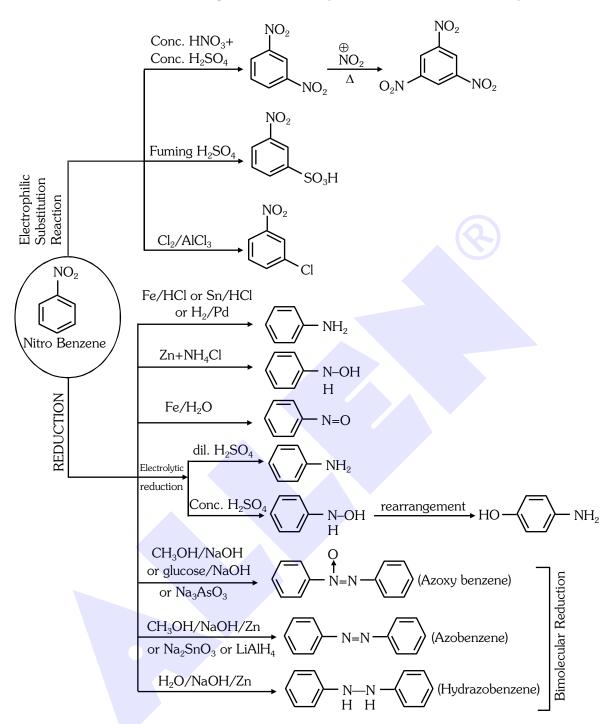
6.3 Chemical Properties

Nitrobezene shows following chemical reactions -

(1) Reactions due to NO₂ group.



(2) Reactions due to benzene ring: (A) Electrophilic substitution (B) Nucleophilic substitution



6.4 Test of Nitrobenzene

Mulliken Barker Test: Ethanolic solution of nitrobenzene is treated with zinc dust and NH_4Cl solution. The mixture is heated and filter in a test tube containing Tollen's reagent a grey or black precipitate (Ag mirror) is formed.

$$C_{_{6}}H_{_{5}}NO_{_{2}} + Zn + NH_{_{4}}Cl \longrightarrow C_{_{6}}H_{_{5}}NH - OH \xrightarrow{\quad Tollen's \ reagent \quad} C_{_{6}}H_{_{5}}NO \quad + \quad Silver \ mirror \ (Ag \downarrow)$$
 Phenyl hydroxyl amine \qquad \text{Nitroso benzene}

6.5 Uses

(i) As a solvent



(ii) In manufacture of aniline and azo dye

BEGINNER'S BOX-2

- 1. Nitration of which of the following compound is difficult:-
 - (1) Benzene
- (2) Nitrobenzene
- (3) Toluene
- (4) Phenol
- **2.** Nitration of nitrobenzene in presence of fuming nitric acid will generate a :-
 - (1) Solid product
- (2) Gaseous product
- (3) Semi-solid product
- (4) Liquid product
- **3.** $C_6H_5NO_2 \xrightarrow{Sn/HCl} A \xrightarrow{NaNO_2/HCl} B$; To obtain benzene from B, the suitable reagent is :
 - (1) SnCl₂ + HCl
- (2) H₂PO₂
- $(3) C_2H_5N_2Cl$
- (4) Methanol
- **4.** When nitrobenzene is heated with conc. HNO_3 and conc. H_2SO_4 the product would be obtained?
 - (1) T.N.T.
- (2) D.N.B.
- (3) D.D.T.
- (4) T.E.L.
- **5.** Which of the following has the maximum value of dipole moment?







ANSWER'S KEY											
BEGINNER'S BOX-1	Que.	1	2	3							
	Ans.	4	1	4							
BEGINNER'S BOX-2	Que.	1	2	3	4	5					
	Ans.	2	1	2	2	2					