Ranjan Singh
Chemistry Classes
JEE (Main & Advanced) • NEET • XI • XII

Study Package

Ranjan Singh
M.Sc. Bio-Chemistry(P.U)
Ex-Faculty : Narayana & Goal

ORGANIC CHEMISTRY

AMINES

Director's Message

Ranjan Singh

M.Sc.(Biochemistry), P.U.

Chemistry plays a central and important role in all competitive examinations as well as in day to day life. For last so many years, I have constantly been in touch with students, guiding them in Chemistry and looking into their difficulties for them to succeed in their board as well as competitive examinations JEE(Mains & Advance) | NEET.

I have felt a need for a good coaching centre to fulfil the requirements of students. Students need a highly experienced and qualified faculty in chemistry, who can guide them well, clear their doubts, provide them the effective & tricky notes, and make them do much needed practice. More importantly they should also be provided Classroom Monitoring, Periodical & Surprise Tests to guide them in the proper direction. I realize that, it is very important to diagnose the basic weaknesses and problems of students not succeeding in JEE(Mains & Advance) | NEET and Board exams. In fact, as question patterns are changing, now they need to have a different approach for these Examinations.

At RANJAN SINGH CHEMISTRY CLASSES, we have our own way to prepare students for Competitive Examinations as well as Board Examination at a time so they can crack the entrance exam like JEE(Mains & Advance) and NEET as well as 12th Board simultaneously. We act as a medium to provide the simplest, easiest and a comfortable way to make students achieve their target. At RANJAN SINGH CHEMISTRY CLASSES(RSCC), we guide our students with the best motivational classes so weak students are also able to believe that, They can do it.

When you join RANJAN SINGH CHEMISTRY CLASSES you become a part of the powerful force which propels you towards your goal and if you get a position among the rankers with my excellent guidance, I will think that our efforts have borne fruits.

M.Sc(Biochemistry), P.U.
Ex-faculty : Narayana IIT Academy
& Goal Institute

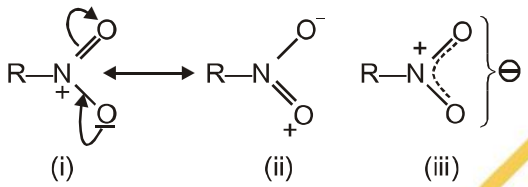
Ranjan Singh

NITRO COMPOUNDS

Compound containing NO_2 group are termed as nitro compounds. NO_2 group is infact ambident group and is capable of getting attached to the carbon chain through nitrogen (*e.g.*, RNO_2) well as through oxygen (*e.g.*, R–O–N=O alkyl nitrite).

Electronic Structure of NO_2 Group :

Nitro alkane have high dipole moment. This suggest that nitro alkanes may be represented by following 2 canonical structures :



The resonance hybrid structure (iii) has both the N–O bond lengths equal, which is actually found.

General Methods of Preparation

- **By heating an alkyl halide with alcoholic solution of silver nitrite**

  $C_2H_5Br + AgNO_2 \xrightarrow{\Delta} C_2H_5NO_2 + AgBr$

  (Some amount of C_2H_5–ONO is also formed)

- **By direct nitration of hydrocarbons :** Nitration of alkanes is difficult in comparison with that of aromatic hydrocarbons. Alkanes undergo nitration with fuming HNO_3 in the vapour phase at 423-673 K under pressure giving a mixture of nitroalkanes resulting through cleavage of C—C bonds. For example,

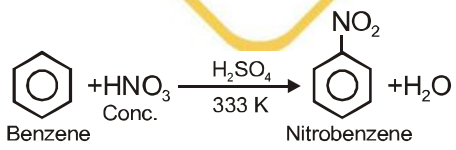
  $\underset{\text{Ethane}}{CH_3CH_3} \xrightarrow[HNO_3,\ 673\,K]{\text{Fuming}} \underset{\text{Nitroethane}}{CH_3CH_2NO_2} + \underset{\text{Nitromethane}}{CH_3—NO_2}$

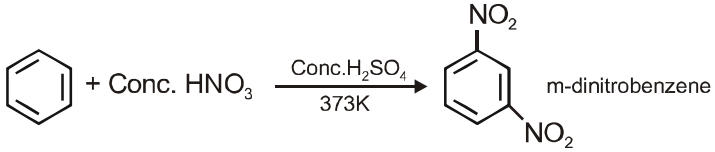
  Lower members can be nitrated by vapour phase nitrations.

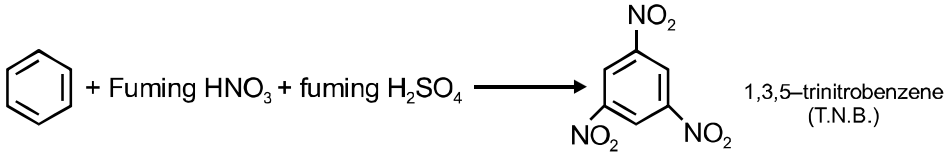
  This reaction occurs by a free radical mechanism and the ease of substitution of hydrogens follows the following order.

  tertiary > secondary > primary

- Aromatic nitro compounds are prepared by nitration of aromatic compounds with nitric acid or **nitrating mixture** (mixture of conc. HNO_3 with conc. H_2SO_4)



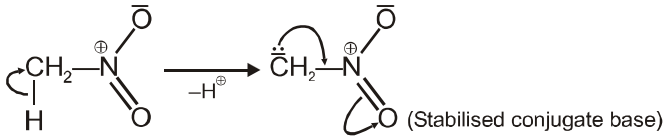




Chemical Properties

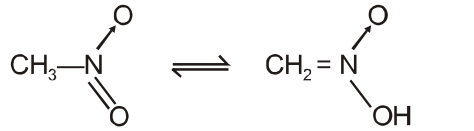
A. Reactions due to α-H-atom

- **Acidity :** Due to stablisation of conjugate base formed, primary and secondary nitroalkances having hydrogen atom on the carbon atom directly attched with $-NO_2$ are weak acidic,



(Stabilised conjugate base)

Therefore, nitroalkanes having α-H show tautomerism.



Nitro-form (Pseudo acid form) Aci-form (Nitrolic form) a strong acid

- **Action of halogen :**

$$CH_3NO_2 \xrightarrow[NaOH]{Cl_2} CCl_3NO_2$$
Nitrochloroform (chloropicrin)

- **Action of nitrous acid :**
  - Primary nitroalkanes react with nitrous acid to form nitrolic acids, which dissolves in sodium hydroxide giving red solution.

$$CH_3CH_2NO_2 + O = NOH \longrightarrow \underset{\text{Nitrolic acid}}{Ch_3 - \overset{\overset{NOH}{\|}}{C} - No_2} + H_2O$$

$$CH_3 - \overset{\overset{NOH}{\|}}{C} - NO_2 + NaOH \longrightarrow CH_3 - \overset{\overset{NONa}{\|}}{C} - NO_2 + H_2O$$
Sod. Nitrolate (red)

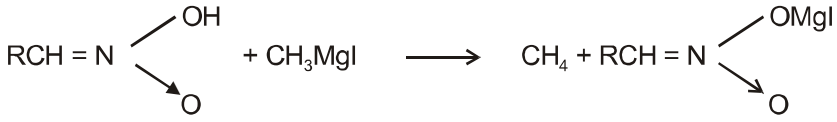
  - Secondary nitroalkanes react with nitrous acid to give colourless crystalline pseudonitroles which give blue colour in sodium hydroxide solution.

$$R - \overset{\overset{H}{|}}{\underset{\underset{R}{|}}{C}} - NO_2 + HON = O \longrightarrow R - \overset{\overset{N = O}{|}}{\underset{\underset{R}{|}}{C}} - NO_2 + H_2O$$
Pseudonitrol (Blue in NaOH)

  - Tertiary nitroalkanes do not react with nitrous acid because they do not contain an α-hydrogen.
- **Condensation with aldehydes :** Primary and secondary nitroparaffins condense with aldehydes in the presence of alkali forming **nitroalcohols.**

$$CH_3CHO + CH_3NO_2 \longrightarrow \underset{\beta\text{–Hydroxy nitropropane}}{CH_3CH(OH)CH_2NO_2}$$

◆ **Reaction with Grignard reagent :**



◆ **Hydrolysis :**

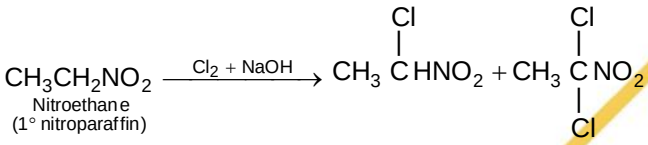
(a) $CH_3CH_2NO_2 + H_2O \xrightarrow{HCl} CH_3COOH + NH_2OH$

(b) Secondary nitroalkanes on hydrolysis produce ketones.

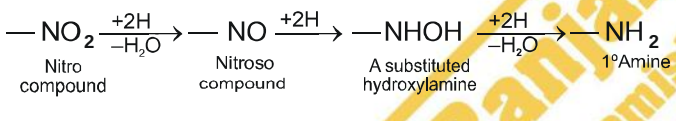
$$2R_2CHNO_2 \xrightarrow[\text{boiling}]{HCl} 2R_2CO + N_2O + H_2O$$

(c) Tertiary nitroalkanes do not undergo hydrolysis.

◆ **Halogenation :** Primary and secondary nitroparaffins are readily halogenated in alkali solution (X_2 + NaOH or NaOX). The halogen atom enters the α-position.



◆ **Reduction :** Various reduction stages of nitro group are given below

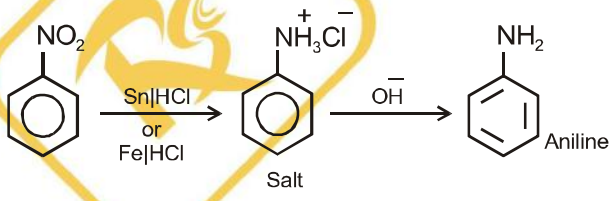


Reduction in strongly acidic medium

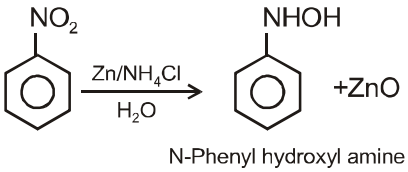
$$CH_3CH_2NO_2 + 6[H] \xrightarrow[OH^-]{Sn/HCl} \underset{\text{Ethylamine}}{CH_3CH_2NH_2} + H_2O$$

(i) Reduction of Nitro benzene in different medium

(a) Acidic Medium

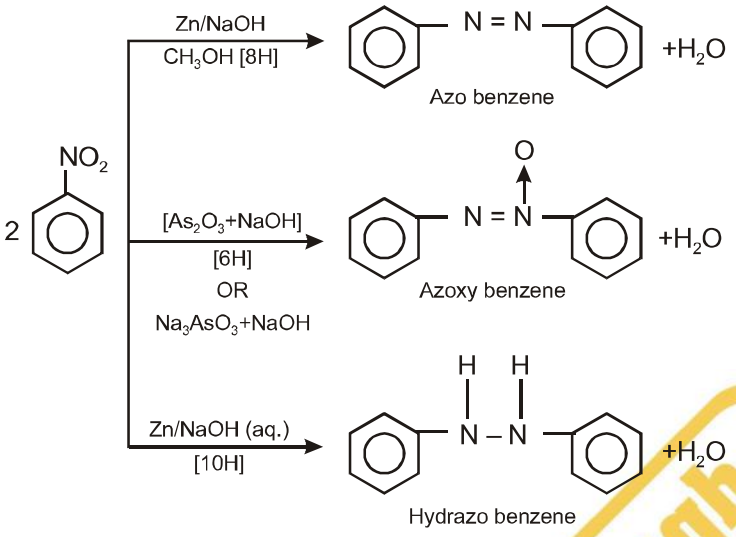


(b) Neutral Medium



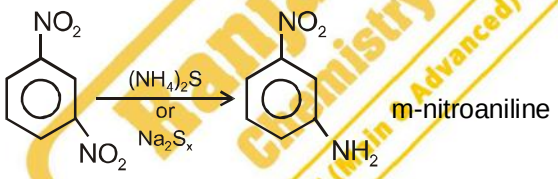
(c) Reduction in alkaline medium

Depending upon the nature of the reducing agent, nitro benzene forms different products.

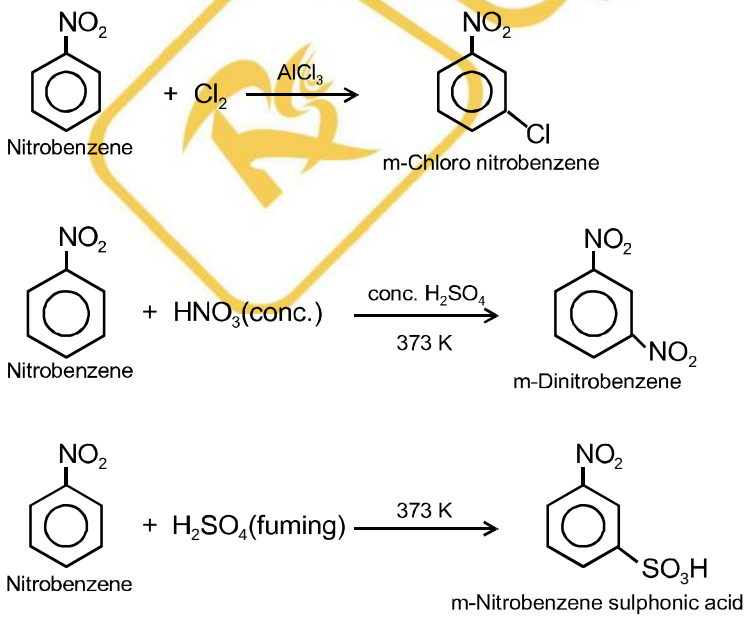


(ii) Selective Reduction (Zinin Reduction)

Reduction of m-dinitrobenzene with ammonium sulphide or sodium poly sulphide reduces only one $-NO_2$ group.

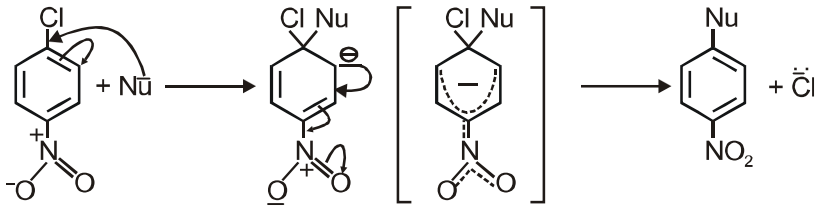


◆ **Electrophilic substituion**



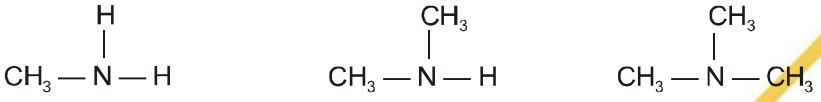
◆ **Nucleophilic Aromatic substitution**

1° amine act as nucleophile and attacks another molecule of alkyl halide.



Stablisation of anion by resonance

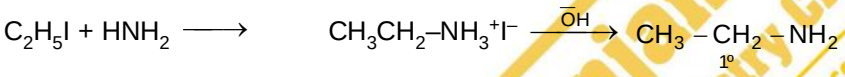
CLASIFICATION OF AMINES



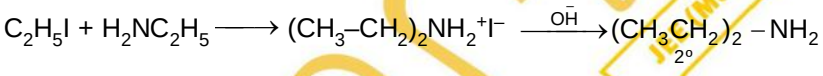
Methylamine (Primary) | Dimethylamine (Secondary) | Trimethylamine (Tertiary amine)

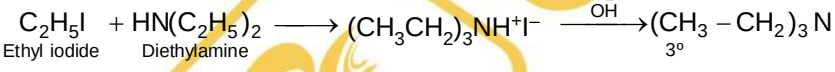
General Methods of Preparation

◆ **By the reaction of an alkyl halide with ammonia** (Ammonolysis of alkylhalide) **:**

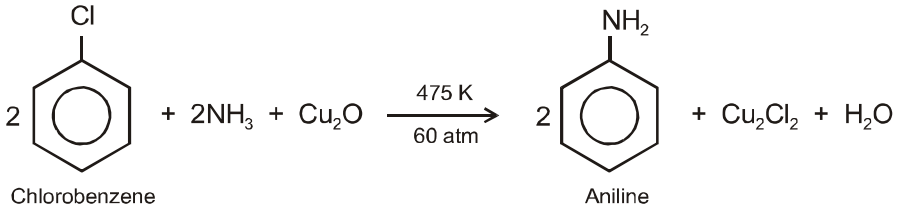


The reaction does not give only 1° amine as the product, because now ammine can act as nucleophile and attacks at other molecule of alkyl halide



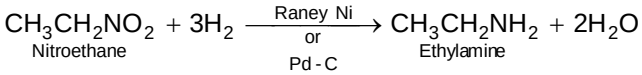


Note : *Arylamines cannot be prepared by this method. Aryl amine i.e., aniline is however prepared by reacting chlorobenzene with* NH_3



Chlorobenzene | Aniline

◆ **By the reduction of nitro compounds :**



Nitroethane | Ethylamine

$$\underset{\text{Nitrobenzene}}{C_6H_5NO_2} + 3H_2 \xrightarrow[\text{or Pd - C}]{\text{Raney Ni}} \underset{\text{Aniline}}{C_6H_5NH_2} + 2H_2O$$

with above reactions only 1º –amine can be formed.

◆ **By the reduction of alkyl nitriles (or cyanides) and isonitriles (isocyanides) :**

$$\underset{\text{Acetonitrile}}{CH_3C \equiv N} \xrightarrow[LiAlH_4 \text{ or } Na/C_2H_5OH]{\text{Raney Ni}/H_2} \underset{\text{Ethylamine}}{CH_3CH_2NH_2}$$

$$CH_3NC \xrightarrow[\text{Or } LiAlH_4]{\text{Raney Ni}/H_2} \underset{2^o \text{ amine}}{CH_3NHCH_3}$$

◆ **By the reduction of amides :**

$$\underset{\text{Acetamide}}{CH_3CONH_2} \xrightarrow{LiAlH_4/\text{ether}} \underset{\text{Ethylamine}}{CH_3CH_2NH_2}$$

◆ **By the reduction of oximes :**

$$\underset{\text{Acetaldoxime}}{CH_3CH = NOH} + 4[H] \xrightarrow{Na/C_2H_5OH} \underset{\text{Ethylamine}}{CH_3CH_2NH_2} + H_2O$$

◆ **By rearrangement reactions**

By Hofmann bromamide reaction : This is one of the most convenient method for the preparation of primary amines. It involves action of halogen (bromine or chlorine) and alkali (NaOH or KOH) on 1° amides to form amines with one carbon atom less. In this reaction molecular rearrangement takes place, in which alkyl group migrated over to N–atom.

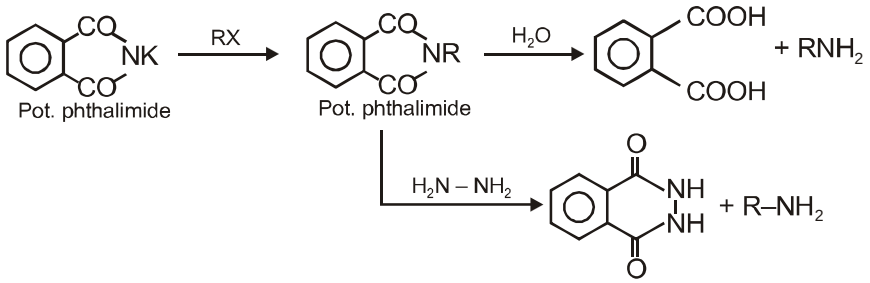
$$CH_3CONH_2 + Br_2 + 4KOH \rightarrow CH_3NH_2 + 2KBr + K_2CO_3 + 2H_2O$$

$$\underset{\text{Benzamide}}{C_6H_5CONH_2} + Br_2 + 4KOH \rightarrow \underset{\text{Aniline}}{C_6H_5NH_2} + K_2CO_3 + 2KBr + 2H_2O$$

Schmidt reaction : $RCOOH + HN_3 \xrightarrow[H_2SO_4]{\text{Conc.}} R\text{–}NH_2 + CO_2 + N_2 + H_2O$

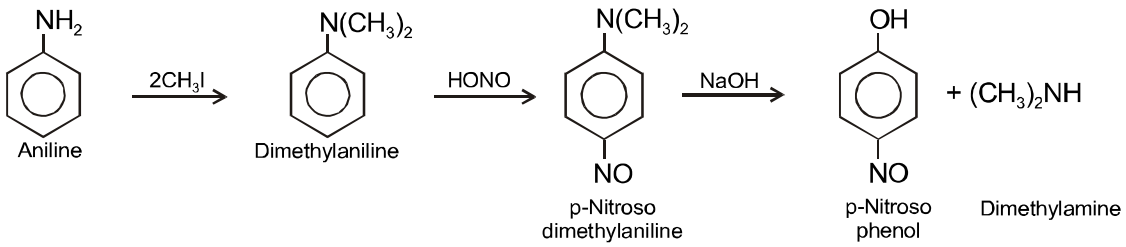
Curtius reaction : $RCOCl + HN_3 \xrightarrow{\Delta} R\text{–}NH_2 + HCl + CO_2 + N_2$

◆ **By Gabriel phthalimide reaction :** This is a very convenient method for the preparation of pure aliphatic primary amines. Phthalimide is first of all treated with KOH to form potassium phthalimide which on heating with alkyl halide gives N-alkyl phthalimide. The latter is hydrolysed or hydrozinolysed to give primary amines.



Aromatic amines cannot be prepared from this reaction.

◆ **Secondary amines can be prepared by the hydrolysis of p-nitroso-dialkyl aniline with boiling alkali:**



◆ **Tertiary amines are prepared by the decomposition of tetra-alkyl ammonium hydroxide :**

$$(C_2H_5)_4N^+I^- + AgOH \longrightarrow (C_2H_5)_4N^+OH^- + AgI$$

Tatraethyl ammonium iodide → Tatraethyl ammonium hydroxide

$$(C_2H_5)_4N^+OH^- \xrightarrow{heat} (C_2H_5)_3N + C_2H_4 + H_2O$$

Triethyl amine

However, tetramethyl ammonium hydroxide also decomposes to give tertiary amine but in a different way.

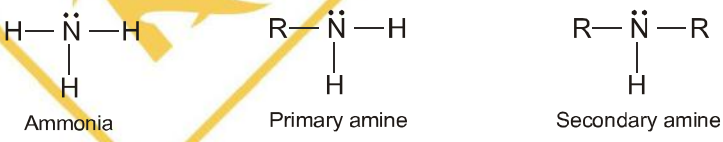
$$(CH_3)_4N^+OH^- \xrightarrow{heat} (CH_3)_3N + CH_3OH$$

Chemical Properties

Nitrogen atom of all the three types of amines has a lone pair of electrons which is responsible for most of the reactions of amines.

A. Reactions given by primary, secondary and tertiary amines :

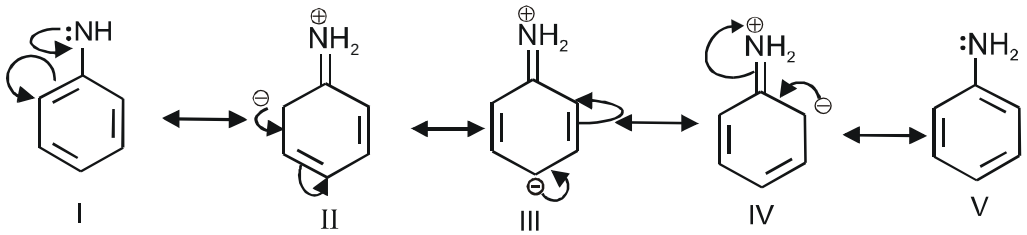
◆ **Basic character :** The basic character of amines is due to the presence of unshared electron pair on nitrogen atom which accepts proton; the readiness with which the lone pair of electrons is available for co-ordination with a proton determine the relative basic strength of amines.



Like ammonia, amines dissolve in water to form alkylammonium ion and hydroxide ion.

$$RNH_2 + H_2O \rightleftharpoons RNH_3^+ + OH^-$$

Aliphatic amines are stronger bases than ammonia and aryl amines. [$RNH_2 > NH_3 > C_6H_5NH_2$]



We have observed that aniline is a resonance hybrid of five structures (I to V) while the protonated aniline (anilinium ion) is a resonance hybrid of only two structures.

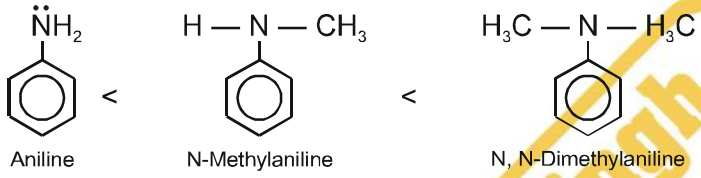
◆ **Arylalkylamines**

Arylalkylamines are stronger bases than arylamines (e.g., aniline), but slightly weaker than the alkylamines.

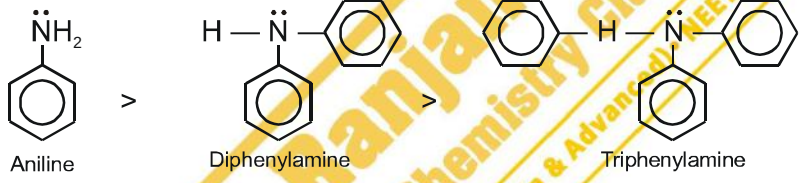
Alkylamines (e.g., CH_3NH_2) > Arylalkylamines (e.g., $C_6H_5CH_2NH_2$) > Arylamines (e.g., $C_6H_5NH_2$)

Effect of substituents on the nitrogen atom of the group :

◆ The replacement of hydrogen atom of an amino group by an electron-releasing substituent (e.g., methyl group) increases the basic character.



◆ On the other hand, replacement of hydrogen atom(s) of the amino group by electron-withdrawing phenyl group(s) decreases the basic character.



Reaction of water :

NH_3 (Ammonia) $+ H_2O \longrightarrow$ NH_4OH (Ammonium hydroxide) $\rightleftharpoons NH_4^+ + OH^-$

CH_3NH_2 (Methyl amine (Pri.)) $+ H_2O \longrightarrow$ CH_3NH_3OH (Methyl amm. hydroxide) $\rightleftharpoons CH_3NH_3^+ + OH^-$

$(CH_3)_2NH$ (Dimethyl amine (Sec.)) $+ H_2O \longrightarrow$ $(CH_3)_2NH_2OH$ (Dimethyl amm. hydroxide) $\rightleftharpoons (CH_3)_2NH_2^+ + OH^-$

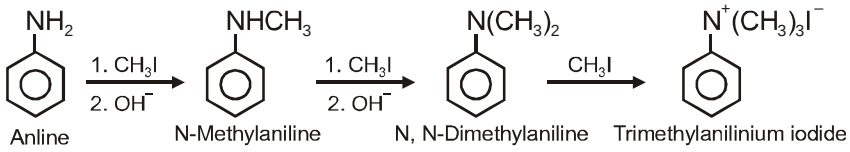
Reaction with inorganic acids :

$C_2H_5NH_2$ (Ethyl amine) $+ HCl \longrightarrow$ $C_2H_5NH_3^+Cl^-$ (Ethylamine hydrochloride)

$2(C_2H_5)_2NH$ (Diethyl amine) $+ H_2SO_4 \longrightarrow$ $[(C_2H_5)_2NH_2]_2.SO_4$ (Diethylamine hydrogen sulphate)

◆ **Alkylation :**

CH_3NH_2 (Methyl amine (primary amine)) $\xrightarrow[2.\ OH^-]{1.\ CH_3I}$ $(CH_3)_2NH$ (Dimethyl amine (sec. amine)) $\xrightarrow[2.\ OH^-]{1.\ CH_3I}$ $(CH_3)_3N$ (Trimethyl amine (ter. amine)) $\xrightarrow{CH_3I}$ $(CH_3)_4N^+I^-$ (Tetramethylammine. iodide)



Hence, this reaction may be used for distinguishing the three types of amines.

◆ **Dealkylation :**

$$\underset{\text{Trimethyl amine hydrochloride}}{(CH_3)_3N.HCl} \xrightarrow{\text{heat}} \underset{\text{Dimethyl amine}}{(CH_3)_2NH} + CH_3Cl$$

$$\underset{\text{Dimethyl amine hydrochloride}}{(CH_3)_2NH.HCl} \xrightarrow{\text{heat}} \underset{\text{Methyl amine}}{CH_3NH_2} + CH_3Cl$$

$$\underset{\text{Methyl amine hydrochloride}}{CH_3NH_2.HCl} \xrightarrow{\text{heat}} \underset{\text{Methylchloride}}{CH_3Cl} + NH_3$$

◆ **Reaction with nitrous acid :** Different types of amines form different products with nitrous acid ($NaNO_2$ + HCl).

- An ice cold solution of a **primary aromatic amine** in hydrochloric acid reacts with an ice-cold aqueous solution of sodium nitrite, forming water-soluble compound known as **diazonium salt**.

$$NaNO_2 + HCl \longrightarrow HNO_2 + NaCl$$

$$\underset{\text{Aniline hydrochloride}}{C_6H_5NH_2.HCl} + HONO \xrightarrow[0-5^\circ C]{} \underset{\text{Benzenediazonium chloride}}{C_6H_5\overset{+}{N}\equiv N\,\overline{Cl}} + H_2O$$

Aliphatic primary amines react with cold nitrous acid to give alcohols or sometimes alkenes with the quantitative evolution of nitrogen gas (test for aliphatic primary amines).

$$CH_3CH_2NH_2 \xrightarrow[273-278\ K]{HONO/HCl} \underset{\text{Ethanediazonium chloride}}{[CH_3CH_2\overset{+}{N}\equiv N\,\overline{Cl}]} \xrightarrow{H_2O} CH_3CH_2OH + N_2$$

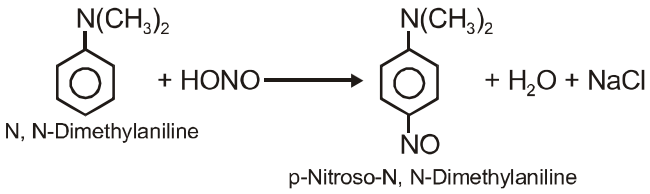
◆ Secondary amines (aliphatic as well as aromatic) react with nitrous acid to form N-nitrosoamines.

$$\underset{\text{Dimethylamine}}{(CH_3)_2NH} + HONO \longrightarrow \underset{\text{N-Nitrosodimethylamine}}{(CH_3)_2N-N=O} + H_2O$$

Nitrosoamines are water-insoluble yellow oils and when warmed with a crystal of phenol and a few drops of conc. H_2SO_4 produce a green solution which turns blue on adding alkali. This reaciton is known as **Libermann's nitroso reaction and may be used as a test for secondary amines.**

◆ Aliphatic tertiary amines dissolves in cold nitrous acid to form unstable nitrites which decompose on warming to give nitrosoamine and alcohol.

$$\underset{\text{Trimethyl amine}}{(CH_3)_3N} + HNO_2 \longrightarrow \underset{\text{Trimethylammoniumnitrite}}{(CH_3)_3\overset{+}{N}H\,\overline{N}O_2} \xrightarrow{\text{heat}} \underset{\text{N-Nitrosodimethylamine}}{(CH_3)_3N.NO} + CH_3OH$$



N, N-Dimethylaniline

p-Nitroso-N, N-Dimethylaniline

B. Reactions given only by primary and secondary amines :

Acylation : (Reaction with acetyl chloride) : Primary and secondary amines react with acid chlorides and acid anhydrides to form acyl derivatives or substituted amides.

$$CH_3NH_2 + ClCOCH_3 \longrightarrow \underset{\text{Acetyl methyl amine (N–Methylacet amide)}}{CH_3NHCOCH_3} + HCl$$

$$(CH_3)_2NH + ClCOCH_3 \longrightarrow \underset{\text{Acetyl dimethyl amine (N, N–Dimethyl acetamide)}}{(CH_3)_2NCOCH_3} + HCl$$

Like alkyl amines, aryl amines react with acid chlorides and acid anhydrides to form aryl substituted amides commonly called anilides. The reaction is best carried out in the presence of a base like pyridine.

$$C_2H_5NH_2 + CH_3MgBr \longrightarrow CH_4 + Mg\begin{matrix}Br\\ NHC_2H_5\end{matrix}$$

$$(C_2H_5)_2NH + C_2H_5MgBr \longrightarrow C_2H_6 + Mg\begin{matrix}Br\\ N(C_2H_5)_2\end{matrix}$$

C. Reactions given only by primary amines :

- **Carbylamine reaction :**

$$\underset{\text{Ethylamine}}{C_2H_5NH_2} + CHCl_3 + 3KOH \longrightarrow \underset{\text{Ethyl isocyanide}}{C_2H_5NC} + 3KCl + 3H_2O$$

$$\underset{\text{Aniline}}{C_6H_5NH_2} + CHCl_3 + 3KOH \longrightarrow \underset{\text{Phenyl isocyanide}}{C_6H_5NC} + 3KCl + 3H_2O$$

- **Hofmann's mustard oil reaction :**

$$CH_3NH_2 + S = C = S \longrightarrow S = C\begin{matrix}NHCH_3\\ SH\end{matrix}$$

N–Methyl dithiocarbamic acid

$\downarrow HgCl_2$

$$CH_3N = C = S + HgS + 2HCl$$

Methyl isothiocyanate (Mustard oil like smell) Black ppt.

$$\underset{\text{Aniline}}{C_6H_5NH_2} + S=C=S \xrightarrow{HgCl_2} \underset{\text{Phenyl isothiocyanate}}{C_6H_5N=C=S} + H_2S + 2HCl$$

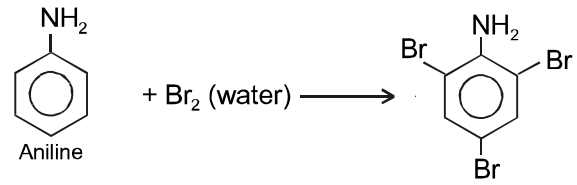
◆ **Reaction with aldehydes and ketones :** Primary amines react with carbonyl group to form **anils** or **schiff's bases**

$$C_2H_5NH_2 + CH_3CHO \longrightarrow \underset{\text{Ethylidenethylamine}}{C_2H_5N{=}CH.CH_3} + H_2O$$

D. Reactions of the benzene nucleus :

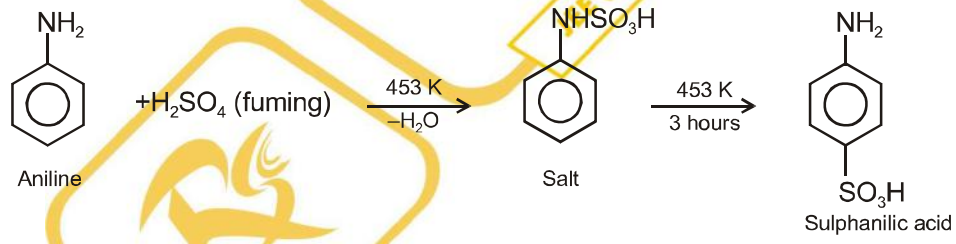
◆ **Electrophilic substitution reaction :**

(a) Halogenation :

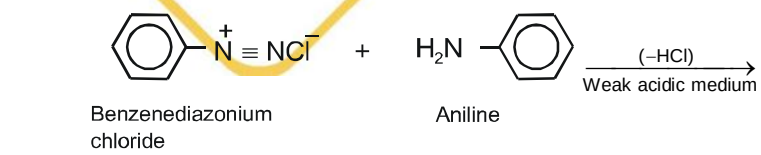


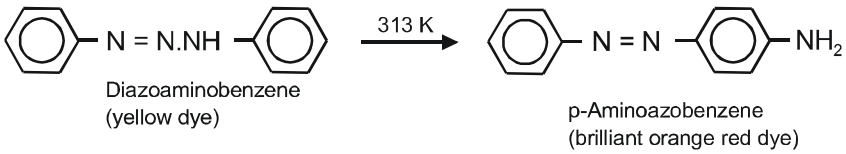
(b) Nitration : Nitration reactions are never performed directly as they get connected to p-benzoquinone hence they are first acetylated and then nitrated.

(c) Sulphonation :



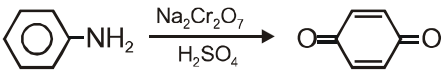
◆ **Coupling reaction :**





◆ **Oxidation :** Arylamines, unlike alkyl amines, are very susceptible to oxidation. This is because of the presence of high electron density on the ring of arylamines due to which electron removal (oxidation) becomes very easy. Thus arylamines (*e.g.,* aniline) darken in colour even on standing in air at room temperature. More intense colour is obtained by stronger oxidising agents *e.g.,*

Oxidising agent	Colour
Bleaching powder	Violet
$K_2Cr_2O_7$ + conc. H_2SO_4	Blue
$K_2Cr_2O_7$ + $CuSO_4$ + dil. H_2SO_4	Black



Aniline p-Benzoquinone (Oxidised product)

CYANIDES AND ISOCYANIDES

Cyanides and isocyanides, the two series of isomeric compounds, are derivatives of hydrogen cyanide (hydrocyanic acid or prussic acid) which exists in the following two tautomeric forms.

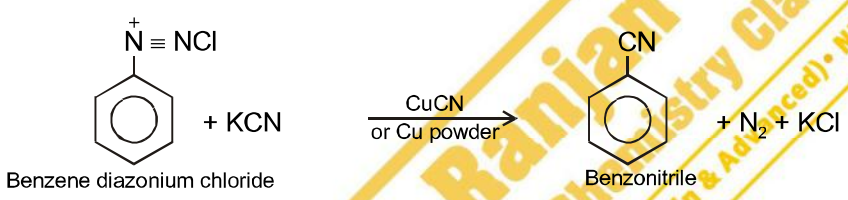
$$H-C\equiv N \rightleftharpoons H-N\overset{\rightarrow}{=}C$$

General methods of preparation of Nitriles and Isonitriles :

- **From alkyl halides :**

$$\underset{\text{Chloromethane}}{CH_3Cl} + KCN \rightarrow \underset{\text{Ethanenitrile}}{CH_3CN} + KCl$$

- **From arenediazonium salts :**



Benzene diazonium chloride Benzonitrile

- **From primary amines :** Alkyl and aryl carbylamines are prepared by carbylamine reaction (heating of primary amine with chloroform and alcoholic potash).

$$\underset{\text{Ethyl amine}}{CH_3CH_2NH_2} + CHCl_3 + 3KOH(alc.) \rightarrow \underset{\text{Ethyl isonitrile}}{CH_3CH_2N\overset{\rightarrow}{=}C} + 3KCl + 3H_2O$$

$$\underset{\text{Aniline}}{C_6H_5NH_2} + CHCl_3 + 3KOH(alc.) \rightarrow \underset{\text{Phenyl isonitrile}}{C_6H_5NC} + 3KCl + 3H_2O$$

Chemical Properties

The two important chemical reactions of nitriles and isonitriles are hydrolysis and reduction.

- **Hydrolysis :**

$$R-C\equiv N \xrightarrow[(+H_2O)]{H^+ \text{ or } OH^-} R-\overset{\overset{O}{\|}}{C}-NH_2 \xrightarrow[+H_2O]{H^+ \text{ or } OH^-} RCOOH + NH_3$$

Isonitriles, on the other hand, **are hydrolysed by dilute acids but not by alkalies to form a primary amine and formic acid.**

$$\underset{\text{Alkyl isonitrile}}{R-N\overset{\rightarrow}{=}C} + H_2O \xrightarrow[(+H_2O)]{H^+} \left[R-NH-\overset{\overset{O}{\|}}{C}-H\right] \xrightarrow[(+H_2O)]{H^+} \underset{\text{1° Amine}}{R-NH_2} + \underset{\text{Methanoic acid}}{HCOOH}$$

Note : *Complete hydrolysis is done using dilute acids while partial hydrolysis is done using conc. acids.*

- **Reduction :** Nitriles are fully reduced to primary amines by sodium and alcohol (Mendius reaction), lithium aluminium hydride or hydrogen in presence of Ni or Pt (catalytic reduction).

$$R-C\equiv N + 4[H] \xrightarrow[\text{or } LiAlH_4]{Na/C_2H_5OH} RCH_2NH_2$$

$$R-NC \xrightarrow[\text{or } LiAlH_4]{Na|C_2H_5OH} R-NH-CH_3$$

$$R-C\equiv N + 2H_2 \xrightarrow{Pt \text{ or } Ni} RCH_2NH_2$$

Stephen's reduction : Partial reduction of nitrile with stannous chloride in presence of hydrochloric acid to form imine hydrochloride (**Stephens reduction**) is also possible. The imine hydrochloride may be decomposed easily with boiling water forming aldehyde as the final product.

$SnCl_2 + 2HCl \rightarrow SnCl_4 + 2H$

$$CH_3-C\equiv N + 2[H] + HCl \xrightarrow[290\ K]{ether} \underset{\text{Acetaldimine hydrochloride}}{CH_3CH=NH.HCl} \xrightarrow[\text{water}]{\text{boiling}} \underset{\text{Ethanal}}{CH_3CHO} + NH_4Cl$$

- **Reaction with Grignard reagents :**

$$R-C\equiv N + R'MgX \xrightarrow{ether} \left[R-\overset{R'}{\underset{|}{C}}=\overset{H}{\underset{|}{N}}-\overset{OH}{\underset{|}{MgX}}\right] \xrightarrow{H^+} R-\overset{R'}{\underset{|}{C}}\equiv O$$

Reaction may not stop at ketonic stage. May be ketone further is attacked by Grignard reagent to give $\overset{o}{3}$ alcohol.

- **Addition reaction :**

$$CH_3-\overset{+}{N}\equiv\overset{-}{C}: + Cl_2 \rightarrow \underset{\text{Methyliminocarbonyl chloride}}{CH_3-N=CCl_2}$$

$$\underset{\text{Methyl isonitrile}}{CH_3-\overset{+}{N}\equiv\overset{-}{C}:} + S \rightarrow \underset{\text{Methyl isothiocyanate}}{CH_3-N=C=S}$$

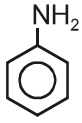
- **Rearrangement :**

$$R-\vec{N}=C \xrightarrow{\Delta} R-C\equiv N$$

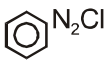
Isonitrile Nitrile

DIAZONIUM SALT

- **Preparation of benzene diazonium chloride**



$$+ NaNO_2 + HCl \xrightarrow{0-5^oC}$$

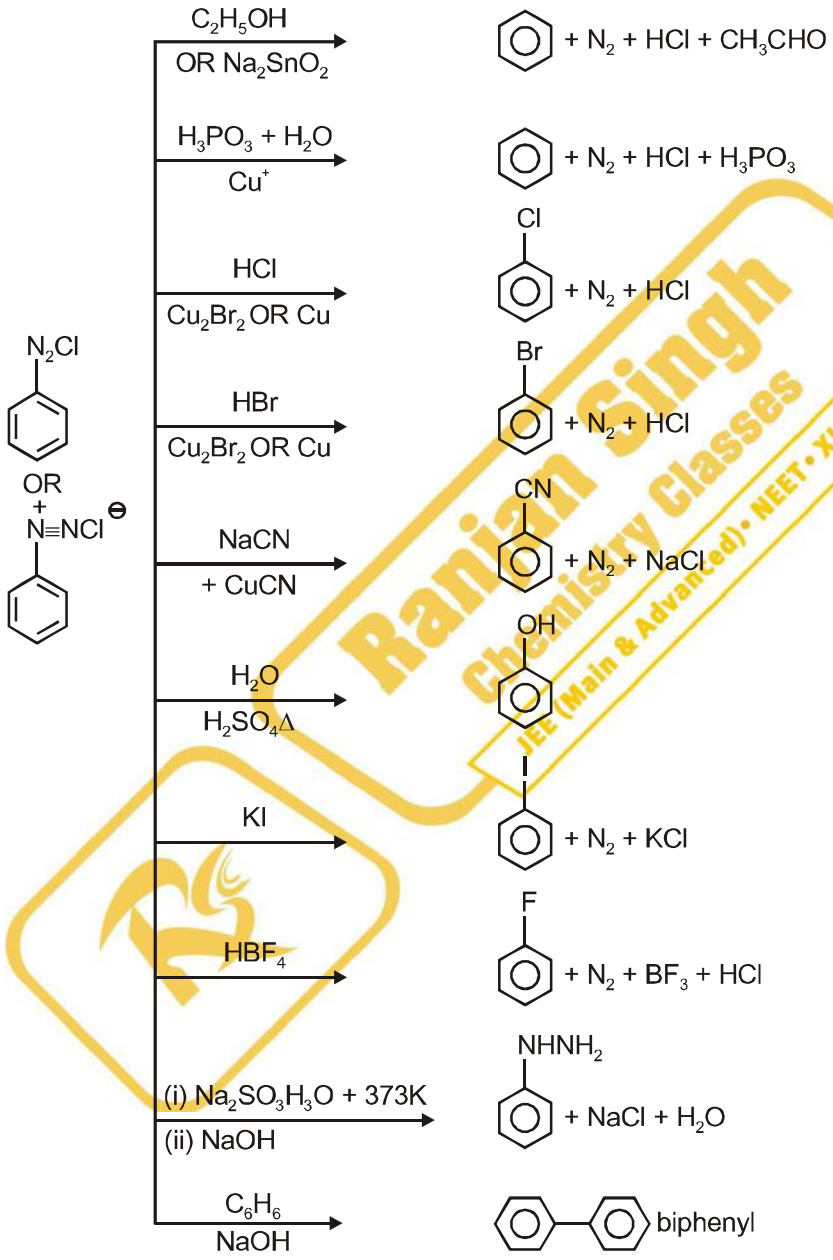


$$+ NaCl + H_2O$$

◆ **Properties of Benzene Diazonium Chloride (B.D.C.)**

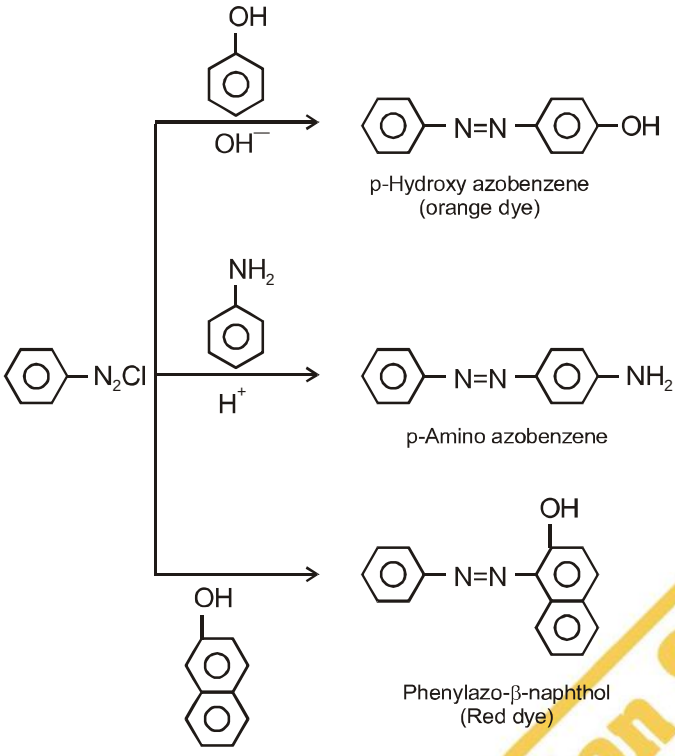
A. Substitution Reaction :

Benzene diazonium chloride is used for prepration of several organic compounds.



B. Coupling Reaction :

Condensation of diazonium salt with electron rich aromatic compounds like phenols and amines to form azodyes.


OH
OH⁻
N=N
OH
p-Hydroxy azobenzene
(orange dye)
NH2
N2Cl
H+
N=N
NH2
p-Amino azobenzene
OH
N=N
OH
Phenylazo-β-naphthol
(Red dye)

TOPIC WISE MCQS

Preparation & General point

1. N–atom in quaternary ammonium halide will have the form-

(A) $-\overset{\oplus}{N}<$ (B) $-\ddot{N}-$ (H)

(C) $\ddot{N}<$ (D) $-\ddot{N}-H$ (H)

2. $-CONH_2 \xrightarrow{\text{Reduction}} -CH_2NH_2$

In above reaction hybridisation state of carbon changes from ..... → .....

(A) $sp \longrightarrow sp^2$ (B) $sp \longrightarrow sp^3$

(C) $sp^2 \longrightarrow sp^3$ (D) $sp^2 \longrightarrow sp$

3. Mendius reaction involves the reduction of -

(A) Cyanoalkanes (B) Alkyl isocyanides

(C) Oximes (D) Nitroalkanes

4. A reaction used in descending a homologous series would be -

(A) $RCONH_2 + Br_2 + KOH$

(B) $RCH_2Cl + KCN$

(C) $RNH_2 + CHCl_3 + KOH$

(D) None of the above

5. 

$\xrightarrow[H^+]{HOH}$ C + D , C and D in the sequence are-

(A) Benzoic acid + aniline

(B) Phthalic acid + ethylamine

(C) Phthalic acid + aniline

(D) Benzoic acid + ethylamine

6. $CH_3CONH_2 \xrightarrow{PCl_5} A \xrightarrow[\text{(partial)}]{H_2O} B$

$\downarrow$ reduction

C

The functional groups of B and C respectively are -

(A) $-\overset{\overset{O}{\|}}{C}-NH_2$, $-NH_2$ (B) $-\overset{\overset{O}{\|}}{C}-NH_2$, $-COOH$

(C) –CN, –NH– (D) $-\overset{\overset{O}{\|}}{C}-OH$, $-\overset{|}{N}-$

7. Reaction for the preparation of 1º amine is-

(A) Hofmann carbylamine reaction

(B) Hoffmann mustard oil reaction

(C) Hofmann bromamide reaction

(D) Lieberman nitroso reaction

8. On reduction of Schiff's base we get-

(A) Primary amine (B) Secondary amine

(C) Anils (D) Anilide

9. In Hofmann degradation of amide the correct order of reagent is-

(A) Br_2, KOH, H_2O (B) KOH, Br_2, H_2O

(C) H_2O, KOH, Br_2 (D) None of the these

10. Alkyl halide reacts with AgCN to form –

(A) Alcohol (B) Cyanide

(C) Isocyanide (D) Both B & C

11. Amide on heating with P_2O_5 gives –

(A) Alkane nitrile (B) Alkyl halide

(C) Amine (D) None

12. Grignard reagent reacts with cyanogen chloride to form –

(A) Alkane nitrile (B) Alkyl halide

(C) Amine (D) None

13. The latest IUPAC name of CH_3NC is –

(A) Methyl isocyanide

(B) Methyl isonitrile

(C) Methylcarbylamine

(D) Carbylamino methane

14. Ethyl iodide on reaction with potassium nitrite gives –

(A) Ethyl nitrite (B) Nitro ethane

(C) Amine (D) Acid

15. R´–N(R)(R") is a-

(A) Mixed 3º amine

(B) Unsymmetrical amine

(C) Both 1st and 2nd

(D) Quartenary salt

16. Which of the following is optically active amine-

(A) CH_3NH_2 (B) CH_3NHCH_3

(C) $CH_3CH_2CH_2N(CH_3)-C_2H_5$

(D) Secondary butylamine

17. Which of the following would undergo Hoffmann bromide reaction to form primary amine-

(A) $RCONHCH_3$ (B) $RCOONH_4$

(C) $RCONH_2$ (D) RCONHOH

18. Which of the following will give primary amine on hydrolysis -

(A) Nitroparaffins (B) Alkyl cyanide

(C) Oxime (D) Alkyl isocyanide

19. The alkanenitriles are isomeric with-

(A) Primary alkanamines

(B) Secondary alkanamines

(C) Alkyl isocyanides

(D) Nitroalkanes

20. Which of the following is obtained by reducing methyl cyanide with Na + C_2H_5OH -

(A) Methyl alcohol (B) Acetic acid

(C) Ethyl amine (D) Methane

21. Ethylamine can be prepared by the all except -

(A) Curtius reaction

(B) Hoffmann reaction

(C) Mendius reaction

(D) Reduction of formaldoxime

Physical Properties

22. Amines are basic in nature because-

(A) They produce OH^- ions when treated with water

(B) They have replaceable H atoms on N atoms

(C) They have lone pair of electron on N atom

(D) None of these

23. Which statement is not correct -

(A) Methyl amine is more basic than NH_3

(B) Amines from hydrogen bonds

(C) Ethyl amine has higher boiling points than propane

(D) Dimethyl amine is less basic than methyl amine

24. Which of the following diazonium salt is relatively stable of 0-5ºC -

(A) $CH_3–N\equiv N\}\ ^{\oplus}Cl^-$

(B) $CH_3–C(CH_3)–N\equiv N\}\ ^{\oplus}Cl^-$

(C) $C_6H_5–N\equiv N\}\ ^{\oplus}Cl^-$

(D) $(CH_3)_3C–N\equiv N\}\ ^{\oplus}Cl^-$

25. The odour of alkyl cyanides is similar to –

(A) Bitter almonds (B) Acid

(C) Fruity smell (D) None

26. The N atom in amines involves-

(A) sp^3 – hybridization

(B) sp^2 –hybridization

(C) sp^2 –and sp^3 – hybridization

(D) None of these

27. Which of the following compound gives the smell of mustard oil-

(A) Alkyl isocyanate (B) Alkyl isothiocyanate

(C) Alkyl isocyanide (D) Alkyl isonitrile

28. Suitable explanation for the order of basic character $(CH_3)_3N < (CH_3)_2NH$ is-

(A) Steric hindrance by bulky methyl group

(B) Higher volatility of 3ºamine

(C) Decreased capacity for H- bond formation with H_2O

(D) Decreased electron- density at N atom

29. The basic character of amines can be explained-

(A) In terms of Lewis and Arrhenius concept

(B) In terms of Lowry and Bronsted concept

(C) In terms of Lewis and Lowry Bronsted concept

(D) Only by Lewis concept

Chemical Properties

30. Propylamine reacts with nitrous acid to from a relatively stable cation viz. -

(A) Propyl diazonium ion

(B) Isopropyl carbocation

(C) Isopropyl diazonium ion

(D) Propyl carbonium ion

31. Which of the following can be detected by carbylamine reaction-
(A) Urea (B) CH_3CONH_2
(C) $C_2H_5NH_2$ (D) All the above

32. Which of the following does not form a sulphur compound with primary amine-
(A) Hinsberg's reagent
(B) Sulphuric acid
(C) Schotten-Boumann reaction
(D) Mustard oil reaction

33. Hinsberg's reagent is-
(A) Diethyl oxalate
(B) Benzyl chloride
(C) Benzene sulphonyl chloride
(D) None of these

34. Hydrolysis of alkyl isocyanide yields –
(A) Primary amine (B) Tert. amine
(C) Alcohol (D) Aldehyde

35. Imino group is present in -
(A) CH_3NH_2 (B) $CH_3NHCOCH_3$
(C) $(CH_3)_2$ CNH (D) $(CH_3)_3N$

36. How many isomeric amines can have the formula $C_4H_{11}N$ -
(A) Five (B) Six
(C) Seven (D) Eight

37. Tilden's reagent is-
(A) $C_6H_5SO_2Cl$ (B) NOCl
(C) $ClNH_2$ (D) $(C_2H_5)_2$ Zn

38. $C_2H_5NH_2$ cannot be prepared by the reduction of-
(A) $C_2H_5NO_2$ (B) CH_3CH = NOH
(C) C_2H_5NC (D) CH_3CN

39. A mixture of 1º, 2º and 3º amine is formed in the reaction-
(A) 1º Amide + caustic potash + bromine
(B) Methyl halide and ammonia
(C) Cyclic imide + H_3O^+
(D) Alkyl isocyanide + H_2

40. The presence of primary amines can be confirmed by-
(A) Reaction with HNO_2
(B) Reaction with $CHCl_3$ and alc. KOH
(C) Reaction with Grignard reagent
(D) Reaction with acetyl chloride

41. Ethylamine can be prepared by the all except-
(A) Curtius reaction
(B) Hofmann reaction
(C) Mendius reaction
(D) Reduction of formaldoxime

42. Ammonolysis of alcohol, i.e.-
$xCH_3OH + yNH_3$ Products
(A) CH_3NH_2
(B) $(CH_3)_2NH_2$
(C) $(CH_3)_3N$
(D) A mixture of amines

43. The compound obtained by the reaction between primary amine and aldehyde is-
(A) An amide (B) Imine
(C) Nitrite (D) Nitro

44. Which one of the following behaves both as nucleophile and as an electrophile ?
(A) $CH_3C{\equiv}N$ (B) CH_3–OH
(C) H_2C=CH–CH_3 (D) CH_3–NH_3

45. A primary nitroalkane is treated with nitrous acid, which of the following will be the main product:
(A) pseudonitrol (B) nitrolic acid
(C) a primary amine (D) a primary alcohol

46. Acetonitrile has the structure :
(A) C_2H_5NC (B) C_2H_5CN
(C) CH_3NC (D) CH_3CN

47. Which of the following method is generally not employed for the separation of primary, scondary and tertiary amines ?
(A) fractional distillation (B) Hinsberg's method
(C) Hofmann's method (D) Filteration

48. How many primary amines are possible for the formula $C_4H_{11}N$?
(A) 1 (B) 2
(C) 3 (D) 4

49. $CH_3NH_2 + CHCl_3 + 3KOH \rightarrow X + Y + 3H_2O$; compounds X and Y are :
(A) CH_3CN + 3KCl (B) CH_3NC + 3KCl
(C) CH_3CONH_2 + 3KCl (D) $CH_3NC + K_2CO_3$

50. The alkanenitriles are isomeric with-
(A) Primary alkanamines
(B) Secondary alkanamines
(C) Alkyl isocyanides
(D) Nitroalkanes

MISCELLANEOUS QUESTIONS

1. Which of the following compounds possesses a chiral nitrogen atom ?

(A) $CH_3CH_2\underset{\displaystyle NH_2}{\underset{|}{C}}HCH_3$

(B) $CH_3CH_2NHCH_2CH_3$

(C) $CH_3CH_2CH_2\underset{\displaystyle CH_3}{\underset{|}{N}}CH_2CH_3$

(D) $CH_3CH_2\underset{\displaystyle CH_3}{\underset{|}{N}}CH_2CH_3$

2. How many molecules of methyl bromide should react with ethylamine successively to convert the latter into a quaternary ammonium salt ?

(A) One (B) Two

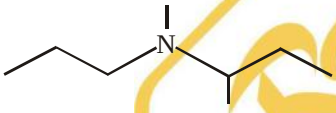
(C) Three (D) Four

3. An amine (X) on being heated with an excess of methyl bromide produces diethyldimethy-lammonium bromide. The amine (X) is–

(A) $C_2H_5NH_2$ (B) $(C_2H_5)_2NH$

(C) $C_2H_5NHCH_3$ (D) $C_2H_5N(CH_3)_2$

4. The IUPAC name of the compound



is–

(A) N,3-dimethyl-N-propyl-3-propanamine

(B) N-methyl-N-propyl-2-butanamine

(C) s-butylmethyl-n-propylamine

(D) N, 1-dimethyl-N-propyl-propanamine

5. The reaction

$CH_3Br + NH_3(\text{excess}) \xrightarrow{\text{heat}} CH_3NH_2 + HBr$

is an example of a–

(A) bimolecular electrophilic substitution reaction

(B) unimolecular nucleophilic substitution reaction

(C) bimolecular nucleophilic substituion reaction

(D) bimolecular free radical substitution reaction

6. Which of the following compounds on hydrolysis yields a carboxylic acid and a secondary amine ?

(A) CH_3CH_2NC (B) $CH_3CONHCH_3$

(C) $PhNHCOCH_3$ (D) $PhCONPh$ (with CH_3 on N)

7. The end product (B) formed in the reaction

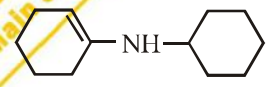
$CH_3CH_2Br \xrightarrow{AgCN} A \xrightarrow[H_3O^+]{\text{1. NaOH, prolonged heat}} B$ is–

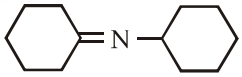
(A) $CH_3CH_2NHCH_3$ (B) $CH_3CH_2CH_2NH_2$

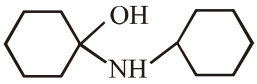
(C) $CH_3CH_2NH_2$ (D) CH_3CH_2NHCOH

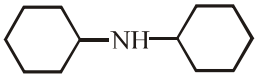
8. The major product formed in the reaction

is–

(A) 

(B) 

(C) 

(D) 

9. The reaction of $RCONH_2$ with a mixture of Br_2 and aqueous KOH gives RNH_2 as the main product. The intermediate(s) involved in this reaction is(are)–

(A) RCONHBr (B) $RCO\bar{N}BrK^+$

(C) R–N=C=O (D) All of these

10. The end product (B) formed in the reaction

$CH_2=CH_2 \xrightarrow[2.\ KCN(\text{excess})]{\text{1. } Br_2,\ CCl_4} A \xrightarrow[2.\ H_3O^+]{\text{1. } LiAlH_4} B$

(A) $CH_2=CHCH_2NH_2$

(B) $H_2N(CH_2)_4NH_2$

(C) $CH_3NH(CH_2)_2NHCH_3$

(D) $NC(CH_2)_2CN$

11. In which of the following compounds are intermolecular hydrogen bonds not formed among its molecules ?

(A) $(C_2H_5)_2NH$ (B) C_2H_5OH

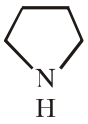
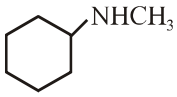
(C) C_2H_5COOH (D) $(C_2H_5)_3N$

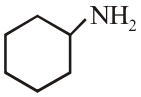
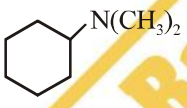
12. Which of the following compounds will liberate CO_2 from $NaHCO_3$?

(A) CH_3CONH_2 (B) $CH_3CH_2NH_2$

(C) $CH_3NH_3^+Cl^-$ (D) $(CH_3)_4N^+OH^-$

13. Among the following compounds which one will produce a Schiff base on reaction with cyclohexanone ?

(A)  (B) 

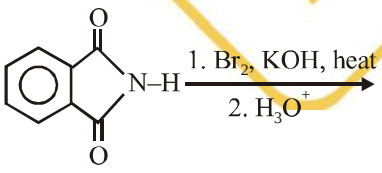
(C)  (D) 

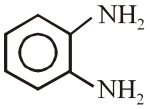
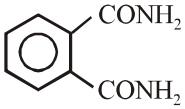
14. Which one of the following compounds will produce a water-insoluble yellow oily liquid of nitrosamine on reaction with $NaNO_2$ and dilute HCl at 0ºC ?

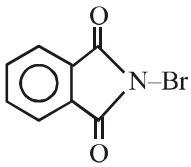
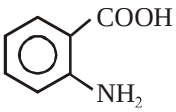
(A) Ethylamine (B) Methylamine

(C) Diethylamine (D) Triethylamine

15. The product formed in the reaction–

 is–

(A)  (B) 

(C)  (D) 

16. Which of the following reactions does not yield an amine ?

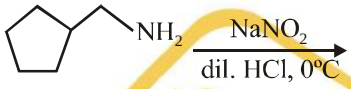
(A) $RX + NH_3 \rightarrow$

(B) $RCH{=}NOH \xrightarrow[C_2H_5OH]{Na}$

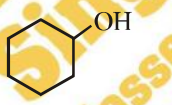
(C) $RCN + H_2O \xrightarrow{H^+}$

(D) $RCONH_2 \xrightarrow[2.\ H_2O]{1.\ LiAlH_4}$

17. The product formed in the reaction



(A)  (B) 

(C)  (D) all of the above

18. Consider the following sequence of reactions–

The major product (B) is–

(A) $CH_3CH_2CH{=}CH_2$

(B) 

(C) $CH_3CH{=}CHCH_3$

(D) 

19. Which of the following statements is not correct regarding ethylamine and aniline ?

(A) Each has a $-NH_2$ group

(B) Both dissolve in HCl

(C) Each reacts with a mixture of $CHCl_3$ and KOH to form a bad smelling compound

(D) Each reacts with HNO_2 to give a hydroxy compound

20. A compound (X) having the molecular formula C_3H_9N reacts with benzenesulphonyl chloride to form a solid that is insoluble in alkalis. The compound (X) is–

(A) $CH_3CH_2CH_2NH_2$ (B) $(CH_3)_2CHNH_2$

(C) $CH_3CH_2NHCH_3$ (D) $(CH_3)_3N$

21. Primary amines on being heated with CS_2 in the presence of $HgCl_2$ form alkyl/aryl isothiocyanates. The reaction is known as–

(A) Hofmann hypobromite reaction

(B) Hofmann elimination reaction

(C) Hofmann-Martius reaction

(D) Hofmann mustard oil reaction

22. Consider the following sequence of reactions

$$X(C_3H_9N) \xrightarrow{HNO_2} C_3H_8O \xrightarrow[H_2SO_4]{K_2Cr_2O_7} C_3H_6O_2$$

The compound (X) is–

(A) $CH_3CH_2NHCH_3$ (B) $CH_3CH_2CH_2NH_2$

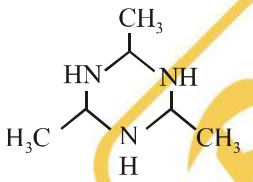
(C) $(CH_3)_2CHNH_2$ (D) $(CH_3)_3N$

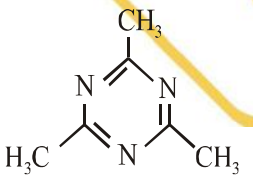
23. The products (A) and (B) are formed in two separate reactions of acetaldehyde–

$$CH_3CHO \xrightarrow{NH_3} A$$

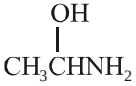
$$CH_3CHO \xrightarrow[Ni,\ heat]{NH_3, H_2} B$$

(A) and (B) are–

(A)  and $CH_3CH_2NH_2$

(B)  and $CH_3CH_2NH_2$

(C) $CH_3–CH=NH$ and $CH_3CH_2NH_2$

(D)  and $(CH_3CH_2)_2NH$

24. The product (A) and (B) of the reaction

$CH_3CH_2NH_2 + CH_3MgBr \rightarrow A + B$

are–

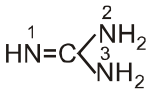
(A) $CH_3CH_2CH_3$ and NH_2MgBr

(B) $CH_3CH_2NHCH_3$ and $MgBr_2$

(C) $CH_3CH_2N(CH_3)_2$ and $MgBr_2$

(D) $CH_3CH_2NHMgBr$ and CH_4

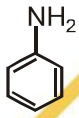
25. Which nitrogen is protonated readily in guanidine ?



(A) 1 (B) 2

(C) 3 (D) All of these

26. Which of the following is most basic ?

(A)  (B) 

(C)  (D) 

27. Which of the following may be prepared by Gabriel phthalimide synthesis ?

(A) Aliphatic amines (B) Aromatic amines

(C) Aliphatic amides (D) Aromatic amides

28. When an organic compound was treated with sodium nitrite and HCl in the ice-cold condition, nitrogen gas was evolved. The compound is :

(A) a nitro compound (B) a primary amine

(C) a secondary amine (D) a tertiary amine

29. In carbylamine reaction :

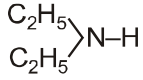
(A) the nucleophile is a RNH_2 and electrophile is : CCl_2

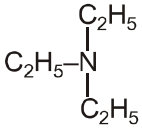
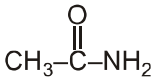
(B) the nucleophile is primary amine and electrophile is CCl_3^-

(C) the nucleophile is CCl_3^- and the electrophile is primary amine

(D) the attacking reagent is electrophile

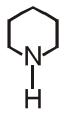
30. Which one of the following will not react with the Grignard reagent (C_2H_5MgBr) ?

(A) $C_2H_5–NH_2$ (B) 

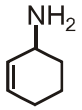
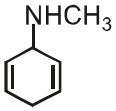
(C)  (D) 

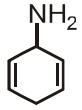
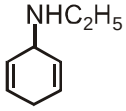
31. One mole of an amine (A) consumes two moles of methyl bromide to give a queternary ammonium salt. The amine (A) is :

(A) $(CH_3)_3CCH_2NH_2$ (B) $(CH_3)_2NCH_2CH_3$

(C)  (piperidine) (D)  (Pyridine)

32. An optically active compound (A) decolourises Br_2/CCl_4 and releases N_2 with nitrous acid. The compound (A) is :

(A)  (B) 

(C)  (D) 

33. (A) $\xrightarrow{H_2/Pt}$ 1° Amine

(B) $\xrightarrow{H_2/Pt}$ 2° Amine:

(A) and (B) respectively are :

(A) RNC, RNC (B) RCN, RCN

(C) RCN, RNC (D) RNC, RCN

34. How many products will be obtained when propane is subjected to vapour phase nitration ?

(A) 2 (B) 3

(C) 4 (D) 5

35. R–Cl + NH_3 (excess) $\rightarrow$ (X) (major product), the major product (X) is a :

(A) 1° amine (B) 2° amine

(C) 3° amine (D) 4° ammonium salt

36. The products (A) and (B) formed in the given reaction is

$RCOCl \xrightarrow{NaN_3} (A) \xrightarrow{C_2H_5OH/\Delta} (B)$

(A) RCON and RCN

(B) RCN and RNC

(C) $RCON_3$ and RCN

(D) $RCON_3$ and RNCO

37. α-amino acids on heating with $Ba(OH)_2$ gives:

(A) Ba salt of acid (B) Amine

(C) α-hydroxy acids (D) None of these

38. $CH_3CH_2NH_2$ contains a basic NH_2 group, but CH_3CONH_2 does not, because :

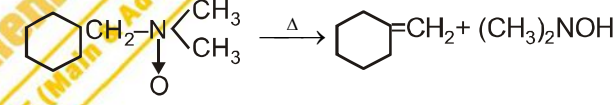
(A) Acetamide is amphoteric in character

(B) In $CH_3CH_2NH_2$ the electron pair on N-atom is delocalised by resonance

(C) In $CH_3CH_2NH_2$ there is no resonance, while in acetamide the lone pair of electrons on N-atom is delocalised and therefore less available for protonation

(D) None of these

39. The reaction



is called :

(A) Cope reaction (B) Ritter reaction

(C) Schmidt reaction (D) Gabriel's reaction

40. The major organic product in the reaction is:

$H_2NCOCH_2CH_2CONH_2 \xrightarrow{Br_2,OH^-}$

(A) $H_2NCO(CH_2)_3NH_2$

(B) $BrNH–CO–(CH_2)_3–CO–NH_2$

(C) $BrNH–CO–(CH_2)_3–CO–NHBr$

(D) $H_2N(CH_2)_2NH_2$

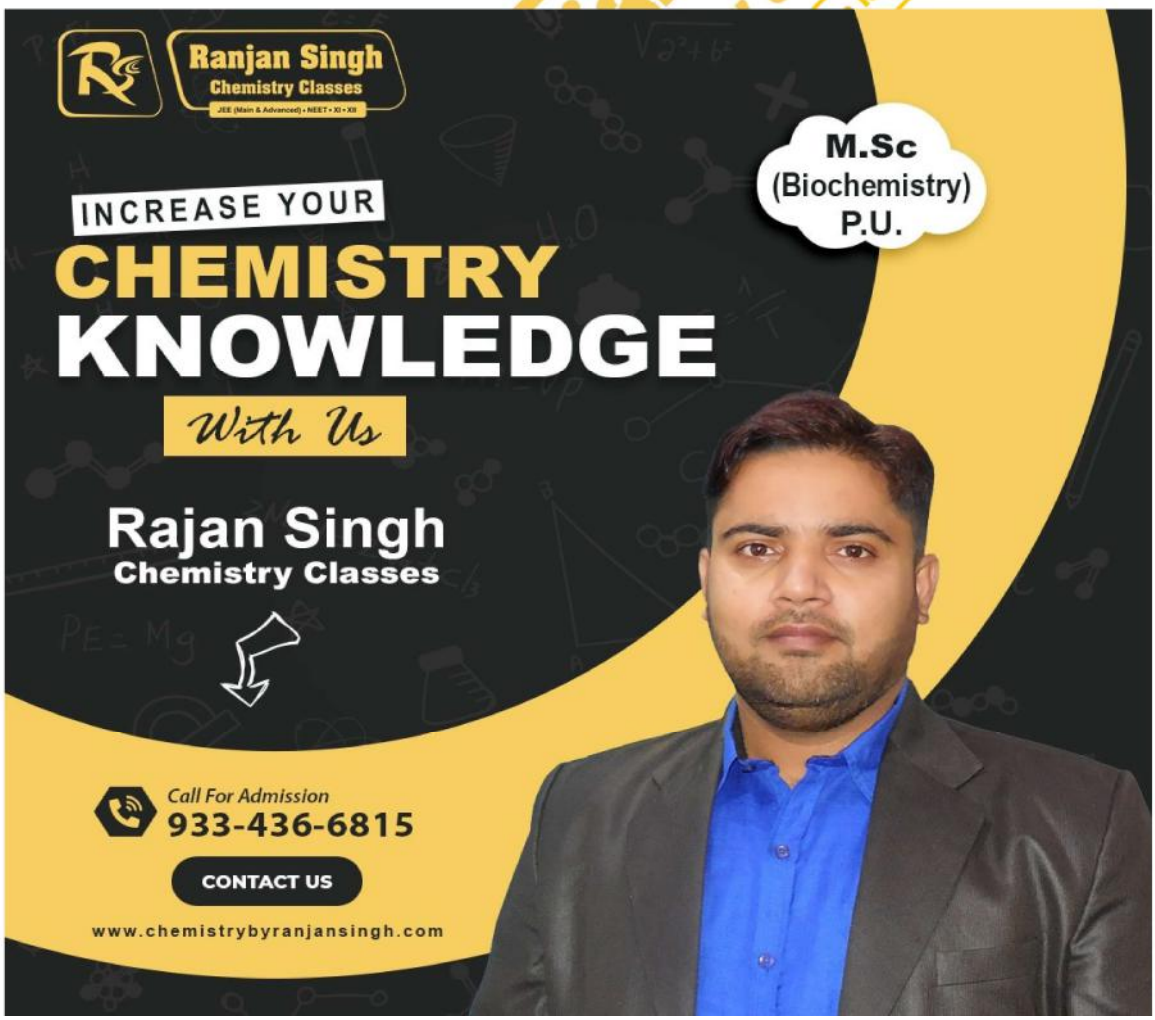
ANSWER KEY

TOPIC WISE MCQS

Qus.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	A	C	A	A	B	A	C	B	A	D	A	A	D	A	D	A	C	A	B	C	A	C	D	A	A
Qus.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Ans.	A	B	A	C	B	A	D	C	A	C	D	B	C	B	B	D	D	B	A	B	D	D	D	B	B

MISCELLANEOUS QUESTIONS

Qus.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	C	C	D	B	C	D	C	A	D	B	D	C	C	C	D	C	D	A	D	C	D	B	A	D	A
Qus.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40										
Ans.	C	C	D	A	C	C	A	C	C	A	D	B	C	A	D										



Our **INFRASTRUCTURE**

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with Ranjan Singh Sir

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In Our Premises

LIBRARY

Help Desk
with complete care

RECEPTION

PROJECTOR

CCTV SECURITY